CALLBACK

From NASA's Aviation Safety Reporting System

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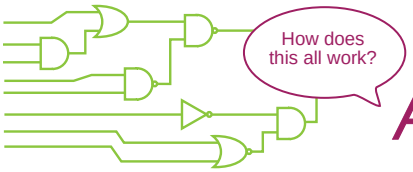
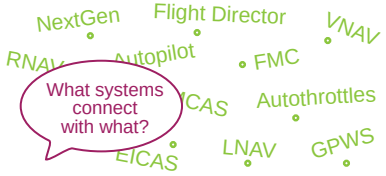


AIRMANSHIP AND AUTOMATION



The skill of mastering automation in today's state-of-the-art aircraft should arguably be included in any modern discussion of proficiency and airmanship. Automation has, in recent years, experienced tremendous growth and currently enhances most phases of flight. Procedures for communication, clearances, weight and balance, taxiing, takeoff, departure, intermediate routing, arrivals, and approaches have all seen extensive change and improvement.

Automation affords many advantages, but it can also lure a pilot or crew into a false sense of security. Complacency becomes a comfortable foe. Simply put, in the mental game, the pilot must think in an expanded dimension, staying not only ahead of the airplane, but ahead of the automation that is controlling the airplane as well. If automation at any level produces unexpected action, then surprise, confusion, loss of situational awareness, or other human factors may have negative results that impact flight safety, even at the lowest levels of automation.

This month, *CALLBACK* shares reports that explore the occasionally obscure, but usually complex, relationships among airmanship, proficiency, and automation at multiple levels. Examine the dynamic interactions, and observe how quickly a situation may deteriorate and jeopardize flight safety. Also investigate the stimuli that introduced the problems, and ponder the human factors involved.

Instructor Blues in a Gray Sky

This instructor experienced an aircraft malfunction in stressful conditions and a low level of automation. The result was a decrease in personal performance and proficiency.

■ *This was my third flight for the day of IFR training and the third plane for the day. The weather minimums and visibility were within limits for the flight. The first part of the flight was [from ZZZ]…into ZZZ1 and…ended with a full stop and taxi-back…for an IFR departure to pick up the LOC-D [approach] back into ZZZ.…*

We were cleared for the approach. The student, under my supervision, flew the approach. When we descended to 1,500 feet, the heading indicator and attitude indicator showed slight precession and tilting, and we did not have the runway in sight. We were returned to ATC…to try it again. This happened twice for the student. Upon the missed [approach], I took the controls and I tried the approach. The attitude indicator, in my opinion, was having a problem, so I treated it as a partial panel. I covered the attitude indicator so it would not distract me. I did not have the runway in sight, so I was returned to ATC…to intercept the localizer.… The flight was supposed to be short, but with the many attempts, the weather was getting worse. I was asked by ATC if I would like to divert to ZZZ1. I proceeded to initiate a climb, but the heading indicator was precessing, and I ended up being 180 degrees off course.

ATC helped me get back on course, but I was having issues with maintaining heading and altitude. ATC asked me if I was having an issue, and I told them I was having a problem with my attitude and heading.… ATC then diverted traffic to assist me. I was given turn-by-turn headings but…lost altitude.… Once I recovered, I was asked if I could use GPS to [proceed] direct to fixes. I confirmed that I could. I maintained heading and altitude,… was vectored to intercept the glideslope and localizer to ZZZ1, and landed there.

I have reviewed this flight to the best of my memory. When I checked the weather prior to the flight, apparently I made an error. I will review my weather minimums before attempting another flight in the future under the same conditions.

Wrestling With Automation

This air carrier Captain identified situational factors that successively led to automation confusion and decreased personal performance, ultimately affecting flight safety.

■ *The aircraft had a deferral for the Power Control Unit (PCU) monitor system. The Minimum Equipment List has no operational limitations. I was the Pilot Flying (PF). This was a busy, very short flight from ZZZ to SNA. The aircraft was Large Display System (LDS). I have flown LDS aircraft infrequently, and my previous 31 years of flying have been [with] round dials. We briefed the entire flight in the blocks because we knew we would be so busy in flight. We were empty, so we briefed a potential low altitude capture. We were cleared to 4,000 feet MSL on departure. The sun was right in our eyes. The First Officer (FO) had a sunshade up,*

and I was wearing sunglasses and a cap to block the sun. The Autopilot (AP) was engaged at approximately 2,500 feet MSL. The airplane was climbing normally. I had preset the SNA localizer, but parked the frequency. Prior to top of climb, I briefly looked down to dial in the localizer frequency (an obvious mistake). The PM called, "Altitude," as the aircraft continued through 4,000 feet. I disconnected the AP and pushed the airplane over to 4,000 feet. I think we went no higher than 4,250 feet. I was having a hard time seeing the display due to the sun. Neither of us saw a low altitude capture, and we were surprised the airplane did not level at the selected altitude. The AP was reengaged.

