

One Zero Ways to Bust an Altitude ...Or Was That Eleven Ways?

by Don George

Here I am, the PIC (Passenger In Coach) on a coast-to-coast wide-body, cruising along at flight level 350. I'm in Seat 25B (one of the cheap seats), feeling fairly comfortable after recovering from an earlier 1/2 incident which involved the guy in 24B suddenly tilting his seat to the full recline position and spearing me with my very own tray table. In any decent football league, that would have been a 15-yard penalty, but I didn't even get an "excuse me."

No cracked ribs, so I try to relax, but I can't because now I'm already worrying about the fact that we will have to descend in a couple of hours, and I know from reading a lot of ASRS reports that our chances of getting down through 11,000 and 10,000 feet without an incident are pretty remote. I conjure up in my mind a scenario which runs like this...

Controller will say, "...descend and cross three zero miles west of Gulch VOR at one-one-thousand, reduce to two five zero knots, report leaving flight level two zero zero, Podunk altimeter three zero zero five." With all those zeros now implanted into the flight crew's heads, one of them will read back "Descend to one-zero-thousand" along with the other values, and the controller will fail to note the wrong altitude in the readback.

Shortly thereafter, we will change over to Approach Control and report "...out of one eight thousand for one-zero-thousand." Again a busy controller will miss the incorrect altitude.

As we start to level off, the controller sees our altitude readout, questions us, and tells us to climb back up to one-one-thousand, where we belong. At the same time, there are a couple of departure aircraft heading in our direction, also at 10,000 feet. We evade them by making some steep turns and climbing rapidly. Not much harm done except a few spilled drinks, and the possible creation of some future paperwork.

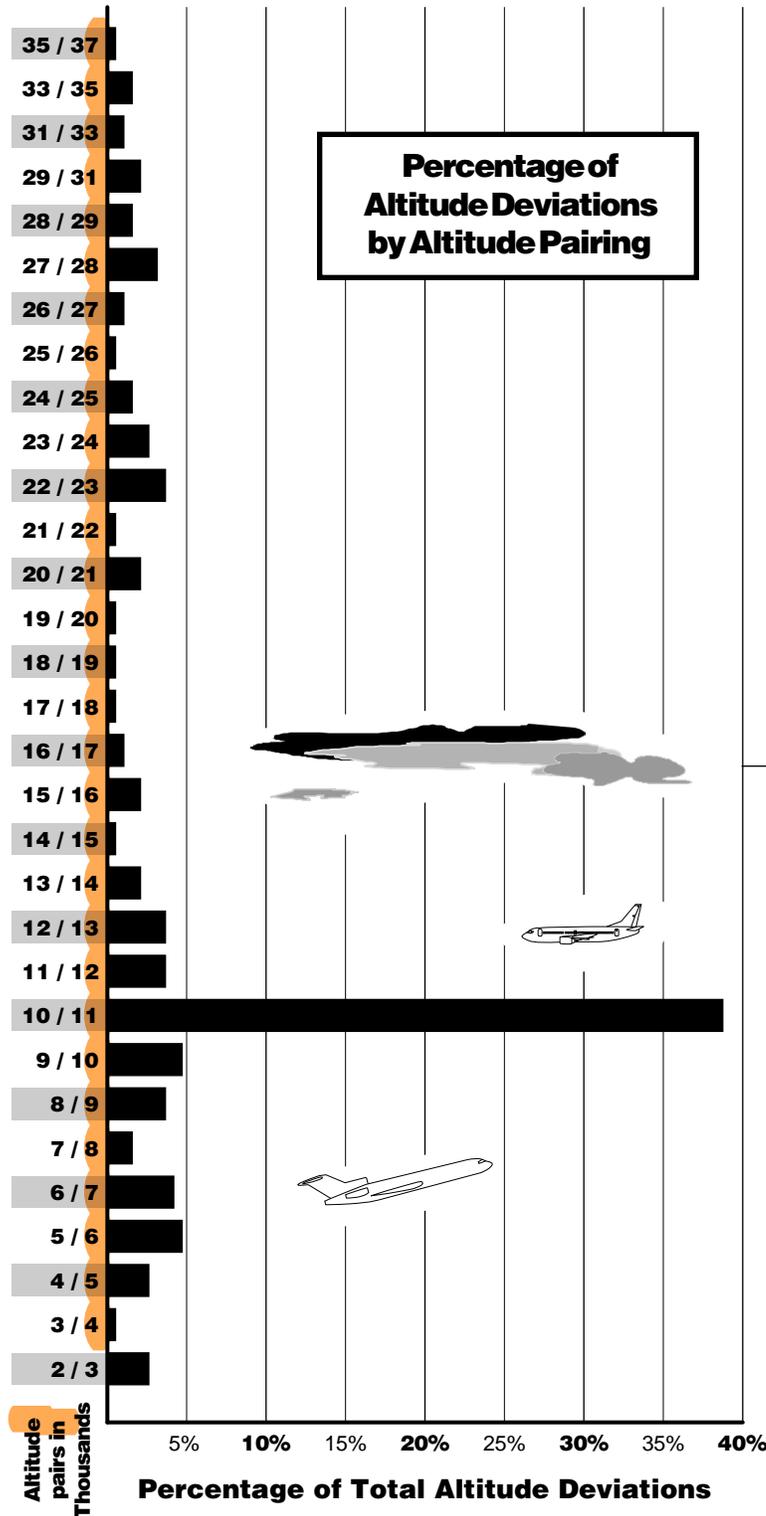
Pretty soon, I hear the announcement for flight attendants to prepare for landing. This is the favorite part of the trip for me because it means that the guy in 24B must put his seat back into the upright position, and it also indicates that we have gotten down through 11,000 and 10,000 feet without hitting another aircraft. Both of these occurrences allow me to breathe a lot easier!!!

