CALLBACK
From NASA's Aviation Safety Reporting System
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AUTOTHROTTLE SPEED CONTROL ISSUES

The term autothrottle (automatic throttle) refers to the thrust control function of the automated Flight Management System (FMS) found on most larger commercial aircraft. Generally speaking, autothrottle systems operate by adjusting the fuel flow to the engines in response to a set of desired parameters compared to actual flight data input. These parameters may be set manually by the pilot or determined automatically by the FMS which instructs the autothrottle to increase or decrease thrust to maintain the desired vertical flight profile and/or airspeed.

It is incumbent upon flight crews to be fully aware of the differences in autothrottle function associated with the FMS mode selections available in their particular aircraft make and model. In some systems, the autothrottles will "wake up" in all modes in order to maintain a selected airspeed or a minimum flying speed, but other systems do not have this feature. In the following ASRS reports, airspeed control issues resulted when the autothrottles did not respond as expected due to a more basic "mode" error— the ON vs. OFF "mode."

Another aspect common to these reports is a delay on the part of one or more of the flight crew in recognizing how the lack of autothrottle response was affecting the aircraft on a very basic level. In an age of flying by "system management," it is important to remember that, when aircraft performance appears compromised, an immediate evaluation of raw data (airspeed, attitude, altitude, thrust setting, rate of climb or descent, DME, etc.) is the flight crew's best resource for understanding the energy state of the jet. Raw data is fast, factual and not subject to programming or mode errors. It represents the "real world" in which the jet exists regardless of how "virtually" it is operated.

A Whole Lot of Shaking Going On

A B757-200 experienced a high altitude stall when the autothrottles failed to re-engage after being intentionally disengaged. Beginning with the Captain's report, the members of the augmented flight crew present three interesting perspectives on the incident.

Captain's report:

■ *We began to pick up light to moderate chop and I selected Mach .78 in the autothrottle speed window. The airspeed decrease was minimal as I fought the autothrottles to retard, so I clicked them off until Mach .78 was achieved. I put .78 in the FMS cruise page, and selected VNAV on the Mode Control Panel. I then gave my seat to the Relief Pilot. [After] I walked to the aft galley to check on the Flight Attendants and passengers…moderate buffeting began. I [returned] to the cockpit where I observed that we were in a climb at .74 Mach passing 30,500 feet…. We advised ATC of the altitude loss due to turbulence and returned to FL350.*

The likely causes include:

1. The autothrottles were not engaged. When I slowed down for the turbulence just before the Relief Pilot was to relieve me, I clicked the autothrottles off, but did not verify they re-engaged in Speed or VNAV mode.

2. Distraction from the seat swap, ATC radio chatter (loud squeal).

3. Late night "fatigue" compounded by 90 minutes of flight in light to moderate chop and thunderstorm deviations. When the vibrations started I thought it was due to another aircraft's wake vortices. The First Officer thought it was a Mach over-speed buffet or engine vibration. The moderate vibrations during the few minutes of buffeting made reading the panel instruments very difficult. The noise from the autopilot disconnect warning was adding to the stress. Stick shaker was noticed by one pilot, but not the other….

Maintaining aircraft control, analyzing the situation, and taking appropriate action are paramount. Mach recovery is also critical in high altitude recovery. When exchanging seats or aircraft control, verify you have the automation doing what you think you have it doing.

Relief Pilot's report:

■ *Approximately five minutes [after I took the left seat], the First Officer commented about an abnormal vibration. The vibration went from light, increasing to moderate, to the point that the autopilot disconnected. The First Officer assumed control of airplane. We scanned the flight instruments to ascertain the problem, but continuous buffeting made it impossible. When we realized our speed was slow we maintained wings level, lowered the nose, and made a smooth recovery. Our altitude went from FL350 to approximately FL290…. Late night flying in continuous turbulence can be very fatiguing.*

First Officer's report:

■ *At FL350 I felt a strange vibration through the airframe, and commented to the flying pilot…. I initially scanned the upper and lower EICAS for a possible engine malfunction. In about 10-15 seconds the siren ("wailer") began. I initially believed it was an over-speed. We began descending. I took control of the airplane, maintained wings level and closed the throttles. The vibration made it difficult to see the flight instruments. I set pitch and thrust for level flight. Upon discovery of very slow speed, I commanded climb thrust and set the nose attitude, accelerated to clean maneuver speed, and began to climb back to assigned altitude.*

The circumstances, beginning with the vibration were highly unusual, something I have never seen demonstrated in the simulator. Furthermore, the high altitude recovery following a possible autopilot disconnect, is something that should be demonstrated in the simulator.