Things were busy with the radio, traffic, and setting up for the approach. I slowed the aircraft, and we selected flaps one. Shortly thereafter we were cleared to 3,000 feet nearing the approach intercept. I selected Flight Level Change and extended the speedbrakes. I selected speed 170 knots and called for flaps 5. All this time, ATC, traffic, and following the PM's actions drew my attention. As we reached 3,000 feet, the aircraft leveled, but the autothrottles (ATs) did not advance. The airspeed dropped below 170 knots and was trending down. As I pushed the throttles up and called for flaps 15, the PM called out, "Airspeed." Airspeed was not increasing, so I disconnected the AP and ATs and verified full throttle. It was then I realized the speedbrakes were still extended. I retracted the speedbrakes. At that time the airspeed increased, and we ballooned to approximately 3,900 feet. No flap limits were exceeded. The ATs and AP were reengaged. We advised ATC of our situation and requested vectors to get set up again and evaluate our status.

We considered contacting Maintenance to ask if the deferral should have any impact on the autoflight system. During the vectors, we were placed in a long line of arrivals and had time to be fully prepared for our next approach. We were given altitude changes and heading changes.... The aircraft seemed to be operating normally. When finally cleared for the approach, we were confident things were normal, and the remainder of the flight was normal. ATC never advised us of any deviations or violations. On the ground, the Mechanic said the deferral would have had no impact on the aircraft going through the selected altitude or on AT operation. We never had any EICAS...messages. I don't know why the ATs did not come up, but I do know I missed the speedbrakes! If I have speedbrakes extended, I normally keep my hand on the handle with my arm against the throttles. If the throttles come up, it's a good reminder to retract the speedbrakes if I forget. This time I took my hand off of the speedbrake handle, as I was busy manipulating the Mode Control Panel (MCP). I've done this short, busy flight before without any of these mistakes. I think my limited exposure to LDS aircraft (the airspeed and altitude trends are not quite as intuitive as round dials for me yet) combined with a high workload flight was definitely a major contributing factor for my errors. I will work on this and not trust the aircraft to do what I think it should do.

Automation Altitudes

This B737 Captain received a clearance to an altitude below the published altitude on an RNAV arrival. The resulting confusion deteriorated into dependency and deviations.

■ *We were cleared to descend via the RNAV arrival.... While at Flight Level 270 (FL270), ATC stated, "Do me a favor and cross ZZZZZ intersection at FL190." The FMC wouldn't initially take FL190 at ZZZZZ intersection because the following waypoint, ZZZZZ1, had a restriction of FL200A [at or above FL200]. While working with the FMC to correct this problem, we failed to clarify if ATC wanted us to descend via, except cross ZZZZZ at FL190, so with the ZZZZZ2 crossing restriction of FL240A (which is only 7.5 miles west of ZZZZZ), it left an extremely steep descent after the ZZZZZ2 intersection. Passing ZZZZZ, the PF intervened with Vertical Speed and increased the rate of descent to make the crossing restriction. The PF failed to immediately reset the MCP altitude to FL190 for the degradation in automation. Passing FL197 at a high rate of descent, the altitude window was reset to FL190, but further intervention and automation degradation was required to keep from busting through FL190. During this intervention, neither the PF nor the PM noticed that the autopilot had disengaged. As a result, the aircraft leveled initially at FL190 and then continued to descend to FL183. The next waypoint [after ZZZZZ1] on the arrival is ZZZZZ3, which has an altitude restriction of FL190. We descended to FL183 before correcting back up to FL190. The rest of the arrival and landing were uneventful.*

There were a number of things we could have done to prevent this event from occurring. Clarify the clearance with ATC. The removal of the FL240A restriction just prior to the ZZZZZ intersection would have allowed us to remain in the highest level of automation and allowed the FMC to correctly program a descent formula. If we had immediately reset the MCP altitude to FL190, the autopilot could have assisted in leveling off at the proper altitude. Proper phraseology by ATC could have mitigated the problem. Both pilots should have been more vigilant in monitoring the aircraft to detect that the autopilot had disengaged.

ASRS Alerts Issued in September 2020	
Subject of Alert	**No. of Alerts**
Aircraft or Aircraft Equipment	2
Airport Facility or Procedure	6
ATC Equipment or Procedure	6
Maintenance Procedure	1
TOTAL	**15**

490

A Monthly Safety Newsletter from

The NASA Aviation Safety Reporting System

P.O. Box 189 Moffett Field, CA 94035-0189

https://asrs.arc.nasa.gov

September 2020 Report Intake	
Air Carrier/Air Taxi Pilots	2,643
General Aviation Pilots	1,303
Flight Attendants	447
Controllers	242
Military/Other	199
Mechanics	146
Dispatchers	116
TOTAL	**5,096**