Mitigated Speech

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Abstract

This is an article that explores why we don't speak up clearly in high risk situations that require clear communications. It pertains to the chapter on Communications. Since most of us are familiar with the recent crash of Continental 3407 in Buffalo, NY on February 13, 2009 I will use that as an example.

Continental Flight 3407

Introduction

I would like you to look at the facts of this flight and apply them to the principles we learned. I have inserted "Author Notes" to provide you references to Human Factor topics you learned. My objective is not to answer any questions but to make you think about how you can apply the learning to this case. You can also apply the same concepts to your job.

Caution: The NTSB investigation has not been concluded. The facts are that the flight data recorders show that the flight was routine until roughly a minute before impact, when the crew lowered the landing gear and extended the flaps. Almost immediately, the airspeed bled off and the stick-shaker activated, followed by a stick-pusher that automatically lowered the nose. It appears the captain pulled back on the stick with enough force to overpower the pusher and added power, causing a 31-degree pitch-up. The wings immediately stalled, and the airplane whipped to the left, then entered a steep right turn. The pilots continued to fight with the controls, and they were starting to recover when they "ran out of altitude."
Due to the conditions it is suspected that the aircraft experienced icing conditions and the crew allowed the airspeed to deteriorate. When the crew extended the flaps for landing the aircraft stalled.

Basic Facts of the Flight:

On February 13, 2009 a Bombardier Dash 8-Q400 crashed just a few miles short of the Buffalo airport enroute from Newark, N.J. The aircraft experienced an aerodynamic stall, rolling back and forth before plunging into a house below. All 49 people aboard and one on the ground were killed. You can view the NTSB re-creation on the Colgan Air 3407 video.

The Dash 8 was a twin-engine turboprop, operated as Continental Flight 3407 by commuter carrier Colgan Air Inc., a division of Pinnacle Airlines Corp. Colgan, based in Manassas, Va., operates nearly 50 planes, carries 2.5 million passengers annually and employs about 480 pilots. It serves as a commuter airline that feeds larger carriers, such as Continental Airlines, United Airlines and US Airways.

Historical Problems in Colgan Air

(Author's Note: Think about these system's problems.

Flight Troubles

Accidents involving Pinnacle Airlines and its Colgan Air unit

- **August 2003:** Colgan turboprop crashes in Yarmouth, Mass., and kills both pilots, as a result of improper maintenance work on a flight-control cable. No passengers are on board.
- **October 2004:** Pinnacle regional jet on a ferry flight without passengers stalls and both engines shut down after pilots use non-standard procedures to climb to unusually high altitude. Two pilots are killed in crash near Jefferson City, Mo.
- **April 2007:** A Bombardier regional jet operated by Pinnacle suffers substantial damage running off the end of a Traverse City, Mich., runway after touching down in bad weather. None of the 49 passengers were hurt, but investigators blame the cockpit crew for faulty decision-making.
- **February 2008:** A Colgan Q400 twin-engine turboprop stalls and crashes while approaching the airport in Buffalo, N.Y., killing 50 people and sparking concerns about cockpit discipline and pilot training at the commuter carrier.

- A year earlier a former FAA inspector warned the Federal Aviation Administration that Colgan Air might have trouble flying the model of plane involved in the disaster. Christopher Monteleon reported that Colgan's pilots flew fatigued, exceeded manufacturer speed recommendations, didn't report broken equipment, and "botched" landing attempts. For his trouble, Monteleon says he was suspended and given a desk job. The FAA insists that it took Monteleon seriously, and that he was not punished for his report. Colgan, meanwhile, dismissed his claims. But early safety-board hearings into the crash that killed 50 made it clear that it was investigating the quality of the FAA's

regulation of Colgan. Monteleon believes the agency was too “cozy” with the airline.

- In recent weeks, Colgan's top two training officials resigned; Mr. Williams has said their decisions were voluntary and not connected to the accident. Darrell Mitchell, Colgan's departing director of training, is slated to testify at Tuesday's hearing.
- Since the accident, industry and government safety experts have uncovered what they claim are other shortcomings at Colgan. The airline began flying Q400s in February 2008, but Colgan pilots say it wasn't until nine months later that they received a detailed bulletin on how to use some of its ice safety features. However, the bulletin was delivered three months before the accident. Colgan said that since it started flying the aircraft, pilots "were trained on the use of all components of the ice protection system on the Q400."
- More recently, Colgan removed several of its senior management pilots, known as check airmen, who are responsible for evaluating the performance of crews in the air as well as in simulators. The airline said that "from time-to-time," it relieves check airmen of their duties if they fail "to perform to the company's high standards."

