THE REMARKABLE FLIGHT OF CACTUS 1549

Venkatarama Krishnan

Professor Emeritus, UMass Lowell

February 2009

THE REMARKABLE FLIGHT OF CACTUS 1549

Venkatarama Krishnan
Professor Emeritus, UMass Lowell

UNITED AIR CACTUS 1549

On January 15, 2009, a US airways flight 1549 with code sign Cactus 1549 was taking off from LaGuardia airport at 3:25PM (EST) bound for Charlotte, North Carolina with 150 passengers and a crew of 5. The twin engine Airbus 320 was piloted by Captain Sullenberger and First Officer Jeffrey Skiles with a cabin crew of three. Sullenberger was a former fighter pilot who also had extensive experience as a glider pilot. As a backup in the unlikely event that both engines stop functioning, the plane was equipped with a fuel supplied auxiliary power unit (APS) and wind powered ram air turbine (RAT) where both can supply emergency electrical power to operate the hydraulic pumps.

First Officer Skiles was at the controls at take-off. Two minutes into the flight at an altitude of 2,700 feet he was the first to notice at 3:27PM a V-formation of Canada geese and thought that they were below the aircraft. Immediately there were several loud thuds and the birds crashed into the windscreen. Moments later both engines lost power and Captain Sullenberger took over from Officer Skiles, who was trying to restart the engines. At 3:28PM, Sullenberger in a clipped terse voice radioed the air traffic controller at the Terminal Control Radar Approach Control (TRACON),"This is Cactus 1539. Hit birds, we lost thrust in both engines. We're turning back towards LaGuardia". The stress was evident when Sullenberger missed the call sign and said 1539 instead of 1549. The air traffic controller, Patrick Harten, immediately alerted LaGuardia and gave landing directions to the stricken airliner.

Hartan: If we can get it to you, do you want to try to land runway 13?
Sullenberger: We're unable. We may end up in the Hudson.
Hartan did not quite believe what Sullenberger was saying and wanted to divert to an alternate runway.
Hartan: Alright Cactus 1549, it's going to be left traffic to runway 31.
Sullenberger: Unable.
Hartan: Okay where do you need to land? Runway four is available if you want to make left traffic to runway four.
Sullenberger saw an airstrip to his right in New Jersey and asked,
Sullenberger: I am not sure if we can make any runway. What's over to our right anything in New Jersey? Maybe Teterboro?
Hartan: Okay yeah. Off to your right side is Teterboro airport. Do you want to try and go to Teterboro?
Sullenberger: Yes.
Hartan called Teterboro airport and made arrangements for 1549 to land there and called,
Hartan: Cactus 1529, turn right two eight zero. You can land runway one at Teterboro.
At this point Hartan was also using the wrong call sign 1529.
Sullenberger: We can't do it
Hartan: Okay, which runway would you like at Teterboro?
Realizing that he had neither the altitude nor the power Sullenberger responded at 3:29PM,
Sullenberger: We're going to be in the Hudson.

Even though Hartan heard this, he was incredulous and asked,
Hartan: I'm sorry, say again Cactus?

Sullenberger did not respond and had the dubious task of both controlling the powerless plane as well as talking on the radio, which is usually the task of the copilot. The air traffic controller Hartan thought that the pilot had signed his own death warrant and that he will never see any of the people aboard Flight 1549 alive. Later, to his immense relief, he came to know that all persons aboard were rescued.

During the last two minutes of the flight Sullenberger was focused on bringing the giant airliner safely on the Hudson River. To accomplish this, several tasks had to performed in synchronism. He has to keep the nose up to provide lift, keep both wings absolutely horizontal so that they will not hit water first, keep the airspeed neither too high nor too low so that the plane will not stall and finally adjust the glide slope to the water. All these maneuvers worked smoothly and the plane landed on the Hudson River at 3:31PM six minutes after take-off from LaGuardia. Before touchdown the stewardesses did an excellent job of keeping the passengers calm and instructed them on the ditching procedures. Just before landing they kept on repeating, “Brace for landing”. Immediately after touchdown the cabin doors were opened, the life rafts were inflated and all passengers exited and lined themselves on both the wings. In the meantime the plying ferryboats made a beeline to the floating aircraft and all passengers and crew were rescued. Captain Sullenberger walked through the plane twice to make sure that all passengers have left before he finally got on the life raft. There was only one major injury of lacerated leg on one of the stewardesses and all the 155 persons were rescued. This was indeed airmanship at its best given that Sullenberger had only six minutes time from take-off. The whole country rejoiced at this feat and the flight crew was honored by New York City. When the passengers and other people lauded Sullenberger’s feat he replied in a matter of fact tone, “I was only doing the job I was hired to do and my crew did a magnificent job in this effort. Perhaps I was also lucky”.