Okay...so I made up all this stuff about the guy in 24B, and the dogfights with other aircraft, but it all could have really happened, because seriously, there is a real life 10K/11K problem, and I wanted to get your attention so that we could talk about it.

Why do a lot of altitude deviations occur at 10,000 and 11,000 feet?

Contributing Factors

In the preparation of this article, I reviewed hundreds of ASRS reports which involved a mix-up with these two altitudes. The reports reveal several causal factors which show up in nearly all of the incidents. I'll review those factors here; however, bear in mind that the incidents do not usually occur as a result of a single causal factor. They almost always reflect a combination of two or more of the following factors.



Similar Sounding Phrases

Pilots misunderstand the clearance, and controllers misunderstand the readback due to the similar sounding phrases of one-zero-thousand and one-one-thousand.

“I believe it is very easy to confuse one-one-thousand with one-zero-thousand, and vice-versa.”

“I don’t know if the controller said 10,000 but intended to say 11,000 or if he said 11,000 and I thought he said 10,000.”

Readback/Hearback

Controllers fail to note incorrect altitude in pilot readbacks. The old hearback bugaboo...

“Voice tape reading showed that the clearance was to 11,000 feet, but readback by [the] captain of 10,000 feet went uncorrected.”

“Controller said ‘Oh, I should have checked your readback.’”

Analysis of the ASRS database indicates that there are far more clearance misinterpretations involving the altitude pair of ten/eleven thousand feet than any other altitude combination—**fully 38 percent** of the sample data set. The next largest category accounted for less than 5 percent of the total deviations in this data set.

The sample data set on which this finding is based is composed of 191 ASRS reports describing incidents with the following characteristics: (1) an assigned altitude was overshoot or undershot, (2) a misinterpreted clearance contributed to the occurrence, (3) the event occurred between 1987 and 1990, and (4) the deviating aircraft attained an altitude 1000 feet, (or 2000 feet above FL 290) above or below its assigned altitude. The search was confined to ASRS Full-Form records since only these contain all of the necessary data elements.

The adjacent figure is based on an analysis of these data. Each category relates to a pair of altitudes that were confused with another, leading to an altitude overshoot or undershoot on either climb or descent.

