Attachment 1
To Operations Group Factual Report

DCA15FA085

Interview Summaries

Contents

1.0 Interviewee: David W. Phillips, Delta MD88 First Officer

Represented by:	**Gordon Rose, Air Line Pilots Association**
Date and Time:	**March 7, 2015, 1030 EST**
Location:	**Delta Air Lines Offices, Atlanta, Georgia**
Present:	**Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steve Acalin, Delta Airlines; Brian Teske, Air Line Pilots Association; James Brocksmith, Boeing**

During the interview, FO Phillips stated the following:

He was 46 years of age and was a first officer (FO) on the MD88 based In Atlanta. He had been in that position for four years. His date of hire at Delta was September 2007. Before flying the MD88 he was an FO on the B737-700/800 for 3 ½ years based in New York. Before coming to Delta, he was flying the E2C Hawkeye in the Navy. He began flying the E2C in 1991 and flew it for 18 years. In 2001 he worked at American Airlines for 8 months as a B727 flight engineer, was furloughed, and returned to the navy. He retired from the Navy 3 years previously after 21 years of service.

He had total flight time of approximately 11,000 hours, of which 4,000 hours were on the MD88 and 2,000 hours were as pilot in command (PIC) in the navy. His certificates included the ATP, multiengine land, B737 and DC9 type ratings and private privileges single engine land. He had no previous accidents, incidents or violations, but had received one non-punitive administrative letter given to multiple crews related to an expired minimum equipment list (MEL) item. That had happened 2 to 3 years previously. He had not been required to take any additional training in the MD88.

He was asked to describe the accident flight. He stated he and the captain did significant preparation for the approach while at cruise because of the weather situation at LaGuardia airport (LGA). They discussed the need for a possible diversion and potential de-icing issues once they were on the ground in LGA, and the captain set the ACARS up to receive automatic updates. They actively pursued braking action reports from ATC and dispatch but did not have a lot of luck with that. The ATIS consistently reported there was a direct crosswind of about 10 kts, which was a concern to them. He checked the adverse weather chapter braking guidelines, which said when braking action advisories were in effect the maximum crosswind guideline was 10 kts. They also had concerns about the visibility, which was being reported as ¼ mile, variable ceilings, snow, freezing fog, and the temperature dew point spread, which was -3/-4. Braking action advisories were in effect. They had the window de-fog system on. The ATIS was reporting runways were wet, sanded and chemically treated, which painted a picture of the runway in his mind.

During the descent, ATC informed them that runway 13 was closed for plowing and during that time there were no runway reports. The captain made an exhaustive approach briefing for the ILS runway 13 and set up for the most conservative configuration, including flaps 40 and maximum autobrake. They planned for a landing weight of 127,500 lbs. During the approach the

tower told them braking action was “good” based on reports from an Airbus and a regional jet (RJ). He felt this was the “green light” for the runway being satisfactory to land. He felt they had “checked every box.” They configured, got the automated callout at 1,000 ft., and the FO confirmed that they were cleared to land and that the missed approach altitude was set. At 500 feet, the FO looked for the runway. At that time he could not see the runway but could sometimes see the ground when looking down. The captain repeated their configuration, which the FO was happy to hear. The decision altitude was 214 ft. Approaching 300 ft., the captain said, “approach lights in sight" and the FO looked up and he also saw the lights but not the runway. Shortly thereafter, the FO called out, “Approaching minimums,” and the captain said “runway in sight.” The FO looked up and saw that the runway was all white, with runway centerline lights visible. The runway markings were difficult to see and it was not the picture he was expecting. There was not much time but everything seemed appropriate to land.

The captain retarded power and flared and the FO felt the airplane settle a little, which was not unusual. He stated everything was within parameters and nothing was unsafe. The airplane landed with “satisfactory contact.” After waiting a second longer than it normally took for the auto spoilers to deploy, the FO determined that the auto spoilers were not automatically deploying, so he reached over and yanked them back himself. There was then an auto spoiler message. He felt the airplane settle as the captain lowered the nose and engaged reverse thrust. The FO could not recall if he made the “spoilers deployed” call but he did call “two in reverse” after he saw two amber and two green reverse lights. He did not observe the engine EPR but did not hear sounds that to him would have indicated over boost.

He felt no action from the autobrakes. He could feel the spoilers and thrust reverse take effect but not the wheel brakes. He called out “110 kts” and saw the nose starting to track left. As the airplane began to drift left he called out forcefully and repeatedly, “come out of reverse.” He had difficulty expressing himself in the time available. The FO saw the captain’s hand come forward on the thrust levers but this had no effect. The airplane continued to veer left and departed the runway surface. The ride was very rough and the FO felt “they were just along for the ride” at that point. He did not know what the captain did to slow the airplane but he estimated the speed when they departed the runway to be about 80 kts. The FO’s visual attention was fully outside at that point. Looking outside, he saw the retaining wall and thought the left wing was caught on it as they skidded along the side of the wall. He was concerned they would go in the water so, without asking permission, he shut down the engines to prevent any further thrust from pushing them over into the water. They then came to rest.

The FO saw they had no power in the airplane, and he attempted to switch on emergency power without success. He also attempted to start the APU without success. He said repeatedly to the captain that they had no power. He did not precisely recall the order of their subsequent actions, but he recalled that the captain called for the evacuation checklist and the FO suggested that they open the cockpit door. They then ran the evacuation checklist. A lot of the actions were not applicable because they had no engines and no power, but they went through the motions anyway, including retracting spoilers, cutting the fuel levers, and pulling the T-handles.

The captain went to the cabin and the FO used his cell phone to call the flight dispatcher, who transferred his call to the LGA tower. He reported to the tower they had 125 passengers, 5 crew,

and 13,000 to 15,000 lbs of fuel. He then saw crash and fire rescue personnel outside the airplane. He partially opened his side window, which would not open completely, and told a member of the crash crew all of the information he had just relayed to the tower. The firefighter then told him that fuel was leaking from the airplane's left wing and they should evacuate the airplane via the right over wing exits. The FO clarified with the firefighter that the firefighter was ordering an evacuation. The FO then told the captain about the firefighter's order and the leaking fuel and that galvanized the evacuation. The FO placed the cockpit paperwork in a trash bag, which he gave to the captain. They took the trash bag, their tablets, and their backpacks with them but left the aircraft logbook and their hats and luggage on the airplane. The captain checked the cabin and lavs to ensure all passengers were off. The FO then exited the airplane, followed by the captain. The FO was impressed by the captain's efforts to ensure that everyone was off the airplane.

Port Authority personnel were already there in large numbers. The crew stood outside the airplane for 5 to 10 minutes before being placed in a command post vehicle, which was an RV. Port Authority personnel and the Delta general manager, Mr. Cordy Campbell, were there. Mr. Campbell ensured that the entire crew was able to remain together despite the efforts of the Port Authority personnel who were seeking to "detain the pilots." After about an hour the crew was released to Delta and they went to the crew lounge. The Delta chief pilot Mike Odey was present. At that time, the FO requested drug and alcohol screening. A Delta representative said he was a trained observer and he did not feel the crew was under the influence and they did not need it, but the FO insisted. He preferred to be tested so that issue could be ruled out. They were there 4 to 5 hours while waiting for drug and alcohol testing, which they completed. They then had a discussion about where they would go next and the crew expressed a desire to return home to their distraught families, so they were driven to JFK airport, where they departed for Atlanta. They arrived in Atlanta about 1 AM.

The FO recalled the last ATIS reported variable ceiling at 900 feet and visibility ¼ mile. The tower told them braking action was good as reported by an Airbus and an RJ. Minimums were 214 feet and RVR 2400 or ½ mile. Asked why they conducted the approach if visibility was ¼ mile, he stated tower reported RVR 6000 and they were legal for the approach.

The FO stated that the Delta flight ahead of them decided to divert to their alternate airport after hearing the runway braking action was fair. The captain had previously said to the FO that if the braking were less than good they would also proceed to holding or to their alternate. Almost immediately thereafter, ATC reported braking action was good, so the previous Delta flight then reversed their decision and took a vector back to LGA.

During the descent ATC told them to plan to hold at Robbinsville VOR (RBV) with a planned expect further clearance (EFC) time of 1555Z, which was their planned arrival time. As they approached the holding point, the runway 13 runway braking condition was reported as fair, but shortly thereafter it was reported as good and flight 1086 was cleared to proceed direct to LGA.

When asked if LGA used Mu figures for braking, he stated he did not think so, and he believed they relied on pilot reports (PIREPS). Asked what he calculated the landing distance to be, he

stated it would be less than 7,000 feet if braking action was good, and 7,200 feet if braking action were fair. He consulted the ODM landing distance charts to determine this.

Asked if he set the autobrakes, he stated he set them to "max." He stated in the MD88 you can set them in flight, but once you lower the landing gear you get a bright amber warning light and you must move the switch to off and then to arm, which he did. Asked what indication he would get if autobrakes failed during landing, he stated he would hear an audible click and see an amber light saying, "Autobrake disarm." He stated he did not see that light and he believed autobrakes did not disarm during the accident landing.

They had filed two alternates, Albany and Syracuse, and had enough fuel to go to either one. They used tablet computers to display their Jeppesen approach charts. He used a paper copy of the ODM, which was provided as part of the airplane ship set of documents.

Asked if he heard the tower use the term "pretty good" with reference to braking action, he said he did not.

The FO stated that they needed braking action of good or better to continue to LGA. He saw the approach lights at 300 feet AGL. After the captain said he saw the runway, the FO looked up and he could see it too. He originally used a landing weight of 130,000 lbs to calculate landing distance, but later used the 127,500 lbs page of the speed book to set speeds for the approach.

He realized quickly after landing the auto spoilers did not work because he was "spring-loaded" to check them in bad conditions.

Asked when he shut the engines down, he said he did so as they were breaching the retaining wall and he thought they still had momentum.

Asked whether either of the flightcrew members activated the brakes manually, he said not that he was aware of. He did not manually apply the wheel brakes. He did not know if they had become disarmed. He had assumed they would activate.

Asked when thrust reverse was supposed to be activated, he stated the sleeves could be unlocked on main wheel touchdown but thrust could not be applied until nose wheel touchdown. The maximum allowable reverse thrust was 1.6 EPR. The captain did all the movement of the thrust levers.

He did not notice the captain using nose wheel steering, but that would be difficult for him to see.

After pulling the speedbrake lever, he did not look at the annunciator (OAP), but he heard an audible "beep beep speedbrakes" message, or something like that, which was repeated.

Asked what he expected when he saw the runway, he stated he expected if it was wet, sanded and chemically treated that he would see asphalt, runway markings and perhaps clutter or slush but not a layer of snow. That had caught him off guard. He did not have a "tremendous amount"

of experience with snow-covered runways, but he had seen all kinds of foul weather and it was not what he expected when the braking action was reported as good.

He saw the runway centerline lights. Asked whether the lights were at maximum brightness, he said he did not know.

Asked whether the MD88 had a "wheel not turning" light, he said no. He felt they had main gear compression without wheel spin up.

He thought they touched down in the first 1,000 feet of the runway. He thought the captain did a good job with that. He knew it was at least the first third and it seemed shorter than that. Asked if he recalled seeing the PAPIs he said he could have but he did not recall. They were aligned with the runway when they broke out of the clouds. The positioning of the runway in the windscreen was what he expected. It was more in line with the FO than the captain because the airplane was crabbed into the crosswind.

He had used the paper copy of the ODM to check landing distance and the captain had checked it using his tablet computer.

They were just starting their right turn to hold when they were cleared to continue their approach. He thought the last wind check they received was 030/11. He also believed that matched the last ATIS they had received.

The crosswind limits were strictly guidelines, but they were key in his mind at that time. Anything from fair to poor had a limit of 10 knots. That was another reason the captain had said if braking action were anything less than good they would divert.

The flight was dispatched from Atlanta and the flight was 20 minutes late because of a repair done to the captain's oxygen mask.

He was not sure exactly where they left the runway during the accident sequence. He guessed they left the runway much earlier than mid-field and came to rest mid-field.

He was surprised the autobrakes did not work. There were normally three phases of deceleration: the spoilers coming up, the reverser sleeves coming out, and then the brakes. He felt the spoilers and the sleeves but not the brakes. When set to max they would normally clamp immediately and it was violent on a dry runway. It would throw items forward. The captain had told the flight attendants to prepare for a quick stop and it did not occur and that was surprising.

Asked if he ever experienced a lack of traction before in the MD-88, he said yes. He said he was familiar with the sensations of the brakes going through a cycle of gripping and not gripping. One could feel a shuddering and movement, a clamping and unclamping. On a dry runway it was consistent. With poor traction one could definitely feel the wheels slide, but it was normally easy to maintain a track down the runway.

He did not recall changing anything in the cockpit after they ran the evacuation checklist. He thought their inability to put power on the airplane after it came to a stop was due to damage to the battery compartment. In hindsight he realized they should have reset the bus, but it never occurred to him until the day after the accident. He did turn the battery off.

The FO stated he did not do first flight of the day preflight checks when he first received the airplane because it was not the first flight of the day. He did not verify emergency power at that time.

He thought the braking action good report they received came from the tower. Asked whether he thought the braking action of good that was reported by the tower had come from an RJ, an Airbus, or both, he said he did not know. The captain thought it was an RJ and later the tower reported that it was from an RJ and an Airbus. The last braking action report came just minutes before landing.

The FO flew the MD90 as well as the MD88. There were some different techniques for landing on contaminated runways. The EPR reverse limit was 1.6 on the MD88 and 1.3 on the MD90. He felt even 1.6 was too high for a contaminated runway.

Asked whether Delta had discussed rudder blanking in training, he said yes. Asked whether he had experienced it before, he said yes. Asked whether that was why he had asked the captain to take the thrust reversers off, he said yes, the E2C had rudder-blanking issues. When he called out about the reversers he was desperate to stay on the runway. The other controls seemed okay, so what remained was rudder authority.

The autopilot was turned off when they broke out. The approach airspeed they were using was bug plus 5. The captain was aware they had a quartering tailwind; he had noted it on a display. Unfortunately, tailwinds were more common that one would like, especially in ATL.

Asked whether, when the captain came out of reverse or brought his hand forward there was no effect, and at what speed he thought that had occurred, he said that he was not sure what speed that had happened. He thought the captain had reduced the thrust enough for rudder authority but the results indicated otherwise.

Asked to confirm that they ran the evacuation checklist he said yes.

Asked to confirm that crash fire rescue ordered the evacuation he said yes.

