

JUST HAVING A LITTLE FUN

By Michael R. Grüninger
of Great Circle Services AG (GCS)
and Capt. Carl C. Norgren

JOIN THE '410 CLUB'

"Man, we can do it. 41 it", joy mixed with surprise and pride resounded in the 23 year old copilot's voice at the controls. He had just reached FL410 during the positioning flight of a Canadair Regional Jet (Bombardier CL-600-2B19) operated by Pinnacle Airlines.

At around 10 pm of the 14th of October 2004 Pinnacle Airlines flight 3701 levelled off at FL 410. The pilots now had become members of the company's infamous and secretive '410 club'.

For the 31 year old captain and his copilot this flight felt not as an extraordinary event.



ABNORMAL

By executing non-standard procedures, the pilots of FL410 exerted great pressure on the aircraft.

They were positioning the aircraft from Little Rock, Arkansas, to Minneapolis-St. Paul, Minnesota, without passengers and without cabin crew on board. Without payload the crew flew the aircraft to its supposed certified maximum operating altitude.

Step Climb

During climb the crew decided they wanted to have some fun. Being alone and young, they executed non-standard procedures they were not in the condition to perform during normal passenger operations.

Admittedly, who has never indulged in some additional action during otherwise dull and boring flights? Most of us have heard stories from pilots who have executed non-standard manoeuvres such as dutch rolls, loopings, side-slipping, steep climbs and steep descents when alone in the aircraft.

The crew of the Challenger performed three pitch-up manoeuvres during climb.

At 450 ft AGL the crew moved the control column to 8° ANU. The pitch angle increased to 22°. The vertical load to 1.8 Gs. The stickshaker sounded and the stickpusher kicked in. The control column was deflected to full AND.

At 15'000 ft the crew exerted a vertical load of 2.3 Gs.

Then they started making large left and right rudder inputs pushing the aircraft nose to sweep across the sky.

Finally, at an altitude of 24'600 feet with the autopilot engaged and a vertical speed of 600 fpm selected, they began the third pitch-up manoeuvre during the ascent. During the pull the vertical airspeed reached 5000 fpm for several seconds. After that the crew selected vertical speed mode again starting at 3000 fpm decreasing to 1000 fpm.

During the last part of the climb to FL 410 the airspeed gradually reduced while the aircraft maintained the selected rate of climb of 500 fpm on vertical speed mode.

Levelling Off at FL410

When the aircraft levelled at FL 410 the airspeed had reduced to 163 KIAS/0.57 MN. It went unnoticed that the airspeed should have been at 240 KIAS in accordance with flight procedures.

ATC and crew were amazed at being at FL410. In the cockpit the joy was great and commented upon. On the ground, ATC wondered about the high flying Canadair Regional Jet.

Soon after the short-lived moment of joy and excitement, the crew understood that they wouldn't be able to maintain the altitude.

Devastating Descent

Two and a half minutes at FL410 on, the stick shaker activated as the airspeed further reduced to 150KIAS, followed by the stick pusher.

Instead of positively lowering the nose to gain speed and recover from the low-energy status, the crew repeatedly pulled the nose of the aircraft up. This move triggered the stick pusher at each time.

Finally the pitch angle increased to 29° ANU and the aircraft entered an aerodynamic stall.

The angle of incidence of the airflow to the engines increased beyond limits and both engines flamed out.

On the Back Side of the Power Curve

When the aircraft reached FL410 it was operating in the region of reversed command, also known as operating "on the back side of the power curve." It occurs when the available engine thrust cannot overcome the increased induced drag associated with low airspeed and high aircraft pitch attitudes. As a result, the airplane cannot accelerate and may lose altitude or stall.

When the stall warning activated, followed by the stick shaker and stick pusher, the crew should have lowered the nose of the aircraft to recover air speed.

Instead the crew attempted to avoid any major altitude loss. What would have been an appropriate technique in a low altitude, low speed stall situation lead to a full aerodynamic stall, aggravated by the loss of both engines.



Tragic Ending

The crew recovered aerodynamic control over the aircraft by FL 340. But both engines were still not producing thrust and N2 had decreased to 0. All subsequent engine start attempts failed. The crew tried both windmilling and APU assisted starts without success.

While still at high altitude, there would have been number of suitable aerodromes within gliding distance. But the crew did not report the dual engine failure to ATC and repeatedly attempted to restart the engines down to a very low altitude.

Eventually the crew realized that they could not restart the engines.

When the engine cooled, the assembly did not match anymore due to thermal stress and the blades stopped rotating freely. The NTSB report states that the engines were 'locked', a condition known to have occurred previously with the Challenger's General Electric CF-340-3 engines.

Out of all available aerodromes in the vicinity of the upset, now the crew was left with less landing options and selected the one which lay beyond gliding distance.

When the captain realized that the emergency landing would occur in a residential area, he courageously opted to stretch the glide as much as possible by not extending the landing gear. The aircraft hit trees and crashed into backyards, but avoided impact with houses.

The aircraft crashed without causing further casualties on the ground. Both captain and co-pilot did not survive the impact.

A Rollercoaster of Feelings

The NTSB did not comment on human factor aspects. By reading the CVR transcript and appreciating the control input history from the FDR, it becomes apparent that the crew was playing with the aircraft.

Big control inputs, both by pulling and pushing the yoke and large inputs on the rudder pedals, exerted great forces on the airframe. An inconsiderate use of flight automation reduced the airspeed to critically low levels. The crew was simply having fun with the aircraft and enjoying the ride.

The mood in the cockpit changed after they could not maintain FL 410.

Without the necessary performance reserves to maintain level flight, the crew slowly had to realise that their fun ride was turning into a very different kind of ride.

And yet, down to almost the last communication with ATC the crew did not admit they had lost both engines and that they were actually in a full scale emergency situation. They denied the extent of the troubles they were in.

This young crew was not able to overcome their initial positive excitement and to revert quickly to a professional way of handling the chain of events.

By applying stall recovery techniques not appropriate to high altitude flying the crew wanted to maintain FL410 which made them a member of the '410 club'.

The main airplane wreckage was located at an elevation of 740 feet.



Michael R. Grüniger is Managing Director of Great Circle Services (GCS) Safety Solutions and Capt. Carl C. Norgren is a freelance contributor to Safety Sense. GCS assists in the whole range of planning and management issues, offering customized solutions to strengthen the position of a business in the aviation market. Its services include training and auditing (IS-BAO, IOSA), consultancy, manual development and process engineering. GCS can be reached at www.gcs-safety.com and +41-41 460 46 60. The column Safety Sense appears regularly in BART International since 2007.

DISASTER

Having fun with an aircraft can have disastrous consequences.