Crew History:

Captain Renslow

Captain Renslow had 3,379 total hours of flight experience and was Airline Transport Pilot rated, which is the highest level of certification available. In the Q400, he had 109 hours flying the aircraft as pilot in command, in addition to 172 hours of formal training (includes classroom, full motion simulator and time in the seat with an instructor on the flight deck and passengers in the cabin) for a total of 261 hours. This qualified him fully in accordance with all applicable Federal Aviation Regulations.

Author’s Note: This is not uncommon in the aviation industry and does meet the FAA standards. 3,379 total hours is a high level of experience and the habit patterns developed during that time will carry over into whatever aircraft he flies. 109 hours in the particular type aircraft he was flying on February 13, 2009 is relatively low but not uncommon. It would have meant that he might not have experienced the type weather/icing conditions in that particular model aircraft but almost certainly would have experienced icing conditions in his career.

Capt. Renslow, 47, joined Colgan in September 2005 after graduating from a pilot-training academy, employment records show. He had a history of flunking check rides -- periodic tests of competency that are also required anytime a pilot begins flying a new type of aircraft. Before joining Colgan, he failed three proficiency checks on general aviation aircraft administered by the FAA, according to investigators and the airline. Colgan's spokesman said the company now believes Capt. Renslow failed to fully disclose that poor performance when applying for a job.

Once at Colgan, he failed in his initial attempt to qualify as a co-pilot on the Beech 1900 aircraft, and also had to redo his check ride to upgrade to captain on the Saab 340 turboprop, according to investigators. Repeated check-ride failures raise red flags, and large carriers rarely keep pilots who require such extensive remedial training, according to numerous industry officials. Colgan's Mr. Williams said Capt. Renslow's last unsatisfactory check ride occurred 16 months before the accident, and he subsequently passed six consecutive competency tests and completed three regular training sessions.

The board released documents showing that safety investigators were told by one training instructor that Renslow “was slow learning” the Dash 8 at the start but his abilities “picked up at the end.”
The training instructor said Renslow struggled to learn the Dash 8’s flight management system, a critical computer, and had difficulty learning switch positions which were opposite from the throws he had been used to on another aircraft (Author’s Note: Think about “Negative Habit Transfer”). This instructor described the captain’s decision-making abilities as very good.
Author’s Note: This is not common in the aviation industry and should have been detected by Colgan. It also indicates to me that the Captain was a marginal performer in his career field.

Co-Pilot Rebecca Shaw

Rebecca Shaw had a clean training record.

First Officer Shaw had 2,220 total hours of flight experience and 772 hours flying the Q400 aircraft, qualifying her fully in accordance with all applicable Federal Aviation Regulations.

Comments Regarding Training

Colgan Air acknowledged Monday that Renslow's training for the Dash 8-Q400 Bombardier didn't include a demonstration or simulation of the stick-pusher system. It noted that the Federal Aviation Administration doesn't require a simulator demonstration of the stick-pusher and added that Renslow "had all the training and experience required to safely operate the Q400." (Author's Note: Think about minimum standards and "Check-the Block" training)

Colgan has said its pilot training programs "meet or exceed regulatory requirements for all major airlines" and crews "are prepared to handle emergency situations they might face." On Sunday, spokesman Joe Williams confirmed in an email that Capt. Renslow had five "unsatisfactory" training check rides in his career -- including two at Colgan -- but passed a subsequent series of training tests and was "fully qualified in the Q400" aircraft.

Colgan said its FAA-approved program includes "comprehensive" classroom training on the stick-pusher but emphasized a demonstration in a simulator "is not required by the FAA and was not part of the training syllabus" Colgan received when it obtained its Q400s.

Colgan's standard training program stops short of demonstrating the operation of the stick-pusher in flight simulators. Without such hands-on experience, safety investigators argue, pilots could be surprised and not react properly when the stick-pusher activates during an emergency. The FAA is required to sign off on all airline training manuals.

The NTSB recommended two years ago that the FAA study whether pilot training on stick-pushers should be improved. It appears the agency didn't change its guidance on stick-pusher training when it revised its training manual last fall on how to recover from a stall, sources said. FAA spokesman Les Dorr said the agency places its emphasis on teaching pilots on how to avoid getting into a situation where a stall occurs, rather than how to recover from one.

Fatigue, Crew Rest, and Morale Factors

Author's Note: Think about motivation and fatigue. Also remember the company knows this is going on but only cares about the legal duty-limit times imposed by the FAA.