The RVR as reported by the tower was not low enough to cause concern. He recalled 6000 RVR in the touchdown zone but it might have been a little less for rollout. He was not sure.

Asked if there was any discussion about using manual brakes when the autobrakes did not grab, he said he did not hear them pop off or see the light come on. When they departed the runway the FO had his hand on the glare shield, so it was possible his hand blocked his view of the warning light.

He recalled NOTAMS, which reported dry on the runway, wet on the taxiway, 3 feet snow banks on either side of the runway, ¼" of snow on the runway, 1/2 " of snow on the taxiway, end lights out of service and side lights partially obscured.

Asked whether, when they touched down, he looked at the thrust levers to see that they were at idle, the he said that he recalled the captain retarding the power and seeing his hand come back.

Asked whether the approach was stable and the touchdown was firm, he said yes.

He did not recall how long it took for them to stop after leaving the runway.

Asked whether the autobrake disconnect amber light came on when the autobrakes appeared not to engage he said no.

Asked whether the nose gear going over the berm felt violent, he said he could not recall. He was surprised to hear later that the nose gear was intact when they stopped. He assumed it had been sheared off.

Asked whether, when pulling the fire handles the bottles were deployed, he said he and the captain discussed it and the bottles were not deployed.

Asked whether the passengers began to deplane before he and the captain finished the evacuation checklist, he said they had no lights and no power, so it was his impression that all the passengers remained on the airplane until the evacuation was ordered.

Asked if they considered doing an autoland, he said yes, he said they had done an autoland test in ATL, so it was on their mind but they did not discuss it.

He confirmed that they had turned off the autopilot when the runway came into sight.

He did not think the accident airplane was one of the Delta airplanes that had asymmetrical thrust engines installed. The power matched up during their takeoff.

Asked whether he thought one thrust reverser popped out sooner than the other, he said he felt it was fairly even and consistent.

Asked if he thought it was possible that the autobrakes were working but there was "nothing for them to bite," he said yes.

Asked whether it seemed that the runway was not plowed all the way to the edges and that contributed to the loss of directional control, he said he thought the captain had a fairly good view of the centerline lights. They had done a fine job with that. They edge lights were obscured by snow effect. He thought that the snow was falling more heavily than was reported. It was heavier than he anticipated.

Asked whether he thought the airplane could have stopped within the full runway length if they stayed on the runway, he said he was not certain due to the lack of traction they encountered.

Asked whether the wind direction and speed was presented on the FMS or PFD, he said yes, and he was monitoring it. It was difficult to see because it was partially obscured by the yoke, but he did look at it quite a bit. Asked if he was aware of any wind gusts during the landing he said he did not know if they encountered any gusts.

He didn't have any sense of a wind gust occurring. Asked why the captain did not immediately order an evacuation, the FO said it was difficult for him to evaluate the pace of events because he experienced a good deal of time compression. His impression was that "they" were getting control of the cabin and passengers and keeping them calm while the airplane waited for crash fire rescue to provide information. The flightcrew did not have any perception of fire, impending structural failure, or anything hazardous. The FO's main concern was that the airplane's position on the berm was unstable and he asked crash fire rescue if there was any danger of the airplane sliding, because all he could see from the cockpit was water. Asked again whey the captain did not order an immediate evacuation, he said that they needed to assess the situation. They were awaiting further direction from crash fire rescue.

Asked why he thought the airplane had departed the runway to the left, the FO said he thought it was due to the combination of the crosswind and the runway condition.

Asked when he told the CA to take the thrust reversers off, he said he told the captain to take reverse thrust off midway between the touchdown and the beginning the excursion and that the captain accomplished it very soon thereafter. Asked what happened with the thrust after the captain came out of reverse, he said thrust remained at idle. He presumed that the reverse sleeves remained open. The captain reduced the EPR setting, but the FO could not recall what the EPR setting was.

Asked how the evacuation command was given, he stated crash fire rescue told them to go off the right side. The FO and captain discussed it and agreed to evacuate via the wing and tail cone. The captain then relayed this to the flight attendants.

Asked what the company's stable approach criteria were at 500 feet, he said gear, flaps, spoilers armed, ignition on, autobrakes max, on target airspeed, on glidepath and aligned with the runway. Asked whether they performed those checks he said yes. The captain had a habit of calling out all that anyway at 500 feet and it was nice to hear him verbalize it. They checked gear, flaps, spoilers armed, and ignition on, target speed, glide slope and lineup. They were within mandatory criteria, which included airspeed, glide path, localizer, configuration deviations, and specifically airspeed deviations of more than 10 kts or PAPI more than one dot low. The flight was on target at 500 ft.

Regarding his personal background, the FO stated he lived in Georgia and had a real estate business that took 10 to 15 hours per week of his time. He had a BS degree in business management. He was married with three children, ages 14, 12 and 1. His ex-wife lived two miles away with his two older children and he was remarried and lived with the 1-year-old. He had

been based in New York and was familiar with LGA although 95% of his flights there had been through JFK airport.

The FO was asked to discuss his activities during the 72 hours prior to the accident.

He concluded a three-day trip on March 1.

On Monday, March 2, he had the day off. Monday was his son's first birthday. Aside from that, he engaged in routine activities around the house with his family and went to sleep about 2200. He received a call about 2400 assigning him a one-day trip described as a "green slip" because they were short of pilots. This trip offered premium pay.

On Tuesday, March 3, he awoke about 0500 and signed in for work at 0700. His quality of sleep had been fine. He left home at 0520, arrived at the employee parking lot after 45 minutes, and signed in half an hour early about 0630. His trip was scheduled to go from ATL to Pensacola, remain 6 ½ hours, and return to ATL, but it was rescheduled, and he ended up deadheading to Pensacola and flying back to ATL, arriving around 1700. He was officially off duty at 1730. He arrived home at 1900 and went to sleep around 2200.

On Wednesday, March 4, he began what was scheduled to be a four-day trip with the accident captain. He woke at 0440 and reported for duty at 0635. He could not specifically recall the quality of his sleep but thought it was fine. He was scheduled to fly 3 legs. He finished duty at 1300 or 1330. He took a brief nap and relaxed in his hotel room, then exercised in the hotel fitness center. He met the captain at 1630 and they went to an oyster pub in Daytona Beach. They each had two beers, but the FO did not finish his second beer. The FO returned to his room by 1830 or 1900. He went to sleep at 2030.

On Thursday, March 5, he awoke at 0410. His quality of sleep had been excellent. The crew was picked up at 0440 and signed in at 0500. They departed at 0600 or 0625. They flew to ATL and arrived early, providing a 1.5 hour layover. He had coffee and oatmeal at a Starbucks in C concourse, his first food of the day. They then operated the flight to LGA. He felt alert. They were scheduled to go on to Orlando after that.

Asked to describe how much sleep per night he needed to feel rested when he was off duty for an extended period of time, he said 7 ½ hours. He considered himself to be a "morning person". He stated that he and his wife shared their bed with their one-year-old son.

He felt his workweek was normal. His three-day trip at the end of February was more of a late evening trip than he usually bid, but he was fairly junior. He normally had 12 to 14 days off per month. His last vacation or extended time off was in early to mid-February.

Asked to describe any emergency or abnormal situations he might have encountered in the past, he said he had had multiple experiences in the military.

He had experienced no significant changes in his health, finances, or personal life in the 12 months preceding the accident, other than the birth of his son.

His vision was 20/20, his hearing was "adequate."

He did not take any prescription medication. He typically drank 1-2 alcoholic beverages 5 days per week with dinner. He did not use tobacco products.

Asked whether, in the 72 hours before the accident, he had taken any medication, prescription or nonprescription, that might have affected his performance, he said he had not. In the days before the accident, he did not experience any minor health issues such as a cold or flu.

The FO felt his workload during the day of the accident was average. The right seat position in the MD-88 was very busy compared to some other aircraft in the fleet, but nothing different from what he was used to from his previous experience.

Asked about workload during the accident approach, he said it was busy but not different from other IMC approaches, except they were on edge and prepared for the quirks of flying into NYC airspace. As it turned out, they were brought in over the final approach fix and then had room to maneuver and descend without difficulty. It was not a "slam dunk" type of approach. They were prepared for it to be busy, but that did not happen. They had no difficulty with noise or vibration, and the only communications problem was trying to tell tower they were going off the runway. The frequency was busy and he was unable to get a word in so he did not even key his mic. The layout of the controls was adequate. It was a "very manageable" cockpit.

The FO stated he liked working for the company and Delta was exceptional. He felt no external pressure from the company overruling his judgment. He also felt no external pressure from his personal life. The FO got along well with the rest of the crew. The captain's mood was fine. The FO had flown with the captain previously, 1-2 years earlier, and thought his proficiency was excellent. The FO stated the captain's strengths were being meticulous and giving thorough briefings. He was a very conservative pilot, and so was the FO. It was nice having him clearly verbalize his judgments about how they would conduct the flight. The captain was very particular about what he expected and set rules of the road along the way. He was specific about the required braking action, fuel and diversions. The captain had stated that if braking action was less than good they would go elsewhere. He was not wishy-washy. They talked about their fuel numbers more than once and had discussed where and when they would divert. Their target fuel number was written down to establish when the FO should call it out to the captain. The captain had included in his briefings the kinds of things the FO would want a captain to call out. His briefings were very thorough. The FO could recall no deviations from SOP or checklists by the captain, and he had heard nothing about the captain's ability to get along with others.

Both the FO and the captain were frustrated in their attempts to get braking action reports. About 45 minutes into the 1.5-hour flight they talked about their concerns in this area. The captain was trying to obtain them from dispatch and the FO was trying to obtain them from ATC. Neither of them was having a lot of early success and they were both frustrated about the lack of real time information other than ATIS and weather updates. The captain was quite directive about it, which the FO appreciated.

Asked about training he received related to the circumstances of the accident, the FO stated one or two cycles ago they practiced max autobrake landings on slippery surfaces because of some previous overrun accidents at various airports. He had done 2 or 3 landings in the simulator in this training. He had been trained to put forward pressure on the yoke, avoid blanking the rudder and use max autobrakes. An example scenario was landing in Cancun, where a wet non-grooved runway could be slippery even in the tropics. They were taught to check the ODM and consider runway grooving.

Asked if he had received any training on general human factors topics that might have been relevant to the accident, he said he had, in the military and with Delta. They talked about threat and error management during every Delta training cycle. Asked whether he had applied any of those principles during the accident approach, he said yes, it was similar to other things he had been trained on over the years. It was a nice refresher. Asked about any special topics addressed during his most recent line-oriented flight training (LOFT) he said that in his last LOFT they did a cargo fire with an immediate landing.

The FO stated the approach speed for the accident flight was 131 knots plus a 5-kt additive for a final approach bug speed of 136 kt. There was no other additive.

The FO stated anti-icing equipment was in use during the descent and remained on throughout the approach. He had the window defog on. The captain had airfoil ice on, opened the pneumatic cross feed valves, and had wing and tail de-ice on. He put tail de-ice on at about the time he extended the landing gear.

The FO was not sure the last time runway 13 was plowed. His impression was that they had been told to expect holding because the airport was plowing it.

The FO said he and the captain did not discuss the accident in detail prior to his interview.

He had filed an ASAP report.

This concluded the interview.

2.0 Interviewee: Captain Theodore W. Lauer Jr., Delta MD88 Captain

Represented by:	**Gordon Rose, ALPA**
Time/Date:	**March 7, 2015, 1330 EST**
Location:	**Delta Air Lines Headquarters, Atlanta, Georgia**
Present:	**Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steve Acalin, Delta Airlines; Brian Teske, Air Line Pilots Association; James Brocksmith, Boeing**

During the interview, Captain Lauer stated the following information.

He was 56 years of age. He was based in Atlanta, Georgia.

His title was Captain on the MD88/90 and he had been in that position for 14 years. Prior to that, he was an international first officer (FO) on the B767-ER. He had held that position for just under 2 years. His date of hire at Delta was August 14, 1989 and he had worked for the airline continuously since that time. Prior to working for Delta he was on active duty in the US Air Force where he went through his initial pilot training, served as a T-38 instructor at Laughlin AFB, served as an F-16 pilot at Kunsan and Hill air bases.

His total flight experience was 15,000 hours, with 11,000 hours in the MD80/90. He had about 9,000 hours of pilot in command time. He held an ATP certificate with a multi-engine land rating and he had a flight engineer rating on the B727, and type ratings on the 757/767 and DC-9. He held a class 1 medical certificate with the limitation that he wears corrective lenses, which he was wearing at the time of the accident.

Captain Lauer was asked to recount the events leading to the accident. He said that he and the FO knew it was going to be challenging when they signed in that day. Delta had issued a critical operations update describing winter weather conditions approaching the northeastern U.S. and he and the FO had discussed it. They told each other that they did not know where would end up spending the night.

Captain Lauer wanted to get to LGA as soon as possible, however two airplanes were pushing back before them. The second was pushing an hour before they departed. Captain Lauer expected that he would be able to obtain a report on the weather conditions from those crews before he arrived at LGA.

After Captain Lauer and the FO took off from ATL they had the ATIS on auto update. They had no MEL items. The temperature at LGA was dropping and snowfall was varying between light and moderate, with reports of freezing fog. That prompted a discussion between him and the FO. They were carrying a lot of fuel and Captain Lauer knew they would be landing with a gross weight of 130,000 lbs, which he considered heavy. 130,000 lbs had been the maximum landing weight on the MD88 for a long time. The captain and FO each pulled out their Operational Data Manuals (ODMs) and determined that they needed a braking action of no less than "good." They knew fair or medium braking was going to be unacceptable for the runway length, wind conditions, configuration, and max autobrake setting.

During arrival, ATC wanted them to go down and slow down quick to make RIDGY, which was typical. There were no surprises there. However, the captain knew there was a braking action advisory at the airport and he was concerned that they had not yet received any updates about braking action. The first indication that things were not going well was when ATC advised them to expect holding at Robbinsville. There was a lot of discussion on the radio between ATC and aircraft arriving ahead of flight 1086, and Captain Lauer recalled ATC mentioning something about snow removal, which indicated to him they were getting accumulation at LGA. Captain Lauer and his FO sent for a field condition report via ACARS, but it did not provide much information. It just mentioned the fact that they were treating the runways and removing snow.