Low and Slow

Lack of communication and confusion about the autothrottle status led to a go-around for a B777-200 flight crew.

■ *The autothrottle became disconnected on final several miles from the runway, but this was not recognized until short final. I noticed the IAS at Vref (142 knots) at 200 feet AGL. I asked the Pilot Flying (PF) to add power and realized that the autothrottles were not driving the power. The PF did not respond immediately. I believe he was confused as to why the autothrottle was not responding. The IAS then decreased to approximately five knots below Vref. I again requested more power and brought the First Officer's attention to the low speed condition more urgently while I began pushing the throttles up myself.*

At this point the PF reacted with more thrust and the speed immediately jumped to Vref +5, but then continued to accelerate beyond Vref +10. I felt the approach to be unstable and called for a missed approach at 50-100 AGL. The go-around was completed without contacting the runway.

More attention to cockpit automation was necessary. A later review of the incident revealed that the PF had disconnected the autothrottles at the same time as the autopilot with the intention of hand flying the approach. By utilizing a "double click" of the autothrottle disconnect button, the Autothrottle Off aural warning was prevented from sounding since the system assumed the act was intentional, as it was in this case. Fatigue following a more than 12-hour flight was a factor.

Lower and Slower

An A321 flight crew got into a low energy situation that led to an "ugly landing" when the autothrottles failed to "spool the engines" as expected.

■ *When it was time to start the managed arrival, I pushed the altitude selector button on the Flight Control Unit (FCU). At this point we suffered a Flight Management Guidance Computer (FMGC)1 malfunction which resulted in loss of my map display as well as a minor ECAM and loss of GPS primary positioning on the Captain's side. This resulted in a transfer of control to the First Officer.*

At the 1,000 feet AGL call the First Officer called "stable" and I confirmed that we were on glide path and within a couple of knots on the low side of Vapp. At the 500 foot call I called "stable, REF minus 3 to 4." Because we were a little slow, I made a conscious decision to watch the airspeed as the A321 tends to be less forgiving if energy gets low. I made a call of "REF minus 5" at some point closer in and another call of "REF minus 8" as we were approaching 50 feet AGL. I was expecting the autothrottle to have spooled the engines by now, but it had not changed the downward trend in airspeed. We landed hard and I was expecting a bounce, but we did not get one.

It was an ugly landing and it unnerved both of us. The weather was not a factor as far as I could tell. It was just an average day with light winds. I cannot remember anything unusual about the gap between Vls and the target speed. It must have looked pretty normal. I do remember looking at the Vapp speed displayed on the First Officer's MCDU since mine was not working and it showed 144 knots, which seemed about right….

The bottom line is that the airspeed drifted downward below Vapp during the last 500 feet of the approach without the autothrottle spooling up the engines. I had not seen this before. Up until now, I have experienced pretty reliable performance from the autothrottle. Upon later reflection I wondered what a go around would have looked like. We were low on energy. The increase in thrust as well as increase in pitch for the go around would have put the tail of the aircraft very close to the runway surface. I am reasonably sure we would have made contact with the runway, wheels first, during the go around. We need more autothrottle OFF practice so it is more instinctive to intervene and skillfully restore proper energy during an approach. We are losing our ability to hand fly the airplane.

ASRS Alerts Issued in January/February 2015	
Subject of Alert	**No. of Alerts**
Aircraft or Aircraft Equipment	1
ATC Equipment or Procedure	1
TOTAL	**2**

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February 2015 Report Intake	
Air Carrier/Air Taxi Pilots	4,392
General Aviation Pilots	988
Controllers	517
Flight Attendants	366
Mechanics	210
Military/Other	175
Dispatchers	87
TOTAL	**6,735**