CALLBACK
From NASA's Aviation Safety Reporting System
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# Altitude Deviations and Misperceptions

Do you remember when you were mastering the mystery of altitude, or are you, perhaps, wrestling with it now? The concept can feel a bit foreign to us without nature's wings. Nonetheless, controlling an aircraft's altitude correctly and precisely is critical to flight safety. Vertical separation from other aircraft and terrain depends on it. Moreover, the science of altimetry is tricky and subject to confusion and misunderstanding. Add Human Factors into the mix, and accurate, error free altitude control can be a difficult challenge. Even the seasoned aviator can fail the task.

ASRS consistently receives altitude deviation incident reports. Catalysts for an altitude deviation could range from a minor distraction to a major system failure. System failures that corrupt altitude information intended for use by the pilot are potential culprits, as are automation and other systems that affect the movement of the aircraft's flight control surfaces. Frequently, Human Factors play the significant role in the sequence of an altitude deviation incident. Mistakes occur in automation management, instrument interpretation, altimeter settings, communication with controllers and crewmembers, and in situations that call for nearly superhuman skills to combat Human Factors issues.

This month, *CALLBACK* presents reports in which altitude deviations are triggered by mistakes or misperceptions shaped by Human Factors issues as opposed to deviations stemming from equipment or system failures.

## Instructor's Investigation

This flight instructor astutely analyzes an altitude deviation and hints of prominent Human Factors involvement.

■ *I was acting as a flight instructor.... My student is a Certified Flight Instructor candidate.... We began with an ILS approach at ZZZ1 with my student flying the aircraft and me handling ATC communications to reduce his workload in the hard IMC conditions. We crossed a cold front while receiving vectors for the ILS approach [to ZZZ1].... We completed the ILS approach without incident and proceeded to the [ZZZ2] VOR for the VOR-A approach into ZZZ, planning to complete a low approach only. We experienced severe turbulence, which forced the autopilot to disconnect, and I took the controls of the aircraft and requested deviations to the north as necessary to track clear of the progressing cold front. Once we got into smoother air, I gave my student the flight controls, and we proceeded direct ZZZ2 [VOR] for a procedure turn. Our plan was to complete the VOR-A approach and then receive radar vectors for the RNAV 01 at ZZZ. My student had proclaimed that he wanted to avoid going back through the cold front while getting vectored for the RNAV 01 approach and suggested we circle to land at ZZZ and cancel the IFR flight plan. When my student suggested this, we had passed the final approach fix inbound and began a descent to the Minimum Descent Altitude (MDA) and were switched over to advisory frequency. I switched frequencies back to Approach to tell them our intentions to try and circle to land. When I told ATC of our intentions, they replied in the affirmative and added, "Aircraft X, low altitude alert, check altitude immediately, altitude indicates 1,800." I replied to the altitude checks and requested an altimeter setting. ATC replied with an altimeter setting of 29.58, and we had a setting of 29.67 set in. I figured this was why they gave us the low altitude alert but then quickly realized that the [stepdown] altitude for the segment of the approach we were on was 2,020 feet, and we were at 1,720 feet with the new altimeter setting. I informed my student to return to 2,020 feet, and we continued...the approach without issue and proceeded with the missed approach and vectors to the RNAV 01 at ZZZ.*

*During the missed approach, I was surprised at myself that I did not catch that the student had descended below the MDA.... During the lead up to the approach, the encounter with the severe turbulence had shaken both me and my student. We also had a back seat passenger who was an instrument student and had never been in IMC before. I was concerned with the safety of my student and the back seat student. I...began thinking about the circle to land approach and how we would request vectors for the RNAV approach if we were unable to circle to land in order to stay away from the front line. I had determined from the weather when we departed ZZZ that circling for the runway at ZZZ would have been nearly impossible with the current ceilings. I told my student this and informed him we would need to execute the RNAV approach in order to make it back into the airport. The workload at the moment was very high and*

*the effects of the turbulence certainly could have impaired multitasking skills for both my student and me. When we began the descent on the approach, we left 3,000 feet for 2,020 feet, which is the minimum altitude until a [stepdown] fix, beyond which…the Minimum Descent Altitude [is] 1,760 feet. My student did not reset the altitude select when we ran our final approach fix check, and the altitude select remained at 3,000 feet. Additionally, when I recognized we were below the published MDA, I should have instructed my student to execute the missed approach.… If this event were to occur again, I would…instruct my student to execute the missed approach rather than working to reclaim the MDA.*

## An Inch from Disaster

A CRJ200 Captain chronicles events that led to an altitude deviation, an unstable approach, and unrecognized Controlled Flight Toward Terrain (CFTT).