The night before the accident, Shaw flew overnight as a passenger from Seattle, changing planes in Memphis, to report to work at Newark Liberty International Airport in New Jersey. She also complained about congestion and may have been suffering from a cold.

Renslow, 47, commuted to Newark from his home near Tampa, Fla. It is unclear where Renslow, who was in the middle of a two-day assignment, slept the night before the trip, but he logged into a computer from Colgan's crew room in Newark at 3 a.m. the night before, according to NTSB documents.

Neither pilot had a "crash pad" or apartment they shared with other pilots in the New York area, nor did they rent a hotel room, NTSB documents said.

NTSB investigators said 93 of the 137 Colgan pilots who worked out of Newark at the time of the accident were commuting from far away.

The company's crew room at the airport is equipped with couches and a big screen TV. Board members said Shaw frequently slept overnight in the crew room in violation of company policy, joking with other crew members that the room had a couch with her name on it.

Mary Finnegan, Colgan's vice president of administration, said the company permits pilots to live anywhere in the country they wish. She said the company also allows them to remove themselves from flight duty if they are fatigued.

"It is their responsibility to commute in and be fit for duty," Finnegan said.

Colgan officials said overnight sleeping wasn't allowed in the crew room because it was a busy place, making quality rest time difficult. The room's lights were kept on all night.

Daniel Morgan, Colgan's vice president for flight safety, said the airline industry has a long history of flight crews commuting long distances to report for work.

Morgan said it is appropriate that the airline sometimes schedule pilots to be on duty up to 16 hours at a stretch with a maximum of eight hours of flight time.

"It's not an ideal way to work, but neither is working overnight in the post office," Morgan said.

Paul Rice, vice president of the Air Line Pilots Association, said airlines — especially regional airlines, where salaries for less senior pilots are lower — have "defaulted to a position that pilots will commute."

"People can't go live in these major cities, or even in the suburbs of these major cities, at $16,000 to $17,000 a year," Rice said.

Shaw, 24, had worked for Colgan Air of Manassas, Va., which operated the flight for Continental, for 13 months, flying 774 hours in her first year. Colgan pays its beginning first officers $21 an hour, which means she would have earned $16,254 that year, although she could have earned more if she worked more hours, said Roger Cox, an NTSB aviation safety expert.

In questioning Colgan officials, Cox suggested that Shaw was commuting from her home near Seattle because she couldn't afford to live in the New York metropolitan area on her salary. She had a second job in a coffee shop when first hired.

Colgan spokesman Joe Williams declined to disclose Shaw's salary, but said the airline's starting first officers typically earn around $24,000.

Additionally, his 24-year-old co-pilot, Rebecca Shaw, had complained before takeoff about being congested and said she probably should have called in sick, according to people who have listened to the cockpit voice recording.

Accident Chain

"Everything that could go wrong on that flight to Buffalo on that wintery night did. We had a crew that did not have adequate rest; they had flown in on the redeye; we had a 24-year-old first officer who had never been in a de-icing situation, and had never handled it; we had a pilot who had failed five proficiency checks who had not been trained on how to handle emergency procedures," said former FAA Chief Michael Goldfarb.

Renslow had never received simulator training for stall warnings, and reacted exactly opposite the way he should have, pulling back on the stick rather than pushing it forward to increase airspeed. It's fatal mistake, but one that the hero of the Hudson, Capt. Sully Sullenberger, predicted months ago, when he told Congress pilot pay cuts and inexperience would make air travel more dangerous.

Events and Threats Leading To the Triggering Event

Author's Note: Think about the clues to the loss of situational awareness (Violation of regulations), attentional failures, lack of planning, lack of awareness, lack of a risk assessment, briefing, etc.

As the plane made its approach toward Buffalo with the autopilot engaged, the crew exchanged idle banter, according to people who have read transcripts of the conversation recovered from the cockpit voice recorder. Federal rules and airline policy prohibit pilots from having extraneous conversations while flying below 10,000 feet.

The crew initially didn't notice the plane's speed had dropped dangerously low, sliding under 115 miles an hour, and risked going into a stall. The slowing speed set off an emergency system called a "stick-pusher," which pushes the control column down in order to send the aircraft into a temporary dive so it can regain speed and recover from a stall.

Author's Note: This would have caused an immediate jump in stress to an extremely high level. Check your text to review the problems associated with this. They are very predictable. The activation of a stick pusher can be a jarring experience for any pilot, especially if the pilot has never experienced it before, said William Waldock, an aviation science professor at Embry-Riddle University in Prescott, Ariz. The natural response is to pull back unless you've been trained through repetition to push forward, he said.

