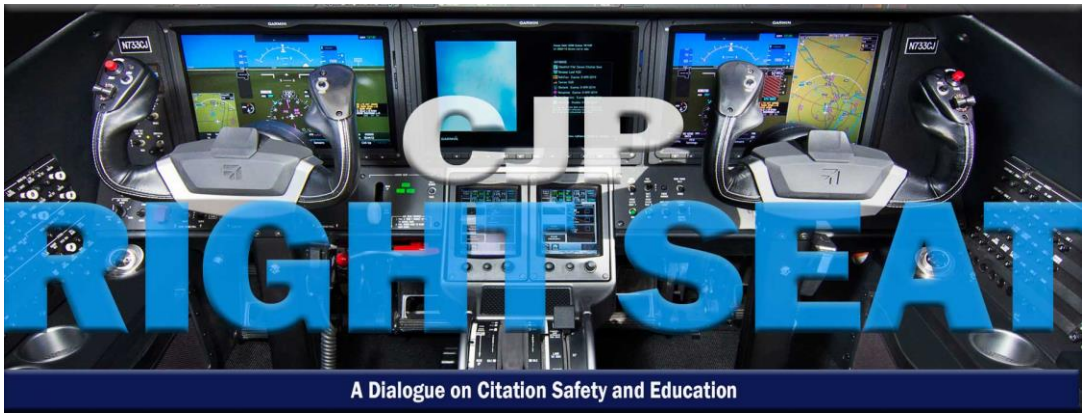
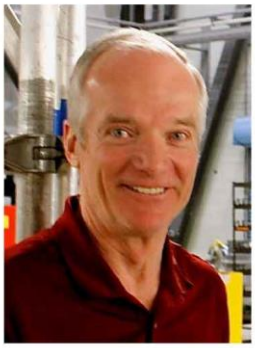
April 2019



— LATEST BRIEFING —

Everyone's Talking About the Boeing 737 Max



by Charlie Precourt, CJP Safety Committee Chairman

After a decades long run of nearly perfect airline safety, Boeing's 737 MAX has suffered two nearly identical loss of control fatal accidents after takeoff. While these aircraft are now grounded, there remain more questions than answers, many of which are applicable to our own flying. In December, I wrote that preventing loss of control should be one of our three New Year's resolutions for 2019. These accidents certainly reinforce the priority we have placed on it, and the fact none of us are immune.

What we know so far is that a new system was added to the -8 and -9 "MAX" variants of the 737, and it was implicated in both accidents. The system is called the Maneuvering Characteristics Augmentation System, or MCAS, and is designed to automatically trim the nose down if the flight computer senses a dangerous combination of airspeed, altitude and angle of attack. The need for the MCAS came from the fact that the MAX had higher thrust engines mounted further forward with larger nacelles. These changes cause greater nose up pitching moments at high AOA. To correct this, Boeing added the MCAS, which *automatically* provides nose down trim to counter these effects. If the pilot activates the trim switch, it will temporarily deactivate MCAS. In both accidents, the system apparently activated incorrectly due to erroneous AOA input from a single sensor. The pilots tried to override it, but it would reactivate as the

sensor remained erroneous. Apparently, they could have overridden it more successfully with the manual trim wheel, which has led to questions about how much operational information and training were provided to the airlines and pilots. In certification, Boeing and the FAA decided the AOA readouts and disagree features were not critical and would be "added cost" options.

With all of this, many questions come to mind. Did Boeing's flight test department recognize the operational issues with the MCAS but "management" decided to "simplify" the add-on for cost savings? That happened to me in a USAF flight test program. I attempted to alert upper management to a loss of control characteristic in a fighter aircraft that was written-off as "this isn't anything new." Five accidents later they were redoing the flight test…it's human nature to take a minimalist approach. Did the program office also minimize the need for training and system operation descriptions in pilot documentation? Why did the program office give a "hazardous" instead of "catastrophic" safety rating for MCAS failure as in hindsight it is obviously catastrophic? Why is it that by the time the 737 MAX was operational, MCAS could command stabilizer deflection more than four times greater than certified. Regulators and airlines were only informed of the greatly increased capability after the Lion Air crash. Why did safety analyses appear to overlook that MCAS could reset itself and repeatedly pitch the aircraft down? Why should this system run off only one sensor? Why did they think AOA miscompare wasn't flight critical? Why were these failure modes not exposed to the training system?

