

CALLBACK

From NASA's Aviation Safety Reporting System



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Climb Via and Descend Via

The FAA's Next Generation (NextGen) effort to modernize the nation's air transportation system touches many facets of aircraft operations. One of the stated NextGen goals is to improve National Airspace System (NAS) efficiency. That goal is achieved, in part, by publishing precise, charted vertical navigation paths on RNAV arrivals and departures along with lateral course requirements. Climb and descend "via" clearances authorize pilots to fly the vertical paths published on RNAV SID and STARs. Under ideal conditions, RNAV SID and STARs and the "via" clearances are designed to reduce pilot and controller workload and improve efficiency when accomplished effectively with aircraft automation. When weather, traffic, or changing conditions lead to additional Controller-issued restrictions, or when system malfunctions and operator errors occur, the resulting complexity, workload, and difficulty usually escalate for pilots and controllers alike, raising vulnerability and susceptibility to error.

ASRS has frequently received reports of incidents that begin with a "climb via" or "descend via" clearance. Common factors in these reports include traps that exist with aircraft automation, misunderstanding the "via" clearance itself, crewmember complacency, fatigue, and poor communication between pilots and other crewmembers or controllers.

This month, *CALLBACK* shares reported incidents revealing concerns, subtle complexities, and secondary problems that were experienced while climbing or descending "via" the SID or STAR.

Via Communication and Performance

This B737 Captain received a "descend via" clearance that the crew considered ambiguous.¹ Another "via" concern was identified, and a suggestion was offered in each situation.

■ *I just had two clearances on the same flight on the ROBUC THREE ARRIVAL into Boston that, in my opinion, highlight some problems with "descend via" clearances that are modified by ATC.*

The first clearance was given by Boston Center prior to ROBUC, namely, "Descend via the ROBUC THREE ARRIVAL, speed 290 until ROBUC." The word "until" introduces a slight ambiguity as to what speed to fly over ROBUC itself – 290 or the published speed of 260? A better clearance would be, "Descend via, except speed 290, then

published speeds at ROBUC," or "Descend via, except speed 290, published speeds after ROBUC." These have different meanings and are not ambiguous.

More seriously, on the handoff to Boston Approach, I think near ROBUC at a speed between 260 and 290 in VNAV PATH mode, we were told to slow to 220. There was no restatement of altitudes, so my understanding was to continue to descend via, except speed 220. Due to the immutable laws of physics and aerodynamics, it is not immediately obvious that the aircraft was capable of complying with the altitude [restrictions] at SOFEE and ERNEI, since the early speed reduction could make the aircraft higher than the upper altitude of the window. There is no easy way to know in advance if compliance is possible. In actuality, we used SPEED INTERVENTION to slow to 220, then used the speedbrake while monitoring the Vertical Situation Display (VSD) to ensure compliance (or possibly not) with the altitude [restrictions].

ATC should be made aware that after an aircraft has begun a "descend via" clearance, it may well be physically impossible to slow below the programmed descent airspeed and still comply with published altitudes, especially altitude windows with upper limits. ... It may be impossible for pilots to know the aircraft capability in this situation until speed has been reduced and actual descent rate examined.

Via Workload, Proficiency, and Computer Speed

An air carrier Captain described multiple problems derived from amended clearances and corresponding FMC recalculations, all while descending via the arrival.

■ *The crew planned for the DOOBI TWO ARRIVAL into Houston [KIAH], expecting Runway 26L. On descent prior to approach, ATC changed the arrival to the ZEEKK ONE ARRIVAL [currently designated ZEEKK TWO] with Runway 26R transition. Next, while inside Alexandria [AEX] on the arrival, Approach...changed the transition to Runway 27. Each change required changes in the FMC, which caused the FMC to become confused, creating a serious distraction to both crew members. This required switching to HDG SEL [command mode] while making sure the crew had the correct flight path and fixes. By the time the FMC figured*

out the descent path, the aircraft was well above the path, necessitating speed brakes to get back on path. Meanwhile, a check of the FMAs revealed that the aircraft was still in HDG SEL mode, which was quickly changed back to LNAV. Lastly, each runway transition on the ZEEKK ONE ARRIVAL into KIAH has a different bottom altitude, and ATC changes induce the opportunity to forget to set the proper altitude once ATC has changed the transition.

This unnecessary chain of events created by ATC must be immediately rectified by terminating the “descend via” clearance until the FMC has been properly programmed and the crew is relieved of having to comply with step down fix restrictions that cannot be verified while the FMC is confused. ATC needs to know about these...potentially dangerous complications that occur when changes are made after a descent has begun on a “descend via” clearance.