As the speed slowed to a dangerous level a stick-shaker is automatically activated when a plane is going into a stall, pointing the aircraft's nose down so it can pick up enough speed to allow the pilot to guide it to a recovery. Capt. Renslow immediate response to a nose-low attitude was to yank back on the controls while adding thrust. Flight 3407 experienced an aerodynamic stall after the control column was pulled back. The plane repeatedly rolled left, and then right and then plunged from the sky, landing on a house about five miles from the airport.
He did the opposite of the proper procedure and tried to force the plane to do the opposite. His effort was strong enough to manually override the stick-pusher. Within seconds, the plane lost lift, bucked violently and started to roll. It slammed into a house five miles from the runway.
Author's Note: Remember what happens if you are unprepared and caught by surprise. He had no appropriate habit pattern to fall back on for a stall condition due

to a lack of training but more importantly a lack of planning. His experience level most certainly would have prepared to this emergency. Pushing forward to gain speed is the proper procedure if the aircraft is in a stall caused by a disruption of airflow over the wings.

Investigators surmise the pilots didn't fully understand the operation of one ice-protection system, and therefore incorrectly programmed approach speeds into a flight computer. Startled by an initial stall warning at low altitude, Capt. Renslow reacted with the mistaken assumption that ice accumulation on the tail caused speed to suddenly drop well below normal, investigators believe.

The NTSB has said the plane wasn't significantly affected by icing but by the low airspeed for gear down and flaps set at 15 degrees.

Author's Note: This type condition could easily have been predicted if the crew had discussed the environmental conditions and potential problems they may have encountered. They had repeatedly noticed ice buildup on the wings so it should not have been a surprise.

Threats

Author's Note: Think about the threats that were available to the crew and the strategies they could have used in advance to manage the risks.

- Environment: It was a frigid night. Other planes in the region had reported light to moderate icing, and the pilots observed ice buildup around their own windshield. Bombardier's twin-engine Q400 has a reputation as a workhorse used extensively in winter and isn't known to be susceptible to ice accumulation (it must have really been bad).
- Fatigue: Both pilots were returning to work after a day off. Capt. Renslow was coming off weeks of late-evening and early-morning flying schedules, often sandwiched around only a few hours of rest. Ms. Shaw had spent the day before the accident skiing. She then took a red-eye flight from Seattle to report for work in Newark.
- Training: While they had received sufficient academic training they had not practiced stall recovery in the aircraft or simulator so habit patterns were not developed. In order to respond quickly they would have had to have had a pre-planned strategy.

Intercom Communications Transcript

As the Dash-8 approached Buffalo on a wintry night, Shaw and Renslow remarked to each other — less than seven minutes before the crash — about how much ice had formed on their wings.

"It's lots of ice," Shaw said.

"Oh yeah that's the most I've seen, most ice I've seen on the leading edges in a long time, in a while anyway I should say," Renslow replied.

Renslow then remarked that he'd flown about 625 hours in the region before he was hired for this job by Colgan Air.

Shaw replied, "I really wouldn't mind going through a winter in the Northeast before I have to upgrade to captain. ... I've never seen icing conditions. I've never deiced. I've never seen any. I've never experienced any of that. I don't want to have to experience that and make those kinds of calls. You know I'dve freaked out. I'dve have like seen this much ice and thought, 'Oh my gosh, we were going to crash.'"

"I would've been fine," Renslow replied. "I would have survived it. There wasn't, we never had to make decisions that I wouldn't have been able to make but ... now I'm more comfortable."

The crew then lowers the landing gear and adjusts the flaps, but at 10:16.26 p.m. there's a sound similar to movement of the flap handle and Shaw says, "Uhhh."

Less than a second later, there are sounds similar to the stick shaker — a warning transmitted through the control stick that the aircraft is nearing a stall. These last for 6.7 seconds. Less than a second later, a horn sounds signaling the autopilot disconnecting and that horn continues until the end of the recording.

At 10:16.34.8, Renslow says, "Jesus Christ."

Shaw says she put the flaps up and asked if she should put the landing gear up. Renslow replies: "Gear up, oh (expletive)."

As noise in the cockpit increases, Renslow adds: "We're down."

There's a thump.

Shaw: "We (sound of scream)."

And the transcript ends.

Author's Note: I want to add some new information on communications that you may find helpful. It is presented following this section and I would like you to use it to evaluate the communications between the pilot and co-pilot. I also want you to use it to look at communications in teams.