Particularly since, in hindsight, the pilot actions to correct the problem don't seem to require heroics. You can read more here:
https://www.seattletimes.com/business/boeing-aerospace/failed-certification-faa-missed-safety-issues-in-the-737-max-system-implicated-in-the-lion-air-crash/

So, while we await the full story, what can we take away from this in our own flying? One item is differences training. Boeing didn't think this change was big enough to provide much in the way of new training (reportedly). Our simulator providers have training for moving from a CJ3 to a CJ3+ for example, or in my case, from the CJ3 I typed in to the CJ1+. If this applies to you, be sure to take advantage of it. Another thing I did when this story broke was to refresh my knowledge of pitch control failures in our Citations. Do you check the trim tab bolts on the elevators (both sides) during preflight? I'm looking closer now. Have you reviewed the memory items for pitch trim failure?

In the 525 Pro Line 21 variants (except for the CJ4):
AP/TRIM DISC Button – Press and Release. Throttles – As Required. Speed Brakes – As Required. Manual Elevator Trim – As Required. Pitch Trim Circuit Breaker – Pull (L panel).

Or in the 510 and 525 Garmin variants:
Control Wheel – Grip Firmly. AP/TRIM – Disconnect, Press and Hold (high elevator forces possible). Trim As Required Using Manual Trim Wheel. AFCS Circuit Breaker (left CB panel) – Pull. AP/TRIM DISC Button – Release. Land ASAP.

Again, notice the "differences." In the 510, and 525 Garmin variants, you hold the AP disconnected. In the 525 Pro Line 21 variants, you press and release. (Note: the CJ4 has a backup trim system even more different than the other models)

Or in both the 510 and 525, how about the amber boxed up and down arrows (E↓↑) displayed on the PFDs (Autopilot Out of Trim) continuous illumination message? (Labeled "Elevator Mistrim" in the 510):

Control Wheel – Grip With Both Hands. AP/TRIM DISC Button – Press and Release (high elevator control forces possible). Elevator Trim – Adjust. AP – Engage.

This occurs when the autopilot senses excessive elevator forces. It is not a memory item, but perhaps it should be!

These are not things you want to have to look up in the heat of battle. I'd recommend next time you're in the simulator you ask to have a look at them so you can respond without having to open the book.

Upset Recovery Training at FRI

And one step better, you should consider the Upset Recovery Training that's available. It's part of our Gold Standard Safety Award endorsed training, and we have organized another training session with Flight Research geared to Citation pilots out at their facility in Mojave. It's planned for the second week in April. They will teach you how to respond to upsets that might be caused by wake turbulence, stalls at high altitude, or some of these pitch control anomalies we've discussed here. They use an Aermacchi Impala jet trainer as well as your own Citation to fly upset scenarios and teach you the best recovery methods. It's great training and well worth your time. You have to wonder about the two Boeing 737 accidents outcomes had the pilots been better prepared.

Another of our New Year's Resolutions was eliminating runway overruns and excursions. In January, we had a fun two-day session at the Park City regional fly-in discussing the details of runway landing performance in adverse conditions. We're planning to provide safety content like this at all of our future regional fly-ins. At Park City, we went through several of the overrun accidents then dove into the performance charts to understand the drivers to landing performance. What we can control as pilots includes an accurate pre-landing assessment of landing distance required. Then fly a stabilized approach, be on Vref and cross the threshold at 50 ft., and then apply full braking and ground flaps asap upon landing. Practice this on good days, and you'll be in great shape when the weather is marginal. And don't hesitate to divert where the conditions are easier to cope with…I've done that three times this winter trying to come home to Ogden. It's been a long winter here!

I spoke with Peter Basile from Textron to see how we're doing with excursions and overruns since the San Antonio convention. He reminded me that the end of winter wasn't a time to ease up as overruns are equally prevalent throughout the year with rain and wet runway issues. There were three Citation runway excursions between October and December. For 2019, we have so far seen no serious runway excursions. There have been two, an '85 Citation 550 that got stuck in the mud with no injuries in Pennsylvania, and a Mustang that left the runway in Paris but was able to taxi in. That is all good news so far. In 2018, as a reference, we had 17 total excursions – 11 runway overruns and six taxiway departures. Let's keep the trend coming down!