Via the Rock or Hard Place

Tenuous circumstances developed for this air carrier pilot while climbing via the SID. Although the crew did receive an amended altitude clearance, the incident might have been prevented.

■ We departed [Runway] 26R on the SNSHN 2 DEPARTURE [currently designated SNSHN 3], which is routed over the Pomona VOR. On this SID, the Pomona VOR is to be crossed at or below 8,000 feet. Clearance was to climb via the SID, except maintain 14,000 feet. SOCAL advised us of VFR traffic less than a mile north of the Pomona VOR at 6,500 feet. Shortly before reaching the Pomona VOR on the SID, SOCAL told us to amend the altitude to maintain 6,000 feet. We then stopped the climb and leveled at 6,000 feet. Shortly after leveling and approaching the Pomona VOR and making the turn on the SID toward terrain, we received an RA to descend due to the VFR traffic over the Pomona VOR. That had us descending toward the terrain.

SOCAL should have provided us with a heading to give us terrain and traffic avoidance.... If it is a necessity that the VFR aircraft operate over the Pomona VOR, since the SID [requires crossing Pomona] at or below 8,000 feet, the VFR traffic needs to be at or above 9,000 feet, or at the very minimum, at or above 8,500 feet to provide separation.

Via the Unfamiliar

A Hawker 800 Captain thought that the clearance to descend via the arrival was confusing. The crew was introduced to a different nuance of “via” that is used in non-US airspace.

■ Upon arrival into Toronto Pearson Airport, we were issued a descent clearance. At the time we were cruising at FL260. The clearance issued was as follows: “Descend

240, descend via the NUBER 2 ARRIVAL,” so we began our descent to FL240, then continued our descent via the arrival as instructed. Passing FL230, the Controller came on and asked where we were going. We were instructed to descend to FL240.... Then we were given, “Descend via the arrival,” so we were planning our first cross, which was at ROKTO between 14,000 and 12,000 feet. The Controller responded... that my clearance to descend via didn’t actually mean that I could descend via. It meant that I was only cleared to the altitude given, but was required to meet STAR restrictions in the process. The way the clearance was given and the meaning of the clearance were very confusing. We discussed it for a few minutes, and I voiced my concern that the way the clearance was given was very confusing. The Controllers did not appear to be bothered,...as if this was not the first encounter with the confusing instructions. He simply gave me a new altitude, and we proceeded normally.

Via Mode Awareness

An A320 Captain was relying on aircraft automation. While descending at night via the arrival, the crew was unaware of a mode change that could have had serious consequences.

From the First Officer’s Report:

■ On the DELTA 4 RNAV arrival [currently designated DELTA 5] into Salt Lake City, [we were] cleared to cross JAMMN at 17,000 feet. I had verified altitude restrictions with the Pilot Flying (PF). Approaching the fix, [we were] cleared to descend via [the arrival]. The PF selected 11,000 feet for the lowest restriction at MAGNE. We were still in MANAGED DESCENT. Prior to SPIEK we both verified [our] altitude and noticed we were low. The aircraft had reverted to VERTICAL SPEED. [We] started the correction and advised ATC, asking for a safe altitude. [We were] given 13,000 feet. We had a visual on terrain and no TCAS warning. [We were] then cleared to maintain 11,000 feet and given a runway assignment of 16L. We continued on downwind and were cleared for a visual.

...Fatigue was the main factor in [not] catching the event immediately.... Losing automation was the ultimate cause, but [the incident] was preventable had we been more alert.

From the Captain’s Report:

■ VERTICAL SPEED was activated at some point without us being aware of the change from MANAGED DESCENT. High task loading, ...distraction with the flight attendant announcement procedures, and approach chart verification [were also factors].

1. See FAA JO 7110.65X, Air Traffic Control, Chg. 2, Section 7 for speed adjustment phraseology.

ASRS Alerts Issued in October 2018	
Subject of Alert	No. of Alerts
Aircraft or Aircraft Equipment	1
Airport Facility or Procedure	7
ATC Equipment or Procedure	1
Hazard to Flight	2
TOTAL	11

467
 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>

October 2018 Report Intake	
Air Carrier/Air Taxi Pilots	5,638
General Aviation Pilots	1,471
Flight Attendants	568
Controllers	506
Military/Other	340
Mechanics	245
Dispatchers	166
TOTAL	8,934