Mitigated Speech

Malcolm Gladwell in his book Outliers describes mitigated speech as any attempt to downplay or sugarcoat the meaning of what is being said.

We mitigate when we're being polite, or when we're ashamed or embarrassed, when we are not experienced, unsure of ourselves, or when we're being deferential to authority. Mitigating speech is not necessarily bad but we have to understand when it is appropriate and when it is not. If you want your boss to do you a favor, you don't say, "I'll need this back by Monday." You mitigate. You say, "Don't bother, if it's too much trouble, but if you have a chance to look at this over the weekend, that would be wonderful." In a situation like that, mitigation is entirely appropriate. In other situations, however - in high risk situations which require clear communication - it's a problem. When we use mitigating speech there is a risk that the other person will either miss or choose to ignore your meaning.

Mitigating speech has been around forever but its affects really came to light in 1982 when Air Florida Flight 90 took off with ice on its wings from National Airport and crashed into the 19th street bridge. The airline industry identified mitigated speech as a major cause of most human factor aircraft accidents. The term used was "lack of assertiveness on the part of a crewmember.

Author's Note: In the course we talk about the barriers to communication and use the Assertive Message as a way to avoid mitigated speech. This section will give you some more background in communication skills.

The linguists Fischer and Judith Orasanu once gave the following hypothetical scenario to a group of airline captains and first officers and asked them how they would respond:

Scenario: “You notice on the weather radar an area of heavy precipitation 25 miles ahead. [The pilot] is maintaining his preset course at Mach .73, even though embedded thunder storms have been reported in your area and you encounter moderate turbulence. You want to ensure that your aircraft will not penetrate this area.”

The captains overwhelmingly said they would issue a command in that situation: "Turn thirty degrees right." They were talking to a subordinate. They had no fear of being blunt. The first officers, on the other hand, were talking to their boss, and so they overwhelmingly chose the most mitigated alternative. They hinted.

It's hard to read Fischer and Orasanu's study and not be just a little hit alarmed, because a hint is the hardest kind of request to decode and the easiest to refuse.

There are at least six ways to try to persuade an individual to change a course of action avoid a problem.

1. Command: - “Strategy X is going to be implemented” -"Turn thirty degrees right." That's the most direct and explicit way of making a point imaginable. It's zero mitigation.

2. Team Obligation Statement: - “We need to try strategy X” - "I think we need to deviate right about now." Notice the use of "we" and the fact that the request is now much less specific. That's a little softer.

3. Team Suggestion: - “Why don’t we try strategy X” - "Let's go around the weather." Implicit in that statement is "we're in this together."

4. Query: - “Do you think strategy X would help us in this situation?” – “Which direction would you like to deviate?" That's even softer than a crew suggestion, because the speaker is conceding that he's not in charge.

5. Preference: - “Perhaps we should take a look at one of these Y alternatives” - "I think it would be wise to turn left or right."

6. Hint: -“I wonder if we could run into any roadblocks on our current course” - "That return at twenty-five miles looks mean." This is the most mitigated statement of all.

Let’s look at an example: On Jan 13, 1982, a freezing cold, snowy day in Washington, Air Florida Flight 90 took off from National Airport, but could not get the lift it needed to keep climbing. It crashed into a bridge linking Washington to the state of Virginia and

plunged into the Potomac. Of the 79 people on board, all but 5 perished many floundering and drowning in the icy water while horror-stricken bystanders watched helplessly from the river's edge and millions more watched, aghast, on their television screens. Experts later concluded that the plane had waited too long after de-icing to take off. Fresh buildup of ice on the wings and engine brought the plane down. How could the pilot and co-pilot have made such a blunder? Didn't at least one of them realize it was dangerous to take off under these conditions?

Keep in mind that the co-pilot was making the take-off and flying the first leg of the trip and the Captain was acting as the co-pilot.

Charlotte Linde, a linguist at the Institute for Research on Learning in Palo Alto, Calif., has studied the "black box" recordings of cockpit conversations that preceded crashes as well as tape recordings of conversations that took place among crews during flight simulations in which problems were presented. Among the black box conversations she studied was the one between the pilot and co-pilot just before the Air Florida crash. The pilot, it turned out, had little experience flying in icy weather. The co-pilot had a bit more, and it became heartbreakingly clear on analysis that he had tried to warn the pilot, but he did so indirectly.

The co-pilot repeatedly called attention to the bad weather and to ice building up on other planes hoping the Captain would give him some guidance:

Co-pilot: “Look how the ice is just hanging on his, ah, back, back there, see that?”