Too Many Numbers

Controllers include several (sometimes, too many) numbers in the same radio transmission.

“The controlling agency, in rapid manner, told us to turn to 310 degrees, slow to 210 knots, and I understood him to say ‘maintain 10.’”

“Very often controllers issue four to five instructions in the same breath, such as ‘turn left 330 degrees, maintain 2000 feet till established, cleared for ILS 30 approach, contact tower 119.4 at the outer marker, and maintain 160 knots until five mile final.’”

Similar Numbers

Altitude crossing points stated in miles may be similar to the altitude to which the flight is cleared.

“Were we cleared to 10,000 feet 11 miles west of ARMEL, or 11,000 feet 10 miles, or 10,000 feet 10 miles, or 11,000 feet 11 miles?”

“Center cleared us to cross 10 DME NE PVD 11 thousand, 250 knots. I read back 11 miles NE PVD 10 thousand, 250 knots. At 10,100 feet I questioned center, and they said 10 north east at 11 thousand, 250 knots. We climbed back up to 11,000 feet.”

250 Knots at 10 Thousand

Pilots tend to associate a 250 knot speed restriction with a 10,000 foot altitude assignment, since civil aircraft are normally restricted to a speed of 250 knots or less below 10,000 feet.

“A clearance for 250 knots generally makes a pilot think about 10,000 feet due to the association of 250 knots below 10 thousand.”

“We think the 250 knot restriction could have led us to assume 10,000 feet because the majority of locations use 10,000 feet / 250 knot crossings in their STAR’s [Standard Terminal Arrival Routes].”

Spring Loaded

Pilots may anticipate receiving a certain clearance, but get something just a little different. Perhaps the last SID or STAR they executed had speed and altitude crossing restrictions that were similar, but not exactly the same as the one they are currently flying.

Noted an air carrier pilot who initiated a premature descent to 10,000 feet from 11,000 feet: “I may have anticipated being given 10,000 feet after seeing [an air carrier aircraft] pass below me.”

Failing to Question the Unusual

Pilots may, or may not, be familiar with normal ATC procedures in a particular area, and in either case, neglect to question an abnormal altitude assignment.

“Next time in and out of DEN we will be aware that the inbound aircraft are normally at 11,000 feet and departure aircraft normally restricted to 10,000 feet.”

“The usual clearance for this arrival is 11,000, but we both followed my error blindly to 10,000 feet.”

The Ten Mindset

Pilots and controllers get what is referred to as a “number ten mindset” after hearing a lot of zeros. It seems like one-zero-thousand then becomes the altitude assignment.

“I do think the number of tens in the clearance was a contributing factor.”

“Flight crew read back ‘one-one-thousand’, but somehow had mindset of one-zero-thousand.”

Reduced Monitoring

Cockpit duties and distractions result in only one flight crew member monitoring the ATC frequency. Similarly, controller workload and frequency congestion are factors which affect the ability of controllers to closely monitor pilot readbacks.

“This type of situation has occurred with this crew member 3 or 4 times since flying two man crew aircraft when one crew member is busy reviewing approach plate and procedures and is distracted from hearing conversation between [the] other crew member and controller.”

One Zero Ways to Bust an Altitude *continued...*

Cockpit Management

Cockpit management and flight crew coordination may be less than optimum, and crew members fail to adequately monitor each other in such tasks as altitude alert setting or read-back of clearances.

“Center cleared our flight from 17,000 feet to 11,000 feet MSL. This was acknowledged by me, however the first officer understood 10,000 feet and placed that altitude in the selector.”

“I will have to watch the music closer while the other guy is playing the piano.”

Radio Technique

Very often controllers and/or pilots fail to use proper techniques. I consider this to be the “big one” when it comes to causative factors. Yes sir, old number one-one (that’s eleven) is a really critical factor.

“The controller was busy, a lot of traffic. Contributing factors: Fast talking, bad radios, long clearances, a lot of numbers—given too fast to comprehend or write down.”