They had engine anti-ice on and, during descent, they turned the airfoil ice on as well. When they did so, Captain Lauer observed a left airfoil abnormal pressure indication. Captain Lauer raised the spoilers because they needed to slow to 210 knots prior to reaching Robbinsville. He also extended the slats so that he could bring the power up and extinguish the airfoil abnormal pressure light. The crew sent a message to a Delta dispatcher telling him they were not getting enough information on the status of snow removal and braking action reports at LGA. The dispatcher sent a reply telling them that he did not know the status and he was checking. Captain Lauer informed the dispatcher that flight 1086 needed good or better braking action to land at LGA and if the braking action was less than good they would need to divert. He did this so the dispatcher would understand their situation.

They continued their arrival. The FO was doing a great job keeping up on the abnormal pressure light. That one was staying on but the rest were going out. It was a nuisance. They were getting ready to go into holding when ATC announced that runway 13 was open and accepting arrivals and instructed them to resume the KORRY arrival, so they began their descent at 210 kits. Airframe icing was light and they were between layers so the airfoil abnormal pressure light was no longer a concern. They captain had already briefed the approach prior to the ODM discussion.

Aircraft arriving ahead of flight 1086 were asking for braking action reports, so Captain Lauer felt they should not chime in. ATC began issuing clearances to PROUD, so Captain Lauer began thinking they needed to set that up, but ATC canceled that and began bringing flights in ahead of flight 1086. The first braking action report Captain Lauer heard was fair. He and the FO looked at each other and said they could not land with that. A flight ahead of them told ATC they could not land with a report of fair breaking action. ATC acknowledged that and, a short time later, transmitted a braking action report of good. Captain Lauer's impression was that the report came from an RJ. He did not quite copy what type it was.

ATC never issued holding at PROUD, and Captain Lauer told the FO they would proceed pending more braking action reports. He was very confident and comfortable with their game plan pending further braking action reports. The latest report he and the FO received prior to actually commencing the approach was that the runways had been plowed, sanded and chemically treated. He remembered the verbiage saying the runway was wet with wet snow.

Captain Lauer had landed on plenty of snowy, icy runways so he was familiar with such conditions. He was also familiar with LGA and the pier and how rapidly conditions could change

there, so they continued. They subsequently heard a report of good braking action from an Airbus and that was what Captain Lauer was looking for. By this point, due to having the spoilers out, they had burned extra fuel and they were using the 127,500 lb. speed card. This gave them a little more margin but they still needed good braking conditions.

They performed the approach checklist and everything was normal. They received a vector and intercepted the approach at 3,000 feet. They were configured and ready to go. Captain Lauer remembered the FO hitting the tail button, because Captain Lauer had not remembered it. In that instance, the FO was spot on, as he was throughout the flight.

They were on final approach. They had Progress Page 2 up on the FMS because Captain Lauer liked to check the wind track on the FMS when he was coming down on final. He noticed that they had a 10-11 kit direct tailwind. That subsequently changed to a quartering tailwind that made him feel better about the situation. While intercepting and coming down on final, he asked the FO to make sure they got a wind check on short final, the FO requested one after they completed the before landing checklist.

Next, they were on final, on airspeed, and coupled to the approach. Everything was great. When the 500-foot callout occurred, Captain Lauer rechecked the airplane's configuration. The gear was down with three green lights, flaps were at 40, spoilers were armed, and autobrakes were set to max. Looking back out the front, he saw the approach lights around 400 feet and called them out. He then began searching visually for the runway. All he could see was white and snow. About 300 feet he was able to make out the runway. He saw the runway centerline and edge lights, but the runway did not look as he expected. He expected to be able to see some part of the landing surface, but the runway was all white. It appeared to be covered by snow. He had landed on snow-covered runways before, the braking action was reported as good, and that they were within their criteria, so he continued the approach.

Captain Lauer called the runway in sight and adjusted his aim point to land within the first 1,000 feet. His objective was to get the airplane on the ground as soon as possible. They touched down within the first 1,000 feet on the centerline and on speed. When they touched down, he lowered the nose to the ground. As he was doing that, he moved the reversers up into idle and then one knob width on the reverser handle to shoot for the target EPR setting. As he was putting the nose down and moving reversers back, the aircraft started to slide to the left. It happened very quickly. At that time, he saw the snow banks on the left. The EPR indications were coming up uniformly but the slide distracted him and brought his attention outside the airplane. He then noticed that the autobrakes did not seem to be slowing the airplane. He did not hear the normal braking sound or feel the usual deceleration. As his visual attention came back inside the cockpit, he saw that the spoiler handle was back. But now the airplane was going rapidly left.

The FO said something like "Watch your reverse, watch your reverse, you're drifting left!" So Captain Lauer adjusted the reverser levers, but he was occupied with the rapid drift to the left. He tried to get the nose to track back to the runway but it became more obvious that even though the nose was tracking the runway the airplane was sliding laterally (sideways) to the left. Once the airplane began sliding left, all the captain's efforts were directed toward stopping that movement.

As they departed the runway surface, his next concern was the berm with the fence line on it that was rapidly approaching. He was desperately trying to steer the airplane to the right but the airplane was not responding. As they came into contact with the berm, he heard the FO say "I'm shutting the engines down". Captain Lauer could not recall if he responded to that callout because he was highly focused on trying to steer the airplane to the right, but he felt it was a good call on the part of the FO. The airplane hit the berm at a 10-20 degree angle. The airplane then turned and rode the berm at an angle. Captain Lauer's thought was that he needed to keep the airplane from going over the berm as the left wing was raking over the steel fence. The nose broke through the fence, and the crew saw the drop-off and the water below.

The airplane came to a stop with the nose sticking through the fence and the cockpit facing the water. The FO refocused the captain's attention on what they needed to do next by telling the captain that they did not have any power. Captain Lauer looked and saw that the FO was right. The FO said, "emergency power on, captain's radios, and you have the comms." Captain Lauer grabbed his microphone and selected com1 but it was dead. There was no battery power, no hockey puck, nothing. He tried cycling the emergency power switch but it was futile. He tried to call the cabin crew in the back but he could not communicate with them. The FO asked if he should open the cockpit door and the Captain said yes. Since 9/11 Captain Lauer liked to have the jumpseat down when he was flying in case someone tried to break into the cockpit, so the jumpseat was down. Captain Lauer opened the door.

Carol, the forward flight attendant, came up. Captain Lauer spoke to her over the jumpseat, telling her the flightcrew did not have any power and told her she needed to assess the exits. At some point during that conversation he also asked if everyone was all right. While he was doing that, the FO was getting his cell phone out. After Captain Lauer finished speaking with the flight attendant, the FO asked him whom they should call. Captain Lauer looked at his rotation schedule for an ops number at LGA, but they were not scheduled to lay over at LGA so he did not have a number on his printout. The FO suggested they call dispatch, and the captain said that was a great idea.

The cockpit was cold and dark and the FO was calling dispatch, so the captain moved the cockpit jumpseat out of the way and walked back to check with the forward flight attendant. It was quiet in the cabin. He was surprised by how calm and quiet it was. It was dark. He had not yet commanded an evacuation. He told the forward flight attendant that because they did not have any power she would need to use a megaphone. He walked over to where it was stowed, got it out, and gave it to her. The forward flight attendant said they did not have the use of the forward galley door. It felt to Captain Lauer as if they were leaning to the right pitched up. However, the door to the forward galley, which was located on the right side, was totally blocked by the steel fence and several fence posts that were bisecting it. Captain Lauer said it looked like they were going to need to use the over wing exits.

Captain Lauer went back into the cockpit and told the FO they needed to run the evacuation checklist. Many items were impossible to accomplish because they did not have power, but they tried to go through it the best they could. As they were finishing that, they heard yelling from outside the cockpit. It was crash fire rescue. The FO opened his window and an emergency

responder told the crew they needed to perform an evacuation because they had a fuel leak on the left side.

The flightcrew was working the situation, but their training scenarios had involved being on the runway and assessing the exits for fire. The aircraft orientation and inability to communicate with the flight attendants in the back and status of the tail cone or the people in the back was a challenge. Captain Lauer's contact was the forward flight attendant and her means of communication was the megaphone. So Captain Lauer said evacuate through the right wing exits only on first officer's side right now and the forward flight attendant initiated the evacuation.

Captain Lauer went back into the flight deck again to check on the FO who told him he had been able to get in touch with the tower using his cell phone. At that time, emergency responders attempted to open the forward galley door. The captain looked down and saw that it was armed, so he stopped them and disarmed the door quickly in case someone else had that idea as well. He did not want the slide inflating with the door blocked by the fence. The FO had told him he had spoken with both dispatch and the tower and the flight attendants were starting the evacuation so Captain Lauer felt here was nothing else he could do, so he went back and assisted with the evacuation as best he could. He assisted the first class passengers. Many of them wanted to carry their bags and he told them to leave their bags behind.

The evacuation had pulled the forward flight attendant to the overawing exits with the megaphone so Captain Lauer could no longer communicate with her. Firefighters told the captain they needed to evacuate through the tail cone as well. Captain Lauer said that in his mind it had seemed as if the airplane was pitched up more than it actually was, so he had not previously considered using the tail cone exit. He made his way back to the center fuselage area and told the forward flight attendant they needed to blow the tail cone and evacuate from it as well. She relayed that message to an aft flight attendant, named Rebecca. Captain Lauer was then able to confirm with firefighters that passengers were exiting from the rear of the airplane. Captain Lauer and the FO continued to assist with the evacuation, urging the passengers to exit as quickly as possible. The crew was fully aware of the fuel leak. In addition, Captain Lauer was concerned because he did not know how far the airplane was leaning over the berm and whether it was near a tipping point.

The flight attendants were "spot on". They kept people calm and focused. They dealt effectively with a potentially confusing situation and got everybody out in an orderly fashion. The flight crew helped as best they could. Some passengers wanted to take bags and the captain said no. He tried to keep the focus on expediting the evacuation. After the passengers evacuated, Captain Lauer told the FO that he needed to check the airplane from front to back to make sure everyone was out. He began at the flight deck and worked his way back, checking everywhere, including the lavatories. The FO remained with him, which he appreciated. Some firefighters came aboard the airplane and told him Captain Lauer had to get off the airplane, but he said he had to finish his check, so they went up to the cockpit. After completing their check, the FO and then the captain evacuated via the tail cone exit. An aluminum extension ladder was sticking up into the tail cone exit and it was "kind of treacherous" getting down it. At some point in the past, a another captain had advised Captain Lauer that if he was ever in an accident the flightcrew should throw everything they could reach into a trash bag and bring it with them, so Captain

Lauer had gathered his EFB and the flight paperwork and he was carrying those items when he evacuated.

The first person Captain Lauer encountered after he exited the airplane was Cory Campbell, the Delta Air Lines ACS for LGA. Mr. Campbell said he was there to assist the crew and get them to a safe place and he had a vehicle. Captain Lauer followed Mr. Campbell to the vehicle and threw his bag of items in the vehicle, but then he told Mr. Campbell he needed to make sure his passengers and flight attendants were on a bus that had been brought out to transport them. Mr. Campbell understood so Captain Lauer and the FO started walking toward the buses. At that time, they were intercepted by Port Authority Police.

The police wanted to take the captain away and separate him from everybody else right then and there. The captain said he needed to make sure all the passengers were on a bus and safe and that all his crewmembers were safe before he was going anywhere. There was a little pushback, but eventually someone understood and they assigned an officer to accompany him as he did that. Captain Lauer thought everyone was on some long buses that had arrived and he was looking for his flight attendants. He did not want them to be transported with the passengers to the terminal. Next, he noticed people getting off the buses. He asked what they were doing and they said they could not stand up in the buses, so they were being moved to a different one. Captain Lauer located the flight attendants and made sure everybody was safe.

At that time, Mr. Campbell stepped in and told the Port Authority he was keeping the crew together and there was a confrontation between the Port Authority and Mr. Campbell. The police allowed the crew to stay together and they were placed in an emergency mobile command vehicle. After that, Captain Lauer began making phone calls. His first call was to the duty pilot, but the first person he actually spoke to was Delta's senior vice president for flight operations. The flightcrew subsequently underwent DOT drug testing and left LGA at 1630 for JFK where they boarded a flight to ATL at1745.

Captain Lauer was asked if he noticed any passenger injuries and he said no, no injuries were brought to his attention and he did not observe any. Asked whether he spoke with any passengers after the accident, he said yes, quite a few. These conversations involved everything from baggage to medication to bathroom requests to consoling people who were crying and upset.

Reflecting back on the evacuation, Captain Lauer said it was a surreal experience. He had previously imagined all the things he would be doing based on his simulator training, but in this case there was no usable information in the cockpit. The activity was at the exits. There were lots of interactions about luggage. Even the flight attendants tried to bring their bags when they evacuated and he told them to leave their bags behind.

Asked to whom he ultimately gave the paperwork he carried off the airplane, the captain said he had given it to Delta's senior air safety investigator.

Asked whether he had considered having the APU on during the approach when he performed the approach briefing, Captain Lauer said yes, in the past it had been routine to have the APU on during CAT III approaches, but it was no longer required as a source of backup power. Normally

for CAT I approaches it was off unless the airplane had a power loss or was likely to encounter heavy rain.

Asked how he used the wheel brakes during the accident, Captain Lauer said he relied heavily on the automation. He had selected max autobrakes because he wanted to give himself the margin and he knew the situation could deteriorate quickly. As soon as the spoiler handle came back they should have maximum braking. If not, a lighted indication would appear and he would know he was on his own for braking. His strategy was to let the automation work for him, at least initially. The ODM had another braking category for max manual braking that involved allowing the autobrakes to initiate max braking and then taking over with manual braking, but he had never used that technique before so he was going to let the airplane autobrake as long as it could.

Asked whether he ever manually applied the wheel brakes during the landing, he said he did not apply them intentionally while they were on the runway. In his mind they were armed and nothing was contradicting that understanding. Because they were skidding left Captain Lauer was initially thinking more about the icing and the slipperiness rather than the fact that the brakes were not working properly. As they slid he looked outside and when he brought his attention back inside the cockpit to check things he did not see any amber light so he believed the brakes were ready to go but they were not getting any gripping action. He was fairly confident that he did not apply the brakes manually at that point.

As they departed the surface of the runway, however, he was in reactive mode. His focus was almost totally outside the airplane with the rudder and he could have used the brakes. He was not sure. He was doing what he felt needed to be done to get stopped. During the initial portion of the landing he was letting the automation work for him and they were just slipping. As they touched down and began drifting left it got worse quickly.