Captain: No Response

Co-pilot: “See all those icicles on the back there and everything?” Captain: Yeah. He expressed concern early on about the long waiting time between de-icing:

Co-pilot: “Boy, this is a, this is a losing battle here on trying to de-ice those things, it [gives] you a false feeling of security, that's all that does.”

Captain: No Response

Shortly after they were given clearance to take off, he again expressed concern:

Co-pilot: “Let's check these tops again (Author’s Note: Top of the wings for ice) since we have been setting here awhile.”

Captain: I think we get to go here in a minute.

When they were about to take off, the co-pilot called attention to the engine instrument readings, which were not normal:

Co-pilot: “That don't seem right, does it? [three-second pause] Ah, that's not right. . . . “

Captain: “Yes, it is, there's 80.”

Co-pilot: “Naw, I don't think that's right. [seven-second pause] Ah, maybe it is.”

Captain: “Hundred and twenty.”

Co-pilot: “I don't know. “

The takeoff proceeded, and 37 seconds later the pilot and co-pilot exchanged their last words.

Co-pilot: “We’re going down Larry.”

Captain: “I know.”

The co-pilot had repeatedly called the pilot's attention to dangerous conditions but did not directly suggest they abort the takeoff even though he was flying. In Linde's judgment, he was expressing his concern indirectly, and the captain didn't pick up on it -- with tragic results.

In the Air Florida case, it is doubtful that the captain did not realize what the co-pilot was suggesting when he said, "Let's check these tops again since we have been setting here awhile" (though it seems safe to assume he did not realize the gravity of the co-pilot's concern). But the indirectness of the co-pilot's phrasing certainly made it easier for the pilot to ignore it. In this sense, the captain's response, "I think we get to go here in a minute," was an indirect way of saying, "I'd rather not." In view of these patterns, the flight crews of some airlines are now given training to express their concerns, even to superiors, in more direct ways.

That the co-pilot was trying to warn the captain indirectly is supported by evidence from another airline accident -- a relatively minor one -- investigated by Linde that also involved the unsuccessful use of indirectness.

Allegheny Airlines Flight 453: On July 9, 1978, Allegheny Airlines Flight 453 was landing at Monroe County Airport in Rochester, when it overran the runway by 728 feet. Everyone survived. This meant that the captain and co-pilot could be interviewed. It turned out that the plane had been flying too fast for a safe landing. The captain should have realized this and flown around a second time, decreasing his speed before trying to land. The captain said he simply had not been aware that he was going too fast. But the co-pilot told interviewers that he "tried to warn the captain in subtle ways, like mentioning the possibility of a tail wind and the slowness of flap extension." His exact words were recorded in the black box. The crosshatches indicate words deleted by the National Transportation Safety Board and were probably expletives:

Co-pilot: Yeah, it looks like you got a tail wind here.

Captain: Yeah. [?]: Yeah [it] moves awfully # slow.

Co-pilot: Yeah the # flaps are slower than a #.

Captain: We'll make it, gonna have to add power.

Co-pilot: I know.

The co-pilot thought the captain would understand that if there was a tail wind, it would result in the plane going too fast, and if the flaps were slow, they would be inadequate to break the speed sufficiently for a safe landing. He thought the captain would then correct for the error by not trying to land. But the captain said he didn't interpret the co-pilot's remarks to mean they were going too fast.

Linde believes it is not a coincidence that the people being indirect in these conversations were the co-pilots. In her analyses of flight-crew conversations she found it was typical for the speech of subordinates to be more mitigated -- polite, tentative or indirect. She also found that topics broached in a mitigated way were more likely to fail, and that captains were more likely to ignore hints from their crew members than the other way around. These findings are evidence that not only can indirectness and other forms of mitigation be misunderstood, but they are also easier to ignore.

Author's Note: The list of accidents where this is a factor goes on and on. One of the key objectives of Human Factor's is to encourage our people to speak up and provide input. Keep this article in mind and when the situation is high risk and requires clear communication.

Risk Management Assessment

Let's look at another example of how you can apply the Buffalo crash to the SPE and GAR Risk Management Models.

Conditions: You are 7 minutes from landing, at a low altitude, and you notice severe ice build up on windscreen. You want to do a quick SPE.

Hazard: Icing accumulation leading to a stall at low altitude.

SPE Model

Severity: **5** Severe (With my experience level if I stall at this altitude the aircraft will crash. A crash is an un-survivable event.

Probability: **3** Occasional (Historical data exists and I am familiar with this event occurring sporadically. It is not uncommon.