“I don’t know who was correct, but I know that I was incorrect in not requesting a confirmation of the clearance, since some doubt existed.”

Confusing Phraseology

Controllers and pilots are frequently misunderstood due to their use of improper phraseology.

“We had understood and read back ‘descending to 10,000.’ Phraseology contributed to this incident.”

“To correct future problems like this, the altitude should be given in the form of ‘ten thousand’ or ‘eleven thousand’, instead of saying ‘one-zero’, or ‘one-one-thousand.’ There is too much of a chance of error. We are used to hearing ten, or eleven, or twelve in everyday life.”

So...What are you going to do about it?

Here are a few starter suggestions.

Corrective Measures

Saying it Twice—Differently

Controllers and pilots are encouraged to use both single digit and group form phraseology in order to reinforce altitude assignments whenever there is the possibility of misunderstanding. Consider the following examples.

Controller transmission: *“(Ident) descend and maintain one-zero-thousand, that’s **ten** (with emphasis) thousand.”*

Pilot transmission: *“Roger (callsign), leaving one-seven-thousand for one-one-thousand, that’s **eleven** (with emphasis) thousand.”*

Note: Recent Air Traffic Procedure 7110.65 Handbook change allows controllers to use this phraseology to reinforce an altitude assignment. Many “old” pilots have used the technique for a long time and find that it helps.

Radio Technique

Take a good hard look at your radio communication techniques. Do you check to make sure the frequency is clear before transmitting? Do you activate transmitter **before** starting to speak? Do you use full and correct callsign? Do you use an acceptable speech rate? Do you enunciate, and emphasize when necessary for clarity? Do you ask the other party to repeat if transmission was not clear, or may have been stepped on? Do you listen up for similar callsigns?

These are just a few of the questions you should ask yourself. I’m sure you can think of many other good technique questions.

...Or Was That Eleven Ways?

Area Familiarity

Pilots should work to improve their “situational awareness” skills. For instance, you often fly in the Dallas/Ft. Worth area and have observed that normally the departures are restricted to 10,000 feet, and the arrivals are held up to 11,000 or higher until arrival and departure routes have crossed. You probably should question any altitude assignment which appears to be in conflict with these normal ATC procedures. Most terminal ATC facilities utilize standard routes and altitudes, and your situational awareness can help prevent an incident.

Reduce the Number of Numbers

Controllers can help make a conscientious effort to defeat the hearback problem, by being aware of the nasty effects of including too many numbers in the same transmission, and by using named intersections rather than number of miles when issuing crossing restrictions. (If necessary, consider changes to local procedures or to letters of agreement.)

Summary

Let’s take a final look at some of the reasons for the 10 thousand/11 thousand altitude problem. Factors include:

- Similarity in the sound of one-zero and one-one-thousand, particularly when other numerical information is being transmitted at the same time.
- Pilots may be spring loaded to expect a 250 knot airspeed in conjunction with a 10,000 foot altitude, thus a clearance for an airspeed of 250 knots may lead the flight crew to mistakenly assume an altitude requirement of 10,000.
- Failure to question an unexpected or unusual clearance; anticipating 10 when hearing a lot of zeros; flight crew and controller distraction; and breakdown in cockpit management.
- The 10K/11K quandary seems to be rooted in confusing phraseology and improper radio technique—compounded by the Readback/Hearback problem.

The solution to the 10K/11K problem lies in realizing the potential for error when descending or climbing through or near the 10,000 and 11,000 foot boundaries, and using *both* single digit and group forms to express these altitudes. Be prepared to question a clearance that seems unusual. If pilots and controllers use clear, concise radio technique, paying particular attention to the hearback phase, the potential for error will be reduced.

An Invitation

No doubt there are a good many readers of this article who are actively engaged in training activities, and you may want to consider this problem as the subject of a lesson or two. If you are interested in obtaining a small package of ASRS reports (about 20) on which to base training sessions, please call or write ASRS and request the 10K/11K Report Package. It will be sent at no charge.