Captain Lauer was informed that preliminary data from the FDR indicated that the left brake pressure came up at some point and the right brake pressure did not. Captain Lauer said he did not recall applying the brakes manually but he did recall using the right rudder pedal and trying to keep the nose aligned with the runway.

Asked whether the airplane was also yawing as it was sliding left, Captain Lauer said no, the airplane was slipping laterally to the left, but it was not yawing. The nose was never pointed to the side of the runway until they hit the berm, at which point it was like they were a toboggan. He recalled the FO calling out that they were drifting or sliding to the left, and he believed the FO's callout reflected what the FO was seeing.

Minimums for the ILS approach were a decision altitude of 214 feet and visibility of ½ mile or 2400 RVR. Asked whether the tower provided them an update on the visibility, the captain said yes, as far as minimums and ceiling, it was okay. The visibility and the altitude where they broke out of the clouds were as expected. Only the visual appearance of the runway was not as expected. Aside from that, the instrument approach progressed normally.

Asked to describe Delta's procedures on how to handle a contaminated or slippery runway, Captain Lauer said the procedure was to use flaps 40 and autobrakes as needed. With the MD88 they also had a concern with the thrust reversers. They had to shoot for a target EPR of 1.3. The reverse could come later, but it was important to kill the forward thrust. Mismatched reverse thrust could be problematic. Also too much reverse thrust could blank the rudder. Anything over 1.1 EPR could result in some blanking of rudder effectiveness.

Asked whether he had deployed the thrust reversers as soon as possible during the landing, he said yes, he thought so. He liked to keep the nose tracking down the runway, but he wanted to kill the lift as well. As they touched down he had pushed the nose down and pulled the reversers back, but the left sliding drew his attention away from the reversers. The sliding happened early and it momentarily drew his attention away from the reversers. Only after he noticed the absence of deceleration from the wheel brakes did he bring his attention back into the cockpit. Then he was putting right rudder in to keep the nose tracking and hearing the FO making callouts about the reversers.

Asked how he operated the reversers, he said that he brought the thrust levers to idle, activated the reversers and advanced them one knob-width each. He would normally tweak them after that to obtain the target EPR setting, but he did not do that until the FO said something. At that time, he brought the reverser handles back toward vertical. He was not sure how much he brought them back exactly, but he thought he moved them to a position that was a bit less than the vertical position. That was what he was shooting for. He could not recall seeing any EPR indications.

Asked whether he was aware that the spoilers did not automatically deploy, he said no, but he learned after the accident that the FO had deployed them. When he looked back in the cockpit the lever was back and he never heard a speedbrake message. Asked whether Delta had a callout for no speedbrake, he said no, the crew was just supposed to move the handle if the spoilers did not automatically deploy. They only had a callout to announce that the spoilers were deployed. There was also no callout if the thrust reversers did not deploy, but there was a callout if one of them deployed and the other did not.

Asked to clarify whether, when he adjusted the reversers in response to the FO's callouts, he was shooting for a vertical handle position or a little less, he said a little less than vertical. Usually about a knob-width from idle would provide 1.3 EPR and you could walk them back. Asked to clarify whether he had a chance to check the EPR indication in response to his adjustments of the thrust reverser handles, he said no, his attention was pulled out of the cockpit to the left initially, and it was then captured by the lack of deceleration which prompted him to check the spoiler handle. During that time, the airplane was sliding left and he was moving the rudder and that was when the FO called out about the reversers and Captain Lauer made a correction to the reversers, but he did not see the EPR indications because of the multiple distractions and dynamic, deteriorating situation. It was one surprise after another.

Asked what the FO called out about the reversers, Captain Lauer said the FO said, "Watch your reversers" and "You're drifting and slipping left." That had prompted Captain Lauer to make the adjustment to the reversers, but he didn't want to divert his attention from looking left to looking

at the gauges. He was relying on the FO to let him know if it was the left or right one. He never felt like he was using a "tremendous amount" of reverse thrust.

Because the whole runway environment was covered in snow he was relying on the centerline lights for flare and directional control and it was very challenging. He had difficulty perceiving the world. There was a snowbank on the left that he could see and he had very divided attention. The urgency of the situation grew more and more and it kept pulling his attention toward physical control and reaction rather than observation and setting something new on the reversers. That was why he felt the FO's callouts were valuable. Asked to clarify the nature of his correction, he said he lowered the reversers in response to the FO's callout. He did not come out of reverse thrust but he made an adjustment.

Asked to clarify when he grabbed the paperwork and other items in the cockpit, he said he collected those items around the time he and the FO were performing the evacuation checklist and firefighters told them that they needed to evacuate.

Captain Lauer was asked to clarify what information he requested of dispatch during the arrival when he extended the slats and was decelerating to 210 knots. He said he requested field conditions and braking action reports and the status of the runway. He sent at least three requests. Asked if he had printouts of the responses from dispatch, he said they had only printed one that indicated that dispatch did not have any braking action reports and would send some as soon as they were available. Asked if that frustrated him, Captain Lauer said yes. Asked how he expressed his frustration, Captain Lauer said he replied to dispatch with a message that included a bunch of exclamation and question marks. He wanted to make sure they knew that if braking were anything less than good they would have to divert. Captain Lauer said he had diverted from LGA in the past due to bad winter weather, the situation with the pier, and a lack of braking action reports. He had discussed what they needed with the FO and was confident they had a good plan.

Asked for the last winds they received from ATC, Captain Lauer said the report they received on short final was winds 020 at 10 or 11. He also remembered looking down at his crosswind indication and thinking the wind was just a touch of a left quartering tailwind.

Asked whether the braking action that was reportedly good during a previous arrival was an Airbus, Captain Lauer said yes, he wasn't sure how far the Airbus was ahead of them or what sequence it was, but it landed on runway 13. That was the only landing runway.

Asked when the runway was reopened following the snow removal, Captain Lauer said it was just as they were approaching Robbinsville. They had just gotten to 210 knots and did not have time to do an exit hold. When shown the arrival chart and asked if that meant they were 42 miles from the airport at that time, he agreed.

Asked whether it was his understanding that the airport had just plowed the runway and treated it with sand and chemicals but by the time flight 1086 arrived it was all white, Captain Lauer said yes. Asked what he had expected the runway to look like, he said he had expected to see at least patches of runway surface. He had flown into Buffalo and other places a lot before and the view

of the runway was not what he expected based on the information he had received from the ATIS and other sources. Captain Lauer said that after the evacuation, when they were standing on the runway, he could not help thinking it did not look like a sanded, chemically treated runway.

Asked to describe the weather conditions he observed upon exiting the aircraft, he said "A lot of snow, very, very cold, and windy." He did not know how much snow was on the runway.

Asked to clarify whether the Airbus that had preceded them had landed after the runway had been cleared and reopened, Captain Lauer said that was his impression. He was confident it was one of those airplanes. If he had not been confident about that he would not have landed. He was confident about the reports he received. Asked whether he had observed any airplanes approaching the airport ahead of him on the TCAS he said yes, maybe the Airbus, but he could not recall how far ahead it was. Flight 1086 had arrived over the field and then made turns and descended to intercept the approach.

Asked whether he and the FO referenced the QRH in response to the left airfoil abnormal pressure light, he said no. The FO asked him later in the arrival if they still had the light, but it had fallen from Captain Lauer's consideration because the icing was trace to nonexistent.

Asked to clarify whether he had told dispatch they needed good or better braking to land at LGA, Captain Lauer said yes, but he did not advise ATC. Asked whether Delta policy required the good braking action report to come from a similar aircraft type, Captain Lauer said not to his knowledge.

Asked how he normally targeted 1.3 EPR when using the thrust reversers, he said his technique was to unlock them at idle, and then move the handles back a knob-width. He did it by feel. He set them like that and let them get stable. He knew the MD88 could have mismatch and lagging. Asked whether that had worked well in the past, he said it had gotten him in the ballpark. Asked whether there was any written guidance on that from Delta, he said no, it was just his technique. Asked if there were any associated callouts, he said only if things were not correct.

Asked whether, in his 14 years on the MD-88, he had ever seen the auto spoilers not come up on a contaminated runway, he said yes, he had seen that during touchdowns that were not firm, depending on the amount of spin up of the wheels and the amount of compression on the gear. When serving as pilot monitoring (PM) he had sometimes also seen them fail to automatically re-stow. For those reasons he would keep his hand there when he was serving as PM in case they did not come up. It was important to get them up right away.

Asked whose responsibility it was to deploy the spoilers if they did not come up, Captain Lauer said it was the PM's responsibility but whoever got to the handle first should deploy them.

Asked when he looked at his wind bar on the navigation display, he said he looked at it when the tower gave them winds 020 at 10.

Asked if he could recall his control wheel displacement during the crosswind landing he said no.

Asked how the airplane would turn in a crosswind if it experienced rudder blanking, he said rudder blanking would interfere with one's ability to track the runway using the rudder.

Asked whether Delta had a policy on seeking Mu ratings for braking action, he said Delta pilots used them when available but braking action reports were primary.

Captain Lauer had seen the airfoil pressure light appear in the past. That was why he had put the speedbrake and slats out, so he could keep the power up, but in the process they broke out of the clouds. They did not have much, if any ice anyway.

Dispatch had not given them a specific number for required landing distance.

Captain Lauer turned the AP off after he had the runway in sight. He did not know exactly when. Asked whether the autothrottles remained on, he said they were probably off soon thereafter, because he wanted to land in the first 1,000 feet. He was fairly confident he turned both off at same time.

Asked to describe the type of crosswind correction he used for the landing, he said left wing down and little right rudder.

Asked to clarify whether he saw the autobrake light come on at any time, he said he did not.

Asked to estimate how much time elapsed between touching down and departing the side of the runway, he said he was not sure. He provided a rough estimate of 5 seconds.

Asked when the engines came out of reverse, Captain Lauer said he did not remember ever taking them totally out of reverse, only making a correction.

Asked whether the reversers deployed evenly, he said yes, he even looked down to check that initially. Normally he would come back to looking at those indications but, as things progressed, he never did.

Asked whether he used full right rudder, he said yes, he was aware of the potential for over controlling and was feeling his way along, but he thought eventually he had it all the way over to one side. His intent was to fly the airplane and keep it tracking down the runway as long as he could.

Asked to estimate how far down the runway the airplane departed the side, he said he thought it was before the 3,000-foot mark. He believed he had touched down in the first 500 feet, and departed the runway perhaps 2,200 to 2,500 feet down the runway.

Asked what happened when the airplane hit the snowbank, Captain Lauer said he thought it might bounce them back toward the runway, but it was like catching a tail hook with the left main gear and he did not have enough rudder authority to counteract that.

Captain Lauer did not calculate the expected landing distance. They looked at the tables in the EFB. A number that stuck in his mind was 7,400 feet. That was what he knew he needed for landing with medium braking action (fair). So he knew if he had good braking action he could make it. The FO came up with a slightly different number but they were in the same ballpark.

Asked whether he had ever had the thrust reversers fail to deploy, he said yes, but he knew and trusted the FO and relied on him to call something like that out if it occurred. He said he and the FO had flown together before, he was very precise and as standard as any FO and he knew he was going to make callouts. Captain Lauer expected that if something were not right he would tell him. He knew and Captain Lauer knew that if a correction needed to be made such as "no right", the FO would tell him.

Captain Lauer was asked for more details about the evacuation. He did not know who opened the overawing exits. Asked whether any equipment other than the megaphone was used during the investigation he said one of the flight attendants was carrying a flashlight. He could not recall if the emergency lighting strips were working. Asked whether the cabin appeared totally dark, he said no, it was daylight but not well lit. Captain Lauer did not attempt to open his own cockpit window because all he could see was water. Asked if he was aware of any difficulty using the overawing exits, he said he did not know. He observed people going through them and it appeared to go smoothly.

He did not know what happened with the aft slide and how the ladder came to be propped inside that exit. He thought the ladder probably came from firefighters. It did not come from the airplane. Captain Lauer did not observe the extent of the fuel spill after exiting. He moved quickly away from the airplane. He also did not smell fuel while he was inside the airplane. He did not observe any conflicts between passengers at the exits. Everyone was very cooperative. Asked what percentage tried to carry their luggage during the evacuation, he said he only interacted with five passengers aboard the airplane during the evacuation. He was primarily dealing with first class. The person who asked Captain Lauer if they could use the restroom was a first class passenger. Captain Lauer said no.

Captain Lauer's residence was located 45-50 minutes from the ATL airport by car, depending on traffic.

He did not hold any other positions at the airline other than captain.

He did not hold any outside employment.

His highest level of education was a B.S. in engineering mechanics.

He was married and lived with his wife. He had no children living at home with him.

Captain Lauer flew into LGA frequently, an average of three times per month. He flew about 50-60 block hours personally made about 20 landings per month.

Captain Lauer was asked to describe his activities in the 72 hours before the accident.

On Monday, March 2 he was off duty. It was an uneventful day. He exercised and engaged in routine activities at home. He probably had a glass or two of wine that night and ate normal meals during the day. He stayed up fairly late watching TV, until 2330 or 2400.

On Tuesday, March 3, he woke about 0700. He volunteered at his church in the morning, exercised, and engaged in routine activities around the house. He went to bed about 2100, which is a little later than he preferred. He liked flying early trips so he could be done early. That was what he bid. So he preferred going to bed early.

On Wednesday, March 4, he woke at 0400, had a light breakfast, and drove to work. His flying trip was uneventful. He went through IND and on to DAB and had a layover there. He exercised at the hotel and then met the FO at 1630. They went to an oyster pub where they ate dinner. Captain Lauer had two beers; the FO had at least 1. They were back at the hotel around 1800 and Captain Lauer was in bed about 2100 because they had an 0440 pickup. He set his alarm for 0340. He recalled waking a couple of times during the night for no particular reason. He specifically remembered waking once at 2330, but he was quickly able to go back to sleep.

On Thursday, March 5, (the day of accident), he woke at 0340. His quality of sleep had been okay. He felt rested that morning. He did not feel fatigued. He ate a breakfast bar and had some coffee in Daytona Beach and flew an uneventful leg to ATL. At the ATL airport he went to an Asian restaurant, ate a 3-egg omelet, and had another cup of coffee. He ate that at 0730. They had an 0845 departure. He drank some water during the accident flight.

Asked how much sleep he needed each night to feel rested when off duty for an extended time, he said that he always tried to get 8 hours of sleep but sometimes at home he would sleep 9 hours. When he was heading out on a bad weather trip he might try to prepare in advance by getting two nights of 9 hours sleep at home. He considered himself a morning person.