Exposure: **4** Great (With significant ice buildup my exposure is great.

SPE = 60 Immediate Correction Required

What actions can you take right now?

With the combine knowledge and experience of the Captain and the Co-Pilot and the academic training they have received in the Dash 8 I will make an assumption (even with the crew history mentioned earlier) that these recommendations are within their capability.

1. Immediately turn the auto pilot off and hand fly the aircraft.
2. With the auto pilot off, maintain proper airspeed throughout the approach and direct the co-pilot to monitor it and note any deviations.
3. Ensure anti/de-ice switches are activated
4. Discuss the symptoms of an impending stall and the recovery procedures.

Remember the NTSB has said the plane wasn't significantly affected by icing but by the low airspeed for gear down and flaps set at 15 degrees.
This, more than likely, would have prevented the crash.

GAR Risk Assessment

Conditions: You have landed safely but never want to go through that again so you and your co-pilot take 15 minutes to do a GAR. This will quickly help you determine what to do in the future.

Supervision: While SOPs and procedures exist I am not that familiar with them due to insufficient training.	**8**
Planning: I have adequate time to plan before entering these conditions but I don't do it because I have been there and done it before with no consequences.	**8**
Contingency Resources: Co-pilot is inexperienced in this situation and may not be of help.	**8**
Communication: Crew communications is not good because the co-pilot hints at things but never says things directly. It is difficult to interpret what they mean.	**8**
Team Selection: Crew is both inexperienced in this situation and has a minimum amount of time in this aircraft.	**9**
Team Fitness: We both commute and are tired. Co-pilot has a chest cold.	**9**
Environment: Heavy ice build up on windscreen that we can see.	**10**
Incident Complexity: Recovery from a stall at low altitude is extremely complex.	**10**
Total Risk Score	**70**

GAR: 70 Red (Implement Measures Immediately)

Countermeasures

Supervision: While SOPs and procedures exist I am not that familiar with them due to insufficient training.	Review company and aircraft manufacturer procedures so you are familiar with them. A quick google check found 49,000 references to icing problems with this and similar type aircraft. To determine the highest threat a quick read makes it apparent that a pilot must: 1. Understand the capabilities of the de-icing/anti-icing systems and their capabilities 2. Understand the difference between wing icing and tail icing. 3. Be clear on the emergency procedures for recovery from a stall due to wing and tail icing (both are different procedures and completely opposite). 4. When icing conditions exist the pilot must not use the autopilot to fly the aircraft.	**4**
Planning: I have adequate time to plan before entering these conditions but I don't do it because I have been there and done it before with no consequences.	Before the flight review the weather, plan appropriately, brief what each of you will do, and what you will do if you encounter a problem.	**4**
Contingency Resources: Co-pilot is inexperienced in this situation and may not be of help.	During flight planning share the information you have learned with the co-pilot. Determine what they know that you may be able to use.	**5**

Communication: Crew communications is not good because the co-pilot hints at things but never says things directly. It is difficult to interpret what they mean.	Brief the co-pilot on how to communicate with you effectively and not hint at concerns or problems. Follow the "sterile cockpit" rule: Not idle chat below 10,000 feet. Only discuss the approach and conditions affecting the flight.	**4**
Team Selection: Crew is both inexperienced in this situation and has a minimum amount of time in this aircraft.	Not much you can do here since you don't control scheduling	**9**
Team Fitness: We both commute and are tired. Co-pilot has a chest cold.	Not much you can do with your salary. Try to get some rest on the airplane flying from your home base to you duty base. If you are sick, take off.	**9**
Environment: Heavy ice build up on windscreen that we can see.	Nothing you can control.	**10**
Incident Complexity: Recovery from a stall at low altitude is extremely complex.	Knowledge of the procedure and constant review will make it easier. During your next simulator session ask the simulator instructor to let you practice a wing and tail stall recovery.	**5**
Total Risk Score	**70**	**50**

New Score: 50 Amber (Moderate Threat) Moderate ice buildup is a threat but one that prepared pilots face daily and aircraft are designed for. If the icing is classified as 'Severe' you are prohibited from flying into it.
It's not rocket science. Whether you are a pilot, maintenance worker, LE Officer, etc., risk management works, and it can work quickly.

Other Problems

Leadership

Poor Designated Leadership

- Not adhering to the 'sterile cockpit' regulation and engaging in idle chatter during a critical phase of flight.
- Failure to monitor, predict errors, and recognize poor judgments.
- Not having the required subject matter expertise to perform the task.
- Failure to perform a briefing regarding the threat. Specify tasks to be assigned.
- Coordinate the gathering of required information.
- Focus the team's attention on task.
- Consider and assess risks and alternatives.
- Continually assess and reassess the situation.