The question will always be asked, “How does this water landing compare with three other crash landings during the past 53 years where no lives were lost? The three that will be discussed are Pan Am flight 943, Air Canada flight 143 and Air Transat flight 236.

PAN AM FLIGHT 943

On October 15, 1956, during the pre jet liner era Captain Richard Ogg with 24 passengers and a flight crew of 6 took off from Honolulu airport to San Francisco on Pan Am Boeing 377 Stratocruiser Flight 943. The take-off at 10:26PM PST was uneventful. Among the passengers was a young mother with 18-month-old twin girls. The flying time for the distance of about 2,400m was about nine hours. Midway through the flight after the plane had crossed the point of no return the number one engine started to malfunction with a speeding propeller. Ten minutes later the number four engine failed leaving the plane with only two functioning engines and the aircraft was losing altitude because of the drag. It was not possible for Captain Ogg either to proceed forward to San Francisco or to go back to Honolulu. The only alternative was to ditch the aircraft in the Pacific.
It was usual in those days to keep a coast guard cutter at the midway point in the Pacific as a communications relay help for the aircraft, and on that day the cutter Pontchartrain was close by. Captain Ogg radioed the cutter about his predicament. The skipper of the cutter advised that he could ditch immediately since the sea was calm, but Captain Ogg preferred to ditch

during daylight hours. He circled the cutter for four hours to partly to burn the excess fuel and partly to wait for daylight and radioed,
"We will try to stay aloft until daylight".

During this wait, the passengers either slept or smoked cigarettes. Finally when daylight arrived it was time to ditch. Some passengers took pictures of the cutter Pontchartrain. Captain Ogg quipped to the Coast Guard,
"Your ship is sure a beautiful sight", for which the Coast Guard replied,
"Thank you, we think so. Glad it's a comfort to you. We got your bacon and eggs on the fire".

During this long wait before ditching, the cabin crew methodically cleared the plane of loose objects and instructed the passengers as to how to inflate the life jackets. Further, they were also aware of the fact that the tail area may break on impact in the water, and cleared the rear berths of passengers.

Captain Ogg made several dry runs in sight of the cutter's crew before the actual ditching. The captain of the cutter after informing Capt. Ogg that the sea was flat and the water temperature was 72 degrees sprayed the ocean with fire retardant foam partly for depth perception and partly for squelching any fire that might erupt.

All was set for the ditching and until the plane hit the water everything seemed to go smoothly. However, just at the point of impact the wings caught a swell of the waves and just as expected the tail snapped away from the plane and sank almost immediately. The crew of the cutter saw with horror the crashing and splitting of the plane and thought that nobody could have survived the crash. They were blinded by the spray and when it cleared they saw that the passengers were standing on the wings. The cutter went to the rescue full steam. In the meantime, Capt. Ogg just like Capt. Sullenberger went through the broken plane twice and made sure that all passengers were evacuated. The sole injury was that of one of the twin girls when she bumped her head and was knocked out. Within 20 minutes the entire plane sank and all the 31 people aboard were rescued.

The cutter Pontchartrain with the rescued passengers and crew steamed into San Francisco harbor a week later and when the reporters asked Captain Ogg about the fantastic job he did, he replied laconically,
"We had a job to do and we had to do it right or else".

Capt. Ogg died in 1991 at the age of 77.

AIR CANADA FLIGHT 143

On July 23, 1983, Captain Robert Pearson and First Officer Maurice Qiuintal were taking off on flight 143 from Montreal International airport to Edmonton via Ottawa with 61 passengers and 6 other crewmembers. The plane was a new twin engine Boeing 767 aircraft delivered to Air Canada four months earlier by Boeing. It was one of the first airliners equipped with a sophisticated Electronic Flight Instrument System operated by electricity generated by the aircraft's jet engines. This instrumentation system made the presence of a flight engineer on the flight deck somewhat redundant.