Asked whether the accident trip was typical for him, he said no. He tried to avoid four-day trips and flying on weekends and the accident trip was a four-day trip. He had bid it because it better accommodated his volunteer schedule and a vacation he had planned for the following week. He normally flew three-day trips that consisted of 3, 2 and 3 legs. He looked for those. He avoided flying more than three legs a day.

His previous trip had ended the Friday before the accident.

Asked whether he had been involved in any previous accidents, he said no. Asked whether he had been involved in any other emergency or abnormal situations he said he had been flying an MD88 to Newark once when the autopilot appeared to start ticking to one side. He diverted to Richmond, turned everything off, declared an emergency and landed at Richmond. The issue turned out to be a connection between the yokes that was slipping.

Asked whether he had ever been disciplined for his performance as pilot he said no. Asked whether he had ever received commendations for his performance as pilot, he said he had received a couple of positive letters from passengers and flight attendants.

He had experienced no significant changes in his health, financial situation, or personal life in the 12 months preceding the accident.

Captain Lauer said his general health was excellent. His vision was fine. He needed correction of distance in his right eye and near vision in both eyes. His hearing was very good.

Captain Lauer was taking several prescription medications.

- Norvasc
- Dulera
- Singulair and aspirin
- Allegra, Claritin, and Flonase

He stated that all these medications had been reported to and approved by his aviation medical examiner.

Asked about his consumption of alcohol, he reported consuming 2 or 3 drinks (beer or wine) three times per week, on weekends or layover.

He reported that he did not use tobacco products.

He did not consider his workload on the day of the accident to be anything out of the ordinary. It was not excessive, however, it was at least moderate because he knew they would be challenged at LGA, and that turned out to be far more than he anticipated.

They were challenged during the accident approach because of coordination and planning that was required. That was when it helped to have someone like the accident FO. The FO had stayed a step ahead of him and shared the workload more. The approach itself was very straightforward, but the accident sequence was much different. Prior to breaking out of the clouds workload was normal for a low IFR approach.

Asked if there were any unusual distractions during the approach, he said there were numerous distractions during the accident sequence and the FO kept refocusing Captain Lauer's attention where it needed to be. It was so easy to get pulled off onto something and fixate.

He reported no difficulties with noise, hearing radio transmissions, or the visibility, layout, and operability of displays and controls.

He loved working for Delta and he loved the people he worked with. Asked whether he felt any external pressure from the company to execute or press an approach that contradicted his best judgment, he said none whatsoever. He also experienced no external pressures during the accident flight related to his personal life.

His mood before the accident was good until he had to rapidly slow down and descend and prepare for holding. They had had one mechanical issue that put them behind departing out of

ATL, and no one liked that happening given that they were in a hurry to get to LGA before the weather got worse. Captain Lauer had told the FO time was their enemy because it was only going to get worse, so they had pumped the speed up and were trying to get to LGA as soon as possible. The maintenance issue only resulted in a 15-20 minute delay. Captain Lauer's O2 mask had popped off and needed to be replaced.

The FO's mood was good.

Captain Lauer said he got along well with the FO but he thought the FO would perform well for any captain. He was not on the FO's "do not fly" list. They had flown one or two previous trips together. He was very comfortable flying with the FO.

The FO's proficiency was "well above average" compared to other Delta FO's. He was thorough, precise, and standard. He demonstrated good communication. He had good stick and rudder skills. Captain Lauer was picky and nothing stuck out about him that would cause concern. The FO was always very quick to point things out as they occurred and ask what Captain Lauer would like to do about them. The FO was always one step ahead of him.

Ask whether they alternated flying legs, Captain Lauer said he would never put an FO in the position of landing at LGA in the conditions they were expecting, so he had arranged so they each fly a pair of legs and Captain Lauer would fly the accident flight. The FO flew IND-ATL and ATL-DAB, and Captain Lauer flew DAB-ATL and ATL-LGA. He had not arranged it that way because he lacked confidence in the FO's ability; it was just a situation that the FO did not need to be in.

Captain Lauer had no idea how the FO got along with other captains.

Asked whether the FO expressed any concerns about the equipment or the conditions during the accident flight, Captain Lauer said sure, they had shared information about the braking action requirement, and they were in agreement about what they needed. It was a shared decision. The FO was comfortable with what they were doing and Captain Lauer was confident the FO would let him know if he was not.

Asked if he had received any training from Delta that related directly to the circumstances of the accident, he said the simulator training about landing on slippery runways had been pretty accurate in terms of slipping in the simulator when you have no traction. The whole sliding thing felt like a surreal simulator type of situation. He had been through extensive training addressing landing on contaminated runways. They were set up and went through a nil braking action scenario in the simulator just to feel it. That had been fairly recent, maybe the recurrent training session before last. He might have had it twice in a row, because the company had had some past excursions. It had been an emphasis item for the company, in his opinion.

Asked if there had been anything particularly helpful about the training or some of aspect of it that did not work in the accident situation, he said the training caused him to plan for an event, which they did for the accident approach. He listed his discussion with the FO about required braking action, how they planned to conduct the approach, and the EPRs. Captain Lauer stated

that his understanding of their performance of the event was based on his memory and the FO's memory, but he was confident that he had applied his training. He stated, however, that he was not trained for hitting a snowbank or leaving the prepared surface of the runway or for aircraft damage during the evacuation, so there were limitations to the training.

Asked whether he could identify any company procedures that might be relevant to the circumstances of the accident, he said that would depend on the findings of the investigation and what the recorders showed. Captain Lauer said he was very opinionated about configurations and priorities and while he did not always agree with official policies, he tried his best to comply with how company wanted him to operate. He did far more flaps 40 than flaps 28 landings. He wanted to slow down and get off the runway as quickly as possible after landing. He was not a big fan of a lot of reverse thrust unless it was needed and he was not a big fan of landing on a dry runway with a target EPR of 1.6. He thought the difference between 1.3 and 1.6 was substantial. He preferred to pick 1.3 and stay consistent. It had worked fine in the past. He thought the airline should make that the target and fly like they trained.

Asked whether he had received any training on human factors topics that might be relevant to the circumstances of the accident, he said human factors training was always valuable and he thought they could do more joint training with the flight attendants. He thought the airline might have moved away from that a little too much and probably needed to revisit it. During this accident, he felt confident that even though they did not have that a communications link that the cabin crew would perform well, but not having it was a bit of a concern. Doing something as simple as keeping the forward flight attendant up front with him might have prevented the situation from deteriorating if something bad had happened. He did not know if the megaphone was ever taken out in the back, because there was a disconnect at the wing line. However, he felt their training had prepared them well and that his whole crew was very professional and competent and knew what they were doing and performed well.

Asked whether Delta pilots underwent joint CRM training with flight attendants he said they had not recently. They used to do it quite a bit. Now a lot of that was coordinated through videos. Their face-to-face training had been cut down. However, it had gotten a little too touchy-feely for a while. Asked what special topics he had most recently encountered during LOFT training, he said the scenario had involved a tail compartment hot light coming on during a flight from Philadelphia to New York. The focus was on deciding who should fly, priorities in handling, and things like that.

Asked whether during slippery runway training they had ever been instructed to say reduce or stow reverse thrust, Captain Lauer said reducing did come up. Coming out of reverse thrust did not. He always thought of it as being an option but he did not know if they ever went totally out of reverse. The emphasis was on decreasing it. The trouble was getting it back in when you needed it in the MD88. The MD90 made it cleaner with the cascades. With the buckets, the reliability and mismatch might cause the flightcrew to become preoccupied. It was really not in Captain Lauer's mind to come totally out of the reversers. That was not necessarily in his repertoire.

This concluded the interview.

3.0 Interview: James Robert Hamilton, Delta Chief Line Check Pilot MD88

Represented by: **Jon Peter Kelly, Delta Legal Dept.**
Date and Time: **March 9, 2015, 1045 EDT**
Location: **Delta Air Lines Headquarters, Atlanta, Georgia**
Present: **Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steve Acalin, Delta Airlines; Brian Teske, Air Line Pilots Association; James Brocksmith, Boeing**

During the interview, Captain Hamilton stated the following:

He was 54 years old. He tried to fly four legs per week, but that was a goal and not always attainable. He had been on the MD88 since 1993 and had been the chief line check pilot (CLCP) for 2 years and 5 months and was a lead line check pilot (LLCP) for five years prior to that. He had not been involved in any accident investigations prior to this one. His date of hire at Delta Air Lines was October 1989.

Capt. Hamilton's duties included hiring and training line check pilots (LCP), maintaining the operating experience (OE) guide and functional check flight (FCF) program, monitoring charter operations for the MD88/90 fleet, evaluating new locations (destinations), publishing the Mad Dog Messenger and co- authoring Flight Crew Bulletins and Electronic Bulletins for the MD88/90. He was a member of the TMG (threat management group), and the JTS (joint training standards).

Capt. Hamilton had 75 LCPs under him and he was responsible for LC policy, which included initial line checks for captains and first officers, recurring line checks for captains, and blitz line checks where approximately 20% of the captains got a line check in a month or a month and a half.

A question was asked about what was required for the initial line check and Capt. Hamilton stated that the initial line check was the last opportunity to verify proficiency. He also explained that the FAA observed these checks for captains and sometimes lead LCPs conducted these checks as well. The LCP Manual explained how the FAA provided the exemption to allow the Lead LCP (LLCP) to do this.

The recurring line check was every 24 months for captains only. First officers got a six-month midphase check after initial OE then no more, but they were evaluated and graded during Captain line checks.

Capt. Hamilton said the blitz checks were the result of identified threats or new procedures and were an opportunity to see if the threat had been eliminated or the new procedures were being adhered to. These were emphasis items and were entered by the LCAs using “survey monkey”, so the company could monitor the results. He gave examples such as recent changes to the Pushback Checklist, center tank fuel and general checklist compliance.

The threat management group (TMG) took collated Flight Operations Quality Assurance (FOQA) and Aviation Safety Action Program (ASAP) data from the Data Analysis Group (DAG) and evaluated the data to determine if it was really a threat. The TMG was made up of fleet captains CLCPs and the director of flight standards. He said there was a "Dirty Dozen" list of threats but that they were now down to nine. Capt Hamilton stated that these threats are communicated to the pilot group through the Hangar Talk publication and the Mad Dog Messenger, both monthly, as well as line and simulator changes.

Capt Hamilton had a monthly JTS meeting. It was a much larger group adding technical writers and flight operations personnel. The Director of Flight Standards, Ed Sternstein, chaired it. This group voted on proposed changes.

He was asked about LOSA and said it was not a line check and Corporate Compliance ran it but Corporate Compliance and Standards were intertwined. Corporate compliance was the DAG and sat on the JTS.

Capt Hamilton was asked to describe any special emphasis items in the last year and he said that runway excursions were emphasis items. They had run a safety risk analysis through the safety management system (SMS) process that had to do with providing pilots actual landing distance calculations via ACARs. They would not have had to pull out the ODM and interpolate. He said that should be out soon, but it had been delayed a couple of times.

He said there had been no other emphasis items relevant to this accident. Asked if there had been any guidance to crews in the last year about operating on contaminated runways, he said contaminated runways had been updated in the FCTM to provide a consistent message. Knowing that they were going to hire thousands of pilots, all the FCTMs had been re-crafted. There were lots of changes from LOSA put out in Mad Dog Messenger and Hangar Talk. He referenced the Cancun Scenario. The Operational Data Manual (ODM), Operational Landing Distance chart and Volume 1 Crosswind Guidance chart had been looked at as well.

Capt Hamilton was asked to look at the crosswind guidance chart and said that a braking action of "good" allowed a crosswind limit of 30 kits, medium to fair was 20 kits and medium to poor was 10 kits. He further stated that these were guidelines not limitations.

The Captain was asked about braking action reports and he said that the report depended on regency and the type of aircraft that made the report. Experience allowed pilot's to evaluate this information in light of the type of aircraft making the report.

Asked to describe reverse thrust technique, he said that the thrust reverser should be unlocked as the nose came down and then thrust would be increased as the nose touched down. The target EPR was 1.3 for contaminated runways and 1.6 for dry. The MD90 had a 1.3 EPR gate. If a pilot went past the gate they were in emergency reverse and that could result in a possible engine removal. The MD88 had buckets and the MD90 had cascade vanes. Max EPR was allowed, up to go-around thrust or the crow's feet indicator.

Capt. Hamilton was asked what guidance was provided to pilots about rudder blanking, and he said that reverse thrust above 1.3 could blank the rudder. He said this was in the FCTM as well as Volume 1. He said he had no personal experience with rudder blanking and that the Cancun event was probably rudder blanking, but hydroplaning was also a factor. More than 1.3 EPR was fine if control was ok.

Capt Hamilton was asked about braking and anti skid. He said that for manual brakes you pushed hard on the brakes and the anti skid worked on a deceleration rate. With auto brakes, medium worked on a deceleration rate and that max auto brakes provided a constant pressure and the anti skid modulated. He stated that there were no annunciations while the anti skid released. He stated that he had felt it cycling, especially on a patchy runway. He also thought there were four independent anti skid systems, one on each wheel. He was asked if he ever had one whole side of the brakes release and the answer was no, never one whole side. He had had one wheel stop working on a side, but not both on one side. When that happened, increased brake pressure was needed on that side to balance. He said that after landing and taxiing in, if one selected the brake temperature gauge and cycled through the brakes that they would see something like 150, 150, 250, and ambient air temperature on the brake that wasn't working. There was no way to know during the use of max brakes if any wheel wasn't braking. He further stated that there were no bulletins on braking in the last year.

Asked who led the TMG, Capt Hamilton said the Director of Flight Standards, Ed Sternstein. He also asked who lead the JTS and Capt Hamilton said the Director of Flight Standards. The question was asked as to who led the DAG and SMS and Capt Hamilton said Corporate Compliance, Chuck Schramek. He was also asked if max auto brakes released in patchy conditions and caused a yaw and the answer was no.

Asked if Cancun was a rudder blanking event Capt Hamilton said it was a low visibility, super wet, non grooved runway and that it was probably a hydroplane event and that he did not now the EPR used. The aircraft left the runway very quickly; one main went off then back on. He did not know how strong the crosswind had been. Asked about specific LGA procedures, Capt. Hamilton stated there were none. The FCTM generalized that with short runways and contamination one should use flaps 40. The use of manual versus auto brakes was a function of weight, runway condition, crew experience, length, etc. He stated that if he was flying to LGA and the runway was dry he would not use max auto brakes, but might use med or none. Asked if he might use manual in ATL he said yes, depending on weight and runway length, crew experience and runway condition.