Our next regional fly-in is in June up at beautiful Mackinac Island in Michigan. We have a great lineup of activities including a variety of training sessions. On Saturday, June 22 David Miller will present “Truth or Dare” scenarios on Citation decision making…as always, this will be entertaining. Maybe he’ll wear his speedo again. We’ll also have a NEXRAD Critical Update with Dr. David Strahle on Saturday morning. Then on Sunday, June 23 Collins and Garmin will present Flight Planning Tips & Techniques. Don’t miss it. You can register on the CJP website. Also, remember to get online to register for the Gold Standard Safety Award. We’re only halfway through the year, so still plenty of time to meet the prerequisites for the award.

Partnering with me for this month’s Right Seat column is a great article from Neil Singer on runway overruns called “A Tale of Two Citations.” Enjoy, and hope to see you at Mackinac Island in June.

Fly safe!

Charlie

Join a Lively Discussion "CJP Truth or Dare"

By David Miller

One of the most valuable aspects of the CJP Regional Events is the opportunity to learn from the experiences of fellow CJP members. During this in-depth presentation at the upcoming Mackinac Island event, I will take you through actual flights flown by Citation owner-pilots, and we will discuss how we evaluate and handle risk.

And I guarantee some eye-opening moments.

Come join us.

A Tale of Two Citations

Too high, too close to the runway.

By Neil Singer

Accidents are usually the result of a string of—sometimes unrelated—latent threats and failures on the part of the aircraft and, more likely, the flight crew. Terrain, weather, airplane, and pilot can combine in seemingly infinite combinations so that no two accidents are ever completely alike.

Sometimes accidents come eerily close to being identical, though. With minor differences ignored, these similar accidents can provide a rare chance to isolate specific actions, and offer a glimpse into possible answers to the age-old question of "What if X had been done instead of Y?" Two accidents that occurred a little over two years apart at the same airport, both involving light jets made by the same company, provide one such opportunity to examine how a single different choice led to very different final outcomes. In one case, all aboard perished; in the other, all survived with no injuries.

ACCIDENT 1: FOUR FATALITIES

In the early morning of January 24, 2006, N86CE, a Cessna Citation 560, approached McClellan-Palomar Airport (CRQ) in Carlsbad, California. McClellan-Palomar has a single runway just shy of 5,000 feet long, and sits a few miles from the Pacific Ocean at 331 feet msl. Despite the relatively benign environment immediately surrounding the airport, approaches from the east can be demanding; the Peninsular Ranges rise to more than 6,000 feet msl within 25 miles of the airport, necessitating minimum segment altitudes as high as 7,100 feet msl on the ILS 24 approach.

As N86CE approached McClellan-Palomar, the crew of two airline transport pilots was navigating to an intermediate fix on the ILS Runway 24 approach when they were cleared for the approach, with the advisory that the glideslope was unusable. The first hint of trouble came just a few seconds after the approach clearance, when the controller asked, "You go nna be able to get down OK?" to which the captain responded, "Ah, yeah, thank you." Approximately two minutes after receiving the approach clearance the controller advised the crew that the airport was at their 12 o'clock position at 6.5 miles. They acknowledged the airport in sight and shortly afterward canceled IFR. The controller again alluded to the aircraft's excessive altitude when he advised the crew that they could "use S-turns to get down."

At this point, the aircraft was just less than six miles from the runway threshold and descending through 5,000 feet. By comparison, on a stabilized approach an aircraft six miles from McClellan-Palomar would be no higher than 2,300 feet msl. The crew maintained a 3,000- to 4,000-feet-per-minute descent until about four-tenths of a mile from the end of the runway, when the descent decreased to 1,000 fpm. During this period, the enhanced ground proximity warning system (EGPWS) alerted the crew for the last 20 seconds of the approach with numerous sink rate alerts, followed by "pull up, pull up, pull up, pull up, pull up, sink rate, sink rate, minimums, minimums, one hundred [feet agl], sink rate, forty [feet agl], thirty [feet agl], sink rate."