The amount of fuel in the tanks was calculated by the Fuel Quantity Indicator System and displayed on the gauges in the cockpit. On that particular day, the fuel gauge system was malfunctioning and the quantity was calculated manually by drip stick measurement as found in measurement of engine oil in automobiles. It should be mentioned that Air Canada was switching from the pound system to the metric system and the Boeing 767 was calibrated in the metric system. The conversion factor used was 1.77-pounds/liter of fuel used in all the other aircraft. What should have been used was 0.8 pounds/liter for the metric system. The result was that instead of 22,300 kg of fuel the ground crew filled only 22,300 pounds of fuel, which is about half the fuel that was needed for the entire flight.

Captain Pearson knew about the malfunction and punched the amount of 22,300 kg of fuel in the flight management computer since the ground crew confirmed that the aircraft had been fully fueled. The brief flight to Ottawa was uneventful. After refueling, he again rechecked the fuel with the same incorrect conversion factor. The consequence of this slip was disastrous.

The take-off from Ottawa was also uneventful but the flight crew was blissfully ignorant that instead of 20,400 kilos of fuel they had only 20,400 pounds or 9300 kilos of fuel! Over Red Lake Ontario the plane was cruising at an altitude of 41,000 feet at about 470 knots, warning signs beeped from the console indicating that there was shortage of fuel in the right wing. Thinking that there was a pump failure, Capt. Pearson turned on the cross feed valve, which would have diverted fuel from the left to the right tanks. Immediately thereafter a second fuel shortage lights came on and he decided to divert to Winnipeg and came down to an altitude of 28,000 feet. A few minutes later a sharp bong emitted from the cockpit warning system indicating complete lack of fuel. Starved of fuel both the powerful engines quit and the aircraft was silent. The passengers had an eerie feeling with no engine roar.

The Boeing 767 was equipped with ram air turbine (RAT) system that automatically drops down in the event of a total power loss. This is a wind turbine, which is operated by the forward motion of the aircraft and supplies power for minimal control so that it can glide to a suitable landing strip. Calculation of the airspeed and the rate of descent indicated that reaching Winnipeg was out of question. At this point First Officer Quintal knew about an abandoned military airfield at Gimli where he had once trained that was about 60 miles away. What he did not know was that the airfield was converted into a drag racing strip with provision for families to go camping and picnicking. The plane glided towards Gimli.

When they reached the Gimli airfield the plane was too high and was going too fast. With no airbrakes to slow the plane Capt Pearson used his expertise on gliding to put the plane into sideslip by crossing the controls. Cross controlling a huge jet had never been attempted but Pearson was successful in reducing the airspeed and to get to the desired altitude. He had no hydraulic power to lower the landing gear and hence he adopted a gravity drop. To his relief the landing gear dropped and locked in position. But the nose gear did not lock. As the plane landed Pearson saw people in the distance and stood on the brakes to stop the plane. The tires blew and the nose gear collapsed and fortunately this gave him more braking power and he was able to stop without any casualties on the ground. Only 10 persons were injured out of a total of 69 persons and there were no loss of life.

When reporters congratulated Capt. Pearson, he responded,
“For me it was a cold, unemotional experience. It was the only time in my entire career I felt

like I was a computer. I had a job to do and I stayed totally focused. I could not have done it without the assistance of Quintal who did all the calculations and knew the existence of Gimli". This statement was exactly along the same lines as Capt. Sullenberger said.

When the same scenario was presented to crews in a simulator all of them crashed the plane and remarked that this cannot be done.

One would have thought that after this superlative airmanship Capt. Pearson would have been commended for his effort. But, following Air Canada's internal investigation, he was demoted for six months, and First Officer Quintal was suspended for two weeks. Some of the ground crew was also suspended. Nevertheless, in 1985 both the pilots were awarded the first ever Federation Aéronautique Internationale Diploma for Outstanding Airmanship. Pearson retired in 1993 and Quintal was elevated as a captain. This aircraft was repaired and served the Air Canada fleet for another 25 years before being retired in 2008.