Asked if there was a runway contaminant limitation for Delta he said if the braking action was nil you could not land at any airport. He asked to refer to the chart in the Airway manual and said that one would not land with standing water, slush, of wet snow in excess of 1 inch. Do not land in dry snow in excess of 4 inches. He was asked what the procedure was if the auto spoilers did not deploy. He said that he prebriefed the copilot to reach around and pull the spoilers out, that if you did not pull up, aft, up they would release. He said that if they released the auto brakes would not work. Asked if a light would then come on saying the auto brakes were not working he said he did not know.

Asked if there was a 15% safety margin in the Operational Landing Distance chart, Capt Hamilton said there was. He was asked if there was guidance for starting the APU when landing on a snowy runway and he said he did not know. He was asked whether if giving a line check in this scenario and the crew did not have the APU running he would make that a debrief item and he said no. Asked about the approach call outs, Capt Hamilton said they were "1,000", "500" approaching minimums, minimums, and runway in sight. He said that standardization was important. Extra calls were okay and even advisable in a difficult situation. About rudder blanking he said there was a caution in the FCTM that was verbatim from the Boeing FCOM and that reducing reverse up to and including stowing the reversers was the procedure. Asked whether after completing the evacuation checklist an evacuation was required, Capt Hamilton said the checklist should be executed to be prepared and that the situation should then be evaluated.

Asked about the approach callouts, and whether a captain might call approach lights in sight and continue until the runway was in sight, he said yes.

Asked about runway braking action reports of fair and good, Capt Hamilton said the most recent report should be used. 1.3 EPR was the recommended reverse thrust but more, up to max could be used. Asked if during the Cancun event the aircraft had yawed or done a "lateral" slide, Capt Hamilton said he did not know. He also stated that the APU was used for a backup power source when conducting CATII /III approaches.

This concluded the interview.

4.0 Interview: David McFadden Short, Delta Fleet Captain MD88

Represented by:	**Jon Peter Kelly, Delta Legal Dept.**
Date and Time:	**March 9, 2015, 1430 EDT**
Location:	**Delta Air Lines Headquarters, Atlanta, Georgia**
Present:	**Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steve Acalin, Delta Airlines; Brian Teske, Air Line Pilots Association; James Brocksmith, Boeing**

During the interview, Captain Short stated the following:

He was 55 years of age. He was the Fleet Captain for the MD88/90 and the 717 aircraft. He had been in this position since July of 2013. Before that he was an aircrew program designee (APD) on the A320 training program and an A320 pilot. Previously he was an APD on the MD88. He had also flown the MD88, MD90, DC9, and 727 as a First Officer.

Captain Short's date of hire at Delta was June of 1989.

Captain Short was asked to describe what his duties entailed as Fleet Captain. He said that as Fleet Captain he oversaw the simulator training as a primary function. He mentioned that

Captain Hamilton had a similar function in that he was "standards" for line flying. Captain Short stated his role was similar in that he was "standards" for simulator training.

He continued to discuss that the position of Fleet captain oversees the curriculum for both fleets with the aid of his APD team. His position approved manual revisions as well. Captain Short sat on the TMG and JTS boards and oversaw roughly 130 simulator instructors, 2 fleet managers, and tech managers who interacted with the technical operations center (TOC) on aircraft technical issues. Captain Short was also involved in discipline boards for new hires who were struggling with training and became involved in watching over the pilots and how they progressed with any training they needed to succeed.

Asked whether there were any elements of the training curriculum that addressed contaminated runways and landing performance, he said initial students were introduced to the different manuals in the 100 series. In the 200 series they are provided with different performance problems that ended with an evaluation in procedure validation (PV) during session 241. This grouping of training events contained six 200 series training hops followed by a 241 evaluation where initial pilots were given performance problems in which they had to use the ODM to figure out landing distances.

This was supplemented later by a 402 session that focused on contaminated runways and cold weather operations. The pilots were trained on an ATL – MEM leg. Enroute to MEM they are informed of runway contamination. The crews were expected to employ all the manuals and CRM to come up with a plan. They were to fly a circling maneuver ultimately landing on 18R. They were told braking action was poor while the instructor put in NIL into the sim setup. The Captain landed first using the different procedures they were taught on rudder, braking, and reverse. After the Captain finished, the crew was debriefed and then they returned to the sim for the FO to complete the same.

The pilots were referred to VOL 1 supplemental procedures chapter that contained an expanded section on aircraft handling, max allowable crosswind for type of contaminations and that type of thing. That was given during the last week of training and was a pretty big event for the students. Captain Short mentioned that initial pilots were using the manuals during the 200 series for performance problems and utilizing the charts.

The 400 series actually went into more detail by doing cold weather ops, deice, culminating in the MEM trip with the "poor" (actually NIL) braking. There was also GO/NO GO training for rejected takeoff to hammer home how systems worked with autobrakes, autospolier, contaminated runway, rudder blanking, and things like that.

Captain Short commented that the initial training was completed in 4 sections. He continued with the following:

100 – Precursor to the electronic oral. Talked about systems with an instructor, and then took the oral.

200 – Was completed in a non-motion FTD that allowed for flows, switchology, procedures, approaches, and missed approaches practice that culminated in a 241 procedure validation. There was a performance problem at the beginning of 241.
300 – Was the stick and rudder series, which included V1 cuts, windshear, crosswind landings, rejected takeoffs, and that kind of thing. This would culminate in a maneuvers validation (34X)
400 – Flown as "block to block" flights. Students would start at a gate with all the paperwork for the flight. It was a LOFT, preflight check, flows, and checklist, and CRM, which culminated in a LOE. There were certain distractors in that the student pilots were given a non-normal that have to deal with and they had to formulate a plan, execute that plan, and then land the aircraft. This was an FAA checkride while a maneuvers validation was a checkride for Delta. The PV (44X) was not a traditional checkride.

Captain Short was asked about the evaluation on the continuing qualification (CQ). He commented that the CQ was a 9-month cycle. It took them about 6 months to build one using inputs from the TEG, JTS, Line Check and evaluator input. He had a team of 5 SMEs draft it then it went through various reviews to make sure it responded to topical issues.

Captain Short said that he had pulled up what Delta had done over the last few years on contaminated runways training. Starting with the cycle that ended Sept 2014, they had done contaminated runway landing computations in the briefing room using the ODM landing distance charts. They also reviewed in the briefing room different things about landing with contamination on runways in the FCTM and the VOL 1. That was the last 9-month cycle.

The previous cycle from Apr 2013 thru Dec 2013 included a series of GO/NO GO decision training scenarios on contaminated runways. They also included landing on contaminated runway where the instructor failed a reverser and an auto spoiler. That was called a SPOT – special procedural operational training. The pilots were briefed so it was not a surprise what they were getting down in the box where they flew the procedures.

Prior to that in July 2012- March 2013, they had a SPOT that reproduced the Cancun issue where a Delta MD88 exited a non-grooved runway, came back on the runway. The main issue was hydroplaning and some other issues. To train, we used Charlotte, where at the time, 18C was not grooved. We also made it an emphasis item for all of the pilots going through recurrent to recommit the 10-9A page looking at usable length and whether it was grooved. To simulate the conditions, while on approach into Charlotte the sim instructor again failed one of the reversers to induce directional issues. Both pilots had an opportunity to fly it.

That was a listing of 3 x 9-month cycles. Landing on contaminated runways was a big issue for some time.

Captain Short was asked about Rudder blanking and what they were able to demonstrate or train in a simulator, and he said they had to introduce something else to get some sort of directional control issues going. The sim instructors could put in a crosswind, but he could not say with confidence that they could reproduce rudder blanking without something else in the mix to get loss of directional control going first. The simulator fidelity did not support realistic reproduction of blanking.

Captain Short said information about rudder blanking was found in VOL 1 and the pilot manual. The instructors did not want to do negative training, but the key to get directional control going was to neutralize to idle and get control back. That was the main teaching focus.

Captain Short was asked how crews were trained with respect to max reverse limit and he said that Delta recently did a comprehensive rewrite of Flight Crew Training Manual (FCTM) to make it better. The manuals talked about targeting 1.6 EPR on a dry runway on the MD88 and 1.3 EPR on a contaminated runway. That was an emphasis item in their briefings and in the revision highlights.

He was asked they helped pilots understand how to go to 1.3 EPR reverse without a detent. He said they trained them in the initial application to wait until the nose was trending downward. As they pulled the reversers out they did not want to yank them out but rather do so uniformly while watching what they were doing on the N1s in case they split. Pilots had to be careful to pull them out symmetrically, and they pointed that out in training.

Captain Short was asked who was observing to ensure that there was no exceeding of the EPR limit. He responded that the pilot flying was responsible for directional control and he was watching. The person pulling them out should look but both should be looking.

Captain Short was asked if there was a callout for deviation or excessive application of reverse thrust and he responded that there was no specific callout but it was the duty of PM to speak clearly to what he saw.

He was asked to describe the threat of high EPR in reverse on a contaminated runway. He said that if one had a crosswind, as discussed in the FCTM, the tail could start exiting toward the side. If the reversers were too high, a pilot could get a whiteout situation and also could have directional control issues. The procedure to regain directional control was to bring the throttles back to idle reverse as referenced in the Volume 1 and FCTM.

Captain Short was asked to look at the chart 16.13 in the VOL 1; he was asked what the recommended guideline was for crosswind speed with fair braking. He answered that the crosswind guideline was degraded from 30 to 20 knots. He was asked again whether, if ATC was telling them fair braking, they could land in 20 knots and be within the guidelines. He answered that was correct. Captain Short commented that 16.13 had recently changed.

Captain Short was asked the source of the chart. He did not know but speculated that the manufacturer of the aircraft had provided it. He could not tell how long Delta had used it but it was a long time.

Captain Short was asked if the simulators had been updated for realistic modeling of wind gusts on ground. He answered that Delta's sims were a little older. They have thunderstorm capability and windshear. For training gusts on the ground they relied on instructors to introduce the winds. He was asked if the instructor could actually introduce a crosswind and he said it was possible but he did not know.

Captain Short was asked how he felt about landing on a snowy runway with the APU on the bus. He answered that the Delta books had a recommendation to do so. He also commented that Delta pilots would also use the APU during an autoland and that it was a requirement. Captain Short also suggested that he thought it was a good idea to do so and back in the day that it was routine to discuss using the APU. He did not know if Douglas required it today but Delta did not do so. He believed most instructors would recommend using the APU for low visibility approaches and that it would be recommended for autoland also. He thought a discussion about the use of the APU was contained in the FCTM or, if not, in Volume 1 supplemental.

Captain Short was asked about the recovery from rudder blanking scenario and how far to reduce reverse thrust in order to recover from a loss of directional control. He responded that that was 2 questions. He answered the first question by saying Delta trained pilots not to close the reversers because the clamshells would close and that it would take several seconds to get them back. They trained pilots to take the reverse thrust to idle and then they could use it again if necessary. Captain Short was asked if pilots were taught to close the reversers if needed and whether that had ever been discussed with their pilots and he answered not to his knowledge.

He was asked if he knew what the wind component was that was used during the 402 series sequence for the contaminated runway. He answered that the wind was 270 at 10, which was a direct crosswind.

Captain Short was asked if there was a max reverse EPR limit. He answered no. "EPR is for engines, N1 is for pilots."

Asked what effect a "knob width" was when setting reverse thrust. He responded that adding a knob width of throttle would take you right to about reverse idle. Pilots were taught to wait until the nose was trending down.

Asked whether pilots were taught to raise and then add one knob-width for reverse idle, Captain Short answered that that would be in the ballpark. Other aircraft had detents. This one was much more reliant on the crew to monitor. It was common for one to come out quicker than the other and crews had to be careful about that and catch it because they did not want that scenario to happen.

Captain Short was asked if this technique was taught or merely depended on the pilot. He said that the main thing they taught was to not yank them out because they were not going to a detent. He believed that line check airmen would teach pilots to use a slow initial application of reverse and then be judicious as they pulled them out further.

Asked to clarify whether rudder blanking occurred in Cancun, Captain Short said he did not know.

Captain Short was asked if the DAG and/or TEG monitored reverse thrust for EPR boosting exceeding 1.6 or 1.3. He answered that that would be in the FOQA data and he was not aware of that.

Captain Short was asked if Delta ever put out any bulletins on conserving fuel by not running the APU airborne. He answered no, not that he was aware of.

Asked if he had received feedback from line pilots about the standardization changes that were made, Captain Short answered that he thought it was positive. He commented that Delta took their input very seriously. Any line pilot could make a pubs change request which was taken to a standards meeting and discussed. He had never seen one dismissed summarily and thought that there was a pretty good feeling of involvement from the line pilots.

Asked if there was a history of failure of auto spoiler deployment, Captain Short answered yes. It had been historically one of their big things back to when he was an FO. They trained the interlinking between auto spoilers and autobrakes and for, RTO, between reversers, auto spoilers, and autobrakes. When they had emphasis items they would build a SPOT around that. An example was go/no-go training. They almost always put in an auto spoiler that had failed and required the pilots to do something.

In 2013 the focus was on Go/No-go with reverser and auto spoiler issues.

Asked about the interlinking of auto spoiler, Captain Short answered that if autobrake were armed and the speedbrake handle was manually pulled back, the autobrakes would engage. However, if the handle were put forward they would not get an autobrake fail light. The autobrakes worked through main wheel spin up and nose wheel compression.

Captain Short was asked if he had ever seen asymmetric auto braking due to ice on one side of the runway. He answered no, not without anti-skid failure indications. They had had differential brake failure scenarios, but he was not sure exactly. He could probably dig up some information at the TOC.

Asked what training was provided with regard to interpreting Mu versus PIREPS for braking action, he said there was a conversion in the chart that was listed in Airway Manual, 4WX.2.5.

Asked if there was a max snow cover on the runway that crews were not supposed to land on, he answered that yes, wet snow is 1", dry 4". That was covered in the Volume 1, Supplemental Procedures 16. Asked whether pilots were exposed to that in training, he said yes, it was part of the cold weather package which was contained in session 402 or CQ, during contaminated runway training.

Captain Short was asked how he would feel about receiving real-time braking action reports from the aircraft directly in front of his aircraft via ACARS. He answered yes, that would be pretty cool but would want to know what kind of aircraft it was.

This concluded the interview.