The Citation crossed the threshold with a groundspeed calculated to have been between 130 and 140 knots. With the six-knot tailwind present, this groundspeed equated to a calibrated airspeed of roughly 131 knots—30 knots faster than the reference approach speed (VREF) of 101 knots appropriate for the aircraft's landing weight. The extra airspeed no doubt contributed to the slightly long landing, with the jet touching down 1,500 feet past the threshold. Nonetheless, Cessna calculated that even with the excessive speed and floating, had the pilots used maximum reverse thrust and braking, the Citation could have stopped 4,746 feet from the approach end of the runway, or 151 feet short of its end.

Within a second of gear contact the pilots had deployed reverse thrust, and for five seconds no cockpit conversation is heard on the cockpit voice recorder until the co-pilot says "Let's get on them," to which the captain replies, "Yeah, I don't like this." Six more seconds pass

before the co-pilot asks twice, in rapid succession, if they are going around, and the captain answers with, “Yeah, let’s get…out of here.”

Witnesses heard the engines spool-up, and the NTSB determined the aircraft became airborne prior to the end of the runway. The flight was tragically short-lived, however, as the aircraft hit a localizer antenna platform located roughly 300 feet past the end of the runway, and two feet lower than the departure end of the runway—implying the airplane was not capable of maintaining level flight at the airspeed at which it lifted off.

The now damaged jet continued flying over downsloping terrain for another 400 feet before hitting the ground and then a building 80 feet lower than the departure end of the runway. The majority of the aircraft structure forward of the engines was consumed or significantly damaged by the ensuing fire, and the two pilots and two passengers died.

ACCIDENT 2: NO INJURIES

On the morning of April 19, 2008, another Citation approached McClellan-Palomar, again from the east with the intention of landing on Runway 24. N54PV was a model 510 Mustang, flown by a single, commercially rated pilot.

The pilot reported that as he descended through 30,000 feet on the assigned arrival, the right primary flight display began to flicker. A few minutes later an alert flashed, indicating that the autopilot had disengaged, and the pilot simultaneously felt the autopilot disengagement and heavy control forces on the yoke. The pilot realized that the electric pitch trim was not functioning, but was able to use the manual pitch trim wheel on the center console.

This act undoubtedly raised the pilot’s workload—with his left hand he would have been required to manually control the aircraft, while his right hand would be working the trim wheel during any speed or configuration changes. The FAA recognizes the reduction in workload a functioning autopilot creates by only allowing single-pilot flight in light jets if the autopilot is working properly.

ATC vectored the aircraft to the ILS approach to Runway 24, and the Mustang broke out of instrument conditions at 2,600 feet msl. Again, a Citation was given a caution by ATC when the controller noted N54PV was abnormally high and queried, “Do you think you can make it?” and again a pilot replied “Yes.” The Mustang crossed the Runway 24 threshold fast—in this case only 15 knots too fast, versus 30 knots for the previous example—above the appropriate VREF, but with a longer float than N86CE had experienced, resulting in a touchdown more than halfway down the runway.

The pilot reported he realized that despite his braking attempts and extension of speed brakes, the airplane was not going to stop before the end of the runway. Facing the downslope at the end and feeling he wouldn’t be able to accelerate the aircraft to liftoff speed, he decided to perform a 180-degree course reversal and ground-looped the jet with aggressive control yoke and rudder deflection. The aircraft came to a stop off the left side of the runway with the main landing gear collapsed, but most important, with no injuries to the pilot or its three passengers.

WHEN YOU'RE DOWN, STAY DOWN

The lesson here should be clear: Once an attempt is made to stop a landing aircraft, the pilot historically is best served by continuing that effort until the airplane stops moving. An aircraft that departs the end of a runway at low speed, with wheels firmly on the ground, is going to be far more survivable in the ensuing accident than one that has limped into the air, marginally controllable, with twice (or more) the speed resulting in four times the kinetic energy.

Both accidents also demonstrate the tunnel vision that can lead to runway excursions. In both cases ATC alerted the pilot that the aircraft was well above the nominal flight path to Runway 24, and in both cases the pilots ignored the warnings—believing they could shed an impressive amount of excess energy in only a few miles. When the voice inside your head says *this doesn't look quite right* becomes a voice on the radio saying the same, it's time to move to Plan B.

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NEIL SINGER is a Master CFI with more than 9,500 hours in 15 years of flying.
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