Poor Functional Leadership

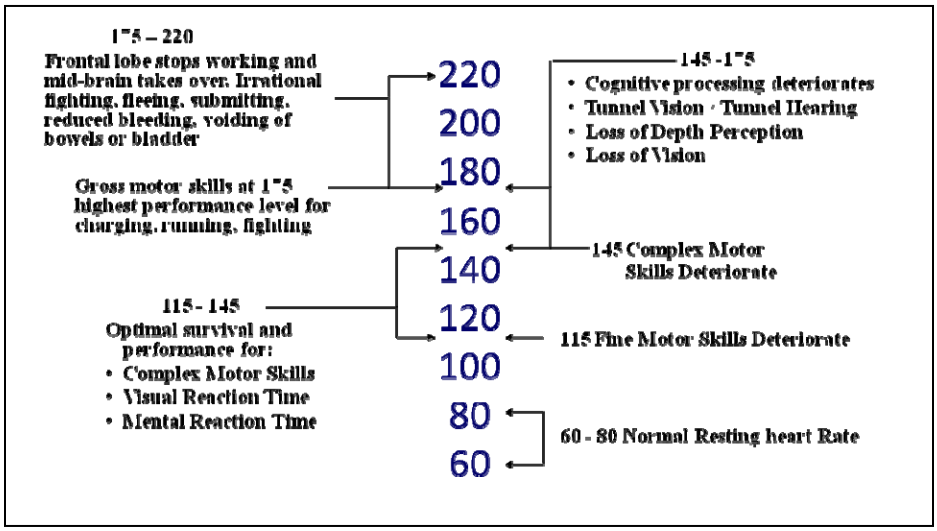
- Not speaking up clearly
- Failure to clearly alert the Captain to a possible dangerous situations

Stress & Performance

High Stress & Long-Term Memory (LTM): Cortisol (**and by extension, severe acute stress**) impairs memory retrieval. Every pilot knows that in a wing stall situation you lower the nose and apply power. If this has not been practiced you will not have developed a habit pattern and may be unable to retrieve that information. The natural reaction when the nose tilts down is to try an pull it up – a fatal input in a stall situation.

Stress & Delay: If the crew had briefed the procedures for a stall the brain no longer requires deliberation to formulate the correct plan, but has only to select between a set of pre-learned responses. The brain can successfully make this sort of decision within 1–2 sec. This conversion of a series of complex operations into one simple operation overcomes the storage capacity limitation within working memory.

Mental Performance: When the crew is caught by surprise the hormonally induced heart rate increases. It was severe enough and quick enough that it probably put them between 175-220. An impossible area to think in.



Situational Awareness

Components of Situational Awareness

- Experience & Training – Both areas deficient.
- Job Skills – Poor skills for this task.
- Team Management Skills – Poor crew coordination.
- Health & Fitness. - Fatigue.

Clues to Loss of Situational Awareness

- Poor Communications: Terrible crew communication
- Confusion or Gut Feeling: Co-pilot was very nervous
- No one Watching or Looking for Hazards: Ice
- Departure from Policies, Procedures, SOPs, Limits, and Regulations: Flying with auto pilot on, violation of sterile cockpit regulation.
- Failure to Meet Planned Targets: Airspeed deviation.
- Fixation or Preoccupation: Just get on the ground, we are so close.

Complacency

While complacency is often a feeling of self-satisfaction, contentment, and, sometimes, smugness about what you are doing we need to understand where this feeling comes from.

- Normalcy: This appeared normal to the Captain because of the highly repetitive nature of the task and the high probability of success.

Communications

Barriers

- Tunnel Vision & Task-Preoccupation: Just flying the aircraft in the approach and not looking for other hazards.
- Lack of Confidence: Co-pilot was very nervous.
- Rank or experience differences: Captain – Co-pilot difference, experience difference

Assertive Message: Not Provided Clearly

MESSAGE FORMAT	SAMPLE MESSAGE
Opening:	Captain
Specific concern using an owned emotion:	I'm concerned about the ice buildup on the wind screen.
Problem Statement:	With the amount of ice I think we may encounter a stall condition
Solution, if any:	I recommend we immediately turn off the auto pilot and maintain our required airspeed throughout the approach and discuss stall recovery procedures.
Request for feedback:	I will monitor your airspeed. Can I turn off the auto pilot now and discuss stall recovery procedures.