5.0 Interviewee: **Mark Steven Carroll, Delta General Manager, Flight Safety Programs**
Represented by: **Thomas Tobin**
Date and Time: **March 10, 2015, 1000 EDT**
Location: **Delta Air Lines Offices, Atlanta, Georgia**
Present: **Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steve Acalin, Delta Air Lines; Brian Teske, Air Line Pilots Association; James Brocksmith, Boeing**

During the interview Mr. Carroll stated the following:

He stated that he was the General Manager, Flight Safety Programs and had been in that position since December of 2014. He was hired by Northwest Airlines in October 2005 following an internship that began in May of that year. While attending Ohio State University as an aviation engineering student he received his commercial multiengine instrument ratings. In May of 2005 he began as an intern in the flight safety department of Northwest Airlines. As a result of this internship he decided not to pursue flying as a line pilot as a career. He was hired in October 2005 as a Flight Operational Quality Assurance (FOQA) analyst full time, where he spent approximately 2 years in that position. He was promoted to air safety investigator, where he spent a couple years doing traditional investigative work. Prior to the merger he was promoted to manager of flight safety. Through the merger and reorganization process he took on a program manager role at Delta Air Lines for 2 years, then moved over and managed the FOQA program until last fall. In December of 2014 he was promoted to GM for flight safety programs. During his tenure at Northwest Airlines he received a DC9 type rating. He has attended numerous NTSB courses, ALPA courses through AI 1, 2, and 3 in safety school. This included much of the traditional training and background.

His flight experience totaled about 300 hours, mostly limited to a Cessna 172, and he flew a Duchess for a while obtaining the Multi-Engine instrument rating. While at Northwest (NWA) he was checked out on the DC9. However, he never flew it operationally or flew it as a line pilot.

He shared that his responsibilities included oversight of the Delta voluntary safety programs. At Delta he managed the Aviation Safety Action Program (ASAP). He also shared that the flight safety manager had oversight responsibility of pilot, dispatchers and the load planners ASAP program. He shared that his department did not oversee the Flight Attendants or the Mechanics, those were managed through their respective divisions. He also managed the Delta FOQA program, safety investigation program, special winter ops airport (SWOA) program and line safety coordination (LSC) program.

He shared that Delta had had an ASAP program in place for approximately 15 years beginning in or around 2000. He was asked how Delta had reviewed those reports. He answered that they were submitted electronically and funneled to the ASAP team. The ASAP team was responsible for the initial coding and processing. They would review the report, making sure identified info was taken out of the text and that the appropriate boxes were checked and a risk rating assigned.

They would then initiate action for follow-up and would decide if they would need to take it further.

When asked about the manager of the ASAP team and their responsibilities he answered that her responsibilities included pilot, dispatcher and load plan programs. The manager of the ASAP program reported directly to Mr. Carroll. Within that organization Delta employed a program manager that managed the load planner and dispatch program for the ASAP manager. Delta employed one specialist for coding the ASAP reports.

When asked if Delta had an Event Review Committee (ERC) he responded that they were a little bit further down the chain. He continued by stating that after the reports had come in and were evaluated, they were passed along to the ERC which was composed of one FAA representative, one representative from ALPA, and a representative from the company. The ERC was the group that decided how to handle the events.

He shared that the FOQA program had started in 1999, and was stood up in the late 1990s. The program was stood up with ALPA and Memorandums of understanding (MOUs). Along with himself, the Delta FOQA team was comprised of 2 specialists, 8 ALPA gatekeepers, and 7 FOQA fleet representatives. The gatekeepers were there, appointed by MEC, keepers of the identified portion because FOQA was de-identified. They did an analysis as well. Fleet representatives came from flight operations and were comprised of line pilots, instructors, simulator instructors, and Line Check Airmen (LCAs). Each FOQA fleet had a fleet representative designated to them. They knew the data, the airplane, routes, and aircraft systems. They were his group's liaison between safety and flight operations. They also had a technical operations representative on the FOQA monitoring team (FMT). To ensure that the recorders were recording the data frames, and that the associated projects were shared with tech ops. He also shared that they had put in place a FOQA data users program. Individuals within the FOQA Management Team were granted access to look at things relevant to their world. They had approached tech services and performance engineering had a representative with direct access for about a year. They were studying the addition of fuel services.

He shared about the safety investigation program. Delta was working to fill a manager of investigations position that had two additional investigators on their staff. They served as safety's on-call representatives, 24 hours, 7 days. They were responsible for monitoring event notifications and NTSB reporting. They were also responsible for getting those initial facts and figures, running the investigation as a point of contact (POC) for Delta. They were the ones that did our NTSB investigations and any high risk events at Delta. They interviewed, wrote reports and issued recommendations. They also coordinated investigation functions. Delta had 3 investigators and another in training.

Another responsibility he shared was that of the SWOA program – a pre-merger Northwest Airline program launched in 2004. The program was designed to identify higher risk airports in the operation. Northern-tier snow belt airports that were deemed higher risk were in the program. They had a matrix to identify them that looked at things like airport elevation, runway length, runway friction measurement, and whether they had vertical guidance. Airports were assigned point values to each of 9 criteria. If the threshold was exceeded, they were designated as SWOA.

If designated, a letter from the senior VP went to the airport director and Delta station manager. Once that occurred, there were certain restrictions placed on their pilot group for landing and taking off. The matrix was in their airway manual and dispatch manual. Pilot and dispatcher were jointly responsible to comply. He shared that the focus was on working with the airport and an established cooperative effort, developing relationships, and working with them on their snow plan to get better information from the airport. Timely accurate information on weather conditions was the name of the game.

There were many incidents that occurred during the winter. Throughout the process, having received accurate information was something they wanted to improve. This was one way to for the company to obtain information and take a proactive stance and work with them directly. The SWOA airports were visited a minimum of every other year where they sat down with the airport and station personnel. They performed in depth review of the snow plan and processes. They even got out in the trucks and were shown around the airport. They examined runway equipment, staffing, communication protocols to crews, and the flight operation center. They had experienced good success with the program. They had maintained the program throughout the merger and extended it to include all of the Delta regional partners (widget carriers). Each airplane was a little different. Different requirements had been based on each airplane, but Delta was responsible. They identified the airports and rolled those out to the connection carriers.

Asked whether LaGuardia was on the SWOA list, he said no. Asked what criteria an airport would have to meet to be put on the SWOA he responded that runway length, airport elevation, and what type of deceleration friction measuring equipment they used. Tapley was placed in a truck whereas continuous friction measuring equipment (CFME) actually measured friction directly on the runway surface. He shared that the Tapley provided a lower score because there was a high level of subjectivity to Tapley. The CFME was more accurate, less risk. Some other criteria included vertical guidance, ILS, PAPI, or VASI. Incident history was another point criterion. When an incident was "owned" by the airport rather than a flight crew, there were points assigned for that. If the braking report was way off, then that would be more on the airport and they would get the associated point value.
He was asked if Tapley and CFME values were reported as Mu. He responded that they were, but they also looked at the type of equipment and level of confidence.

He was asked whether if an airport only offered PIREPs to indicate braking action whether that was one of the criteria. He shared that that had not been included in the matrix. The value was only in how the information was disseminated to pilots. Having only PIREPS available was not a criterion for designating an airport as a SWOA airport, but that aspect was evaluated after an airport was so designated.

There was a decision guide for pilots and dispatchers to run via a flowchart for SWOA. They needed to have timely field condition reports. If the braking action was less than good or mu<40, they had to continue down through the matrix. Any time snow or ice had fallen or accumulated on the runway it was another factor in the matrix. If conditions were clear blue and 70 degrees, they did not expect to use the matrix.

When asked about the number of airports in the SWOA. He answered there were about 36 for mainline and affiliated regional carriers combined. Subsets of those were mainline only. The SWOA airports changed every year, every season. He was asked about any new policies on the crew side about reporting braking action. He responded that he was not familiar with any new policy.

Asked bout the LSC, he said that the team was comprised of 12 line pilots. The team was not based in Atlanta. Pilots had part time work with the LSC and worked at their local base. Their function was to support flight safety in their mission out at the bases. There was one at Los Angeles, one in Salt Lake City, one in Seattle, one in Minneapolis, two in Detroit, two in Atlanta, one in Cincinnati, one in JFK, and one was planned for LaGuardia. That had been posted about 2 months ago. Their function was to work with the Chief Pilot, flight safety and line pilots. They were advocates for flight safety out on the line. They did projects for the Chief Pilots office for flight safety. In the base they met with ATC, attended RSATs, and worked with deice and ground crews. They were the safety representative on the ground at each of those bases. They would do follow-up work, work with ASAP reports, and work with the TRACON and the tower. Representatives were at each base for a variety of safety related functions.

Asked about the staffing figures for the flight safety office, he said full time in flight safety were the Director of Safety, Bill Klein; Mark Carroll; two in FOQA; three in ASAP; and three investigators. There were 10 total. Out one layer from that there were 12 LSCs, 7 FOQA fleet reps, 8 FOQA gatekeepers, 11 flight ops ERC personnel and 9 ALPA ERC personnel.

He was asked if ASAP was working any issues with LaGuardia and winter weather. He said there were no active open investigations with LaGuardia on winter ops. He said there would be, following the accident.

He was asked where the department of safety was located in the corporate hierarchy. He said that he reported to Captain Klein who in turn reported to John Laughter, Senior VP of Safety, Security and Compliance, our director of safety on our certificate. John reported to Gil West, our COO, who reported to the CEO.

When asked about their FAA SMS levels – He said they were level 4. They had an active program, but he was not the SMS expert. Safety participated through their voluntary safety programs, but SMS with Delta was managed through Jason Ragogna as of December 2014, under Kurt Thornburgh (VP of corporate compliance), who reported to John Laughter. Corporate safety managed SMS for the company, but within each division they had their own manager, one in flight ops and one in airport customer service (ACS). They had a roundtable for each division – cargo, ops, in-flight, etc. Each managed their own SMS. Corporate was responsible for bringing all the divisions together. They were a participant and supplied a lot of data from the voluntary safety programs.

He was asked whether the company had a fatigue risk management system (FRMS). He said yes, Captain Jim Mangie managed it in flight operations. He was asked if he had interfaced with that at all. He said that it was managed through Jim. Their participation was to supply reports, anything related to fatigue. There was an investigative process.

He was asked about the SPOT emphasis areas and whether he had any role in working on those. He said that his group had not developed or put together SPOT training, but they fed ideas and recommendations based on what they saw in the voluntary programs as highlighted concerns.

He was asked about any active investigations that involved rudder blanking, autobrakes not engaging or autospoilers not deploying and he said no.

He was asked about the LOSA program. He said that the program was managed through flight ops in Quality Assurance (QA) under Chuck Schramek's group. The safety department participated. Some of the flight safety team members had been LOSA observers in years past. Captain Klein was on the group and participated in reviewing all the reports and putting out the data.

Asked if they had a safety manual, he said they had a lot of manuals. He added that they had operating procedures for the programs.

He was asked what safety issues the safety department had tracked in the last couple years, and whether they had any special emphasis safety issues. He listed wind shear recovery, pilot monitoring, and takeoff configuration warnings due to spoiler handle out of detent on one particular fleet. There many others, including unstable approaches. He was asked if multiple data sources were used to evaluate them. He said yes, they pulled together investigations, ASAP, FOQA. He added that they have a DAG, which was co-chaired by Bill Klein and Chuck Schramek. They blended what they saw in safety, line checks, and the simulator, so if they saw one issue pop up, then they looked across the other programs. The DAG and then the safety review teams (SRTs) performed reviews with flight ops and other divisions.

Asked whether any of their voluntary programs had shown any threats related to contaminated runways, he said yes they had. He was asked how he knew. He responded that he knew mainly through the dispatch ASAP program. They had highlighted it. They expressed concern about getting timely information from the airport. They could see that snow was falling but they did not see any field condition reports (FICONs) from the airport. Sometimes that could be a challenge. SWOA had identified some airports that were higher risk. Not necessarily field conditions, but there were maybe some airports that could have done better.

Asked if there had been any reason up until the present time to examine the airport snow plan at LGA, he said no. Asked if he knew why LGA did not use runway condition measuring equipment, he said he did not know. From previous conversations with airports, he suspected it might have been a question of liability. They would say it was not required. If they provided non-required information it might put them at risk. He did not agree with that, but that was the feedback he had received during airport visits.

A couple of years ago the TALPA ARC looked at runway assessments. Mr. Carroll was not a participant, but airports had some reluctance to provide that information because it was not required. He did not have any experience speaking directly to LGA on this; he had just heard this system wide.

He was asked if LGA came up on the safety radar for non-compliance with any safety issues. He said that they had come up in terms of some of the arrivals they used, VOR approaches. There were some challenging approaches there. Unstable approach rates were above average there. They had some challenging airspace.

He was asked if any threats or issues with the airport itself had been identified and he said, no.

Asked if any of their safety data analysis indicated any challenges involving directional control, he said they had had historical incidents in years past on the MD88. Events had occurred in St. Louis and Cancun. Those would be going back a few years where aircraft went off the side of the runway but they came back on the runway in those cases.

He was asked about pilot procedural compliance issues and if any steps had been taken on that. He said that, in general, flight ops was responsible for that, but there was lots of training conducted. They did SPOT training and shared the information. They shared with the pilot group the why behind the changes. They published newsletters, bulletins, articles, and were constantly looking at their procedures in general. He said they were looking at a new group – the flight path monitoring group and how they could improve. Asked what processes were in place and steps were being taken, he said they had reached out to their human factors experts to take a deeper look into compliance. He said they were in the process of standing up the team. It was a small team designated through safety and flight ops. Everything from new hires to experienced APD safety representatives to human factors. They would look from A-Z at callouts, procedures, anything they could do better in pilot monitoring.

Asked if LGA, JFK, or EWR were ever on the SWOA list, he responded no. He was asked if there were active safety investigations in the company for MD-88 fleet. He said there were many. He was asked how many investigations are there. He said there were 50 or 60, system-wide.

Asked about the last Line Operations Safety Assessment (LOSA), he said they are currently in the process of a LOSA. It may have just closed. He stated that he would attend a data review board next month. The previous LOSA was completed two years ago. It was fleet wide.
Asked to list the top findings during the previous LOSA and to explain whether SOP adherence was included in the last LOSA findings, he said he did not recall, but he thought they included predeparture tasks and taxi out. They would have to ask Mr. Schramek. Asked if he could share any preliminary data on current LOSA, he said he had not seen any data yet and that they were still compiling data.