AIR TRANSAT FLIGHT 236

On August 23, 2001, at 8:52PM (EST) Captain Robert Piche and First Office Dirk DeJager were taking off from Toronto international airport to Lisbon in Portugal on Air Transat Flight 236. It was an Airbus 330 similar to the one Captain Sullenberger piloted. There were 293 passengers and a flight crew of 13 for a total of 306 persons.

On August 24, unknown to the pilots after about 4 hours of flight, the starboard engine started a fuel leak at 12:52AM. After flying for about 40 minutes the warning lights came on the cockpit indicating high oil pressure and low oil temperature. The pilots thought that the warnings were due to computer glitch and ignored them. After flying for another 20 minutes at 1:30AM warning lights came on indicating fuel imbalance in the two tanks with the starboard engine showing near empty. Without realizing that the right engine was leaking Captain Piche opened the cross feed valve to divert fuel from the left tank to the right tank. This diversion had disastrous effect since the uncontrolled leak was continuing to lose fuel. After another 10 minutes of flight, fuel in both tanks was dangerously low. Captain Piche declared emergency because of fuel shortage and guided the plane towards the Azores airport in the mid Atlantic. 28 minutes after declaring emergency at 2:23AM, starved of fuel engine two flamed out. About 15 minutes later engine one also flamed at 30,000 feet out resulting in no power at all. The ram air turbine (RAT) dropped down from the fuselage that offered minimal control to the hydraulic and electrical systems. They were still about 100 miles from the Azores airport. The big Airbus 330 had become a huge glider.

Captain Piche had training in glider flying and he was able to guide the giant Airbus with deft maneuvers and approached the airport at Azores. A new problem arose. The aircraft was going too fast and too high. Piche was able to execute the sideslip maneuvers to slow down aircraft and to lose altitude. Finally at 2:45AM (EST) after about 20 minutes of gliding the aircraft landed very hard at about 200 knots. Immediately Capt Piche applied all the emergency brakes hard and most of the tires burst. 16 persons suffered minor but not life threatening injuries during evacuation and all the 306 people came out alive. This flight was the longest gliding effort on the huge Airbus.

Investigation revealed the fuel leak and pilot error was attributed as the lead cause for the accident. However, the skill of the pilots and the air traffic controller in Azores allowed the flight to land without loss of lives and with only minor injuries to very few passengers. The pilots were applauded as heroes and the aircraft is till in service after repairs. Changes were made in the protocol to make sure that the cross feed valve is engaged only after making sure that there is no fuel leak.

Comparison to Flight 1549

In the three instances cited above only Pan Am 943 ditched in the ocean with power from two operating engines whereas Air Canada 143 and Air Transat 236 like the Cactus 1549 glided into a landing without engine power. All these three pilots exhibited remarkable skill in landing the plane without any loss of lives. In addition to their skills these pilots also had plenty of time and altitude to plan the landing carefully. Even then the last two were hard landings with speeds in excess of 200 knots.

However the case of United 1549 is unique and cannot be compared to the three mentioned above. This landing was a combination of both gliding and ditching in the shortest span of time. Captain Sullenberger in ditching the plane in the Hudson River had the luxury of neither the time nor the altitude to make careful preparations. He had barely four minutes with minimal control from the ram air turbine and APS to glide the plane from an altitude of 2,800 feet and slow the aircraft to an acceptable landing speed of 150 knots. Additionally, he had to make sure that the wings are perfectly level with the water surface so that the plane does not break apart upon impact. Every maneuver had to be performed on instinct and training. He achieved all this with remarkable aplomb and superb airmanship and landed the plane on the Hudson River without any loss of lives. This is indeed airmanship ‘par excellence’ combined with the excellent crew discipline and the fortuitous presence of ferryboats to effect a very quick rescue.

It is also interesting to note that during the span of 53 years all the four pilots who landed the planes without loss of lives had similar comments to the effect that they did the job they were hired to do.

[Author’s Note: The events described in this paper are from the personal knowledge of the author as witnessed on TV when these events occurred. The actual conversations are taken from the transcripts posted on the Internet.]