■ *While at cruise, we both listened to ATIS and discussed the extremely low altimeter at CWA of 29.32. I then got landing data for Runways 35 and 8. I briefed the ILS to Runway 8. We checked in with Minneapolis Center, who told us to expect Runway 35, which we accepted. While descending for a crossing restriction…at 14,000 feet, I [briefed] Runway 35. There was a slight rush due to the change, but it was completely manageable. Descending through FL180, I dialed in the incorrect altimeter of 30.32, even though I had written down 29.32…and dialed 29.32 into the Standby Altimeter. I then called for, and we ran, the Descent Checklist. While running the descent check, neither I nor the First Officer (FO) Pilot Monitoring (PM) caught the altimeter error on my side. I believe I said, "29.32, crosschecked." We were then cleared direct RELCO to cross RELCO at or above 3,000 feet and cleared for the ILS Runway 35. I dialed in 3,000 feet and configured to be at 3,000 feet about 5 miles outside RELCO to allow for deceleration prior to RELCO. Approximately 5 miles outside RELCO, just slowing to 200 knots, zero flaps, and gear up at a 1,000 FPM descent, I believe the PM FO said, "You have the wrong altimeter. We need to climb back up." I immediately saw the error, clicked off the autopilot, and climbed up to 3,000 feet. I then dialed in the correct altimeter. I directed the FO to tell Tower what we were doing. I elected to continue the approach since we crossed RELCO at 3,000 feet. The rest of the approach and landing was hand flown and uneventful.*

*Upon post flight debrief, the PM FO said he momentarily saw his Radio Altimeter (RA) display less than 1,000 feet AGL. The math says this is most likely correct. I did not see this on my side, as I was busy. This means we were unstable…and should have done a go-around and missed approach.… We may have descended to 800 feet to 900 feet…above airport elevation. The terrain around RELCO appears to be the same as the airfield elevation. We did not receive a GPWS, which I believe was due to our speed, descent rate, and absence of towers and terrain in the area.*

*I should pay more attention to every aspect of my flight duties. I have been a Captain for nearly 20 years and have never had a training issue, ATC issue, or any event resembling this.*

## Regular Exercise

After the safety pilot called out the deviation, this AA-5 pilot zeroed in on the cause and alluded to a policy for prevention.

■ *I was practicing a partial panel approach and used my backup steam gauges instead of the primary glass display. It has been a while since I used my backup instruments. I misread the altimeter by 1,000 feet and got lower than intended. My safety pilot did not call out the issue until I dropped to around 500 feet. I've only switched to a glass display two years ago. The lesson I learned here is that remaining competent on older backup instruments is a skill that needs to be exercised regularly.*

## Trust, but Verify

This large transport flight crew received an ATC low altitude alert while on approach. The Captain recounts the actions taken and identifies the mistake and its probable causes, which together suggest a valuable mitigation technique.

■ *We were leveling at 2,700 [feet] MSL and cleared for the ILS Runway 27 at Eastern Iowa Airport (CID). ATC issued a low altitude alert, and while our altimeter indicated that we were 300 feet above the cleared altitude, we executed an immediate go-around and commenced a climb to the ATC issued altitude of 3,000 [feet] MSL.*

*Upon level off, we realized that the altimeters had been incorrectly set during the descent check. We obtained the correct local altimeter setting from ATC and returned to the desired aircraft state. We returned for another ILS to Runway 27 at CID and landed uneventfully.*

*The probable cause was that the altimeter was set incorrectly due to confusion with an ATC received altimeter setting and failure to verify the correct setting. During the pre-descent ATIS check, both crewmembers wrote the correct altimeter setting. During the descent, we set the altimeter according to an ATC issued altimeter setting, which we both believe we heard correctly.*

| ASRS Alerts Issued in November 2021 | |
|---|---|
| **Subject of Alert** | **No. of Alerts** |
| Aircraft or Aircraft Equipment | 2 |
| Airport Facility or Procedure | 11 |
| ATC Equipment or Procedure | 10 |
| Hazard to Flight | 2 |
| **TOTAL** | **25** |



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| November 2021 Report Intake | |
|---|---|
| Air Carrier/Air Taxi Pilots | 4,403 |
| General Aviation Pilots | 1,377 |
| Flight Attendants | 600 |
| Controllers | 346 |
| Military/Other | 309 |
| Mechanics | 198 |
| Dispatchers | 138 |
| **TOTAL** | **7,371** |