Asked what point value would be assigned to LGA as a result of the short runways and zero braking effectiveness measuring equipment, he said he did not recall. He was questioning information they had previously received about the airport's use of a decelerometer. He had learned that on the day of the accident from safety department staff, they did not go out and do a reading and they had not been providing values. That was not what he had been expecting.

Asked who the dispatchers called to get runway braking information, where those people got it and how accurate and timely it was, he said usually the dispatchers would call the ops center at the airport. If it was a hub, the ops center would have 2 or three people, but a station might get it from the airport web site, a fax from the airport, or the NOTAMs system. Each airport had its own process. ACS was uploading it into the Delta system that could be viewed by operations center (OCC) personnel. That process had a lot of manual components. Some of the technology the airports had allowed field condition reports to be sent automatically from the trucks, some they had to drive back to the station, put it in their own template, and give it to someone else to communicate to the operators and it could be slow and manual.

Asked if there was any information he would like to provide that might be relevant to the accident that he had not been asked about, he said from his perspective, he was very happy that NTSB would stand up an airport ops group. That was vital. In his past, field condition reports were an issue that had come up. It varied in emphasis. There was a lot we could do because timely accurate field reports were key. Relying on PIREPs was archaic. It seemed crazy that one would send an airplane in as a guinea pig and see how it went. One thing he had noticed in a lot of snow plans was that by the time the trigger was reached to go in and remove snow, "you've lost the game." That would be his recommendation, to focus on the timeliness of information flow to the captains and FOs, the end users.

He said that the Airways Manual had a decision guide. Each airport in the green page had a remark. The flightcrew and dispatch would look at it before takeoff and landing. They were called Green Pages – the Airline 10-7 pages.

This concluded the interview.

6.0 Interviewee: Christopher A. Lamm, Delta MD88 First Officer

Represented by:	**Thomas Tobin**
Date and Time:	**March 10, 2015, 1345 EDT**
Location:	**Delta Air Lines Offices, Atlanta, Georgia**
Present:	**Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steve Acalin, Delta Air Lines; Brian Teske, Air Line Pilots Association; James Brocksmith, Boeing**

During the interview, FO Lamm stated:

He was 49 years old and had been an instructor for 4.5 years and an aircrew program designee (APD) for just under a year and proficiency check pilot (PCP) for 2.5 years. He was also a seniority list instructor (SLI). FO Lamm has been on the MD88 for 10 years and his date of hire was 23Mar2000.

Prior flight experience included the Navy P3 for 11 years with 9 years flying. He also had 12 years in the reserves of which 5 years were flying.

FO Lamm gave the accident First Officer Phillips a PCP Mod 642 on his second day of his recurrent training on 11Jan2015. Asked about the level of performance of the accident FO, FO Lamm said he did not really remember who FO Phillips was. FO Lamm did have FO Phillips' name written down but when he looked him up in his book, he didn't have any recollection of who he was.

FO Lamm does anywhere from 18 to 22 events per month for 9 months per year. On the other three months, he was out flying the line.

When asked about the summary of maneuvers on that date, FO Lamm said FOs do normal takeoff, a VOR/DME 32 into Jacksonville, a V1 cut, a single-engine approach to a missed approach. This was contained in the 642Z module. The event included SIC removal which involved a special right seat aborted takeoff and subsequent taxi. A revised ATP certificate was issued with SIC removal. The accident FO came to the event with DC9 SIC only and when he left he had an unrestricted type rating. When asked if this scenario involved contaminated runways, he said not on this event. When asked if any maneuvers involved the effects of high levels of reverse thrust during landing. FO Lamm answered no; there is a regular landing at the end of the VOR/DME 32 approach into Jacksonville.

When asked who is responsible for the spoilers to deploy, FO Lamm answered they would auto deploy. FO Lamm stated that the FO was evaluated during a rejected takeoff (RTO) and that the captain was responsible. The FO was evaluated during that RTO and an ILS CAT II approach with callouts he was required to make, but nothing specific with regard to excessive reverse thrust. Asked who was responsible for deploying the spoilers during an RTO, FO Lamm answered they were armed to automatically deploy, but the book said the captain must ensure that they deployed. Asked who was responsible for the spoiler deployment if they failed to automatically deploy on landing and it had to be done manually, he said he was not sure; he would have to look to see if it was specified.

When asked if FO Lamm ever conducted a training scenario involving Cancun, he said yes but it wasn't in Cancun, they did one in Charlotte and one in Atlanta.

Asked in general, what was involved in the contaminated runway training, he stated that that had been several cycles ago, and he would have to look in the instructor guide for specifics on what all the conditions were.

When asked whether there was presently or recently any emphasis in training on pilot proficiency in managing contaminated runways, he said yes.

When asked for an example of an event, he said that in the initial qualification syllabus module-402, they landed in Memphis on a contaminated runway in cold weather operations, winds 270/10, and a direct 10-kt crosswind where you had to look up braking tables. FO Lamm stated poor or fair braking action was set up and this was in the initial qualification syllabus that had been used for the last 4.5 years or at least in his tenure in his department. He stated several cycles ago he did an event with contaminated runways during day 1 of recurrent. More recently, he did

mostly day 2 of recurrent since he became an evaluator. He typically did more of those than day 1 events but did not recall specifics.

When asked if any training dealt with not using excess reverse thrust during initial qualification training, he said it was in the manuals and he thought it was covered in the 300 series.

When asked during training and checking events if he did ask a trainee to do a landing on a contaminated runway, and what sort of reverse EPR he expected them to use, he said he would expect the target to be 1.3 EPR or less, 1.6 on a dry runway and that was in the FCTM. When asked if they did that recently in training events, he said we do landings.

Asked what his critique would be if a pilot exceeded 1.3 EPR, he said he would discuss with them that exceeding 1.3 could cause directional control problems and that if that did happen, the proper procedure was to bring the reverse thrust to reverse idle, regain directional control, and re-engage the reversers.

When asked how he would characterize FO Phillips' performance compared to other first officers, he said he did not recall, and would not know if he would even recognize him.

Asked what technique was used to set the EPRs in reverse thrust, he said that after touchdown, when the nose wheel was starting to come down, they were to initiate reverse and once the nose wheel had touched down, they could engage reverse past idle. It was developing a feel for where to bring those two because there was not a detent.

Asked if there was much variability in what EPR one got for a given lever position, he said it could be and it would vary from aircraft to aircraft.

Asked how he taught pilot about lack of wheel spin up and no spoiler deployment on contaminated runways, he said he did not recall that on any of the modules he taught but he did not do systems instruction.

Asked what would happen if an exceedance were noticed on landing, he said to reduce reverse thrust because there would be a potential to cause directional control problems. He further stated that one would then be able to regain directional control and then resume reverse thrust.

When asked if he had ever seen notes about bringing the reversers to forward idle, he said that was what he was talking about. Asked if he was saying forward idle, he said he did not recall that, but would have to review the manual.

Asked whether as a simulator instructor, he could introduce gusts in the sim by introducing it on landing, he said they typically had not done that. He did not know how the sim would perform; it was pretty complex. He did not know for sure if they could introduce gusts on landing.

Asked do if he typically used steady state winds, he said typically yes.

Asked whether they failed autospoilers or autobrakes when they had FOs perform an RTO from right seat, he said they just performed a normal RTO.

Asked whether he had ever seen a trainee experience an EPR exceedance in the simulator, he said he did not recall seeing one in the simulator. Asked if he had ever seen one on the actual airplane, he said he had possibly seen an exceedance of 1.6 EPR.

When asked if he had ever personally experienced a loss of directional control due to suspected rudder blanking, he said no.

Asked if he had ever seen in training or on the line, reverse thrust get to 2.0 EPR, he said not that he recalled.

When asked if there was anything he had not been asked about that could be relevant to the accident, he said no.

This concluded the interview.

7.0 Interviewee: Alan Todd Nacke, Delta MD88 Captain

Represented by:	**Thomas Tobin, Wilson Elser**
Date and Time:	**March 11, 2015, 1000 EDT**
Location:	**Delta Air Lines Headquarters, Atlanta, Georgia**
Present:	**Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA: Steven Acalin, Delta; Brian Teske, ALPA, James Brocksmith, Boeing**

During the interview, Captain Nacke stated the following:

He was 63 years of age and was an MD88 captain at Delta. He had no other duties at Delta. He had been in his current position for seven years, and he was hired at Delta in October of 1997. He had flown the T38, F15 and F5 during his 25 year Air Force career, but he did not recall his total flight time or MD88 flight time.

He had flown with the accident FO more than once. He had most recently flown one flight leg with him from Pensacola (PNS) to ATL two days before the accident. The weather on the flight was good and the flight was uneventful. The flight took off south from PNS and made a left turn and arrived on runway 10 in ATL. There was a Delta captain on their jumpseat. The FO made a great landing. His standards and airspeed control were good during his visual approach to landing. The FO had picked up the trip as a "green slip" trip. The captain made a remark that the FO got double pay for a doubly good landing. The FO was a "super guy" who the captain had flown with before, but the captain did not remember exactly when that was.

The captain stated the FO's ability to interact with him was very good and he was obviously very comfortable in what he was doing and was very capable. He used reverse thrust on landing and was "pretty much right on the money." The captain felt the FO was better than he was at

managing reverse thrust. He was supposed to hit 1.6 EPR. The runway was dry and they did not use autobrakes.

The captain was asked to clarify his flight experience. He stated he flew less than 300 hours in the right seat of the MD88 but had spent 8 years over all on the MD88.

Asked if he had ever experienced rudder blanking in the MD88, he said no. He had not experienced a failure of the auto spoilers to deploy, although on a nice landing he found he might have to "help" them. On contaminated runways pilots were usually aware of conditions and wanted to set it down. He had not experienced asymmetric braking.

Shown the LGA 10-9 airport diagram page, he was asked what taxiway he normally exited on when landing on runway 13. He stated it was usually "M" or "V". He stated that the tower often asked them either to get off the runway quickly or to roll to the end.

Asked to describe his mindset and technique for landing on contaminated runways, he said he would get it down on speed and land firmly to get braking started. He would brief the FO to make sure the auto spoilers deployed and if they did not, to manually deploy them. He had no problem using MAX autobrakes at airports like DCA or LGA even if the runway were just damp. He stated once the brakes "bite" they could back the autobrake switch off to medium setting or less, and this was selected by the PM after braking had begun.

Regarding the use of reverse thrust on a contaminated runway, he wanted to get it in right away, shooting for the target EPR quickly, depending on how slippery the runway was. He had found the thrust reversers always worked. He used idle reverse rather than coming out of reverse so that if he needed it to stop at the end of the runway he could. Asked the target EPR for contaminated runway landings, he stated it was 1.6 EPR.

Regarding starting the APU prior to landing on a contaminated runway, he stated he used the APU more for approaches as backup electrical power (if he lost a generator) rather than for contaminated runways. If the weather was bad and visibility was low he would start the APU for the approach.

He had never had a problem with braking action reports at LGA. He saw questionable calls elsewhere, such as at Syracuse or Rochester. Sometimes there was a Mu reading from a truck and one did not always know if the reading was accurate.

8.0 Interviewee: Captain Brett Howard Morris, Delta MD88 Captain

Represented by: **Thomas Tobin, Wilson Elser**
Date and Time: **March 11, 2015, 1015 EDT**
Location: **Delta Air Lines Headquarters, Atlanta, Georgia**
Present: **Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA: Steven Acalin, Delta; Brian Teske, ALPA, James Brocksmith, Boeing**

During the interview, Captain Morris stated the following.

His age was 56. He stated that his title and position were as a Captain on MD-88/90 and had been in that position for about 10-11 years.

His date of hire was Jan 14, 1991 and he had no other duties other than flying the line.

Captain Morris stated that he had flown in the Air Force before Delta on the T-38 as a FAPE, and on the F16s for a total of 10 years in the USAF. He stated that at Delta he had flown as an engineer on the 727, copilot on the MD88, and 737 briefly, then back to being an engineer on the 727 for another 5 years. He then upgraded to be a captain on the 737 at the Express operations in MCO. Then he flew as an MD11 FO for 2 years, a 767-ER FO for 2 years and then upgraded to MD88 Captain. That is just a short synopsis of his 25 years total with Delta.

Captain Morris was asked if he had ever flown with the accident FO and he answered yes. It was a short trip and he had just done a two-day trip two days prior. Captain Morris liked to sit reserve. He was called out for a one-day trip that the copilot had been given as a green slip.

The trip had the crew flying ATL to DAY then deadheaded back to ATL. Next, they flew to Cincinnati then back to ATL for a 12.5 hour duty day. Captain Morris remarked that it was a very nice, pretty day. He took the time to glance at the rotation when he was asked to speak with the NTSB – all legs left on time, arrived early. It was one of those perfect days.

Captain Morris was asked when the trip was and he responded that it was Feb 27th of this year.

He was asked his general impression of FO Phillip's flying performance. He stated he believed Phillips had been on the MD88 for more than a few years. Captain Morris stated that he flew with a lot of brand new guys and it was kind of a relief to fly with someone who had lots of experience on the MD88. FO Phillips was very skilled and made the trip very easy and enjoyable. Captain Morris commented that Phillips was a typical example of most guys he had flown with in that he was very professional, easy to work with, and hardworking. Because Captain Morris was flying as a reserve pilot he had done the first two landing while Phillips had made the third. He remembered it as flawless, so much so that he told him to "hit the road" early and Captain Morris would say goodbye to all the passengers and take credit for the landing.

Captain Morris offered that he and Phillips had exchanged some emails in the past on some topics of common interest but he had not had any correspondence with Phillips since the day of the accident.

Captain Morris was asked to describe his impressions on how FO Phillips flew the aircraft. He answered that Phillips showed up promptly, and was very professional. Captain Morris used to be a line check guy, and remarked that he tended be a pain in the rear with very thorough briefings and expected FOs to have top performance. Phillips was very accommodating, professional, and as standard as anyone could be. The trip went so smoothly that he needed to review his records to remember the trip. He had to sit back and think about FO Phillips and the trip because everything had gone very well. FO Phillips did everything exactly standard. Captain Morris told FOs he flew with that he tried to do things by the Delta standard. If he did not, they

were to let him know. FO Phillips did everything he expected a copilot to do and was disappointed to hear that the accident had occurred.

He was asked if he had ever had autospoilers not deploy when armed. He responded that he had never had them not deploy unless there were an MEL listed for them but in over 10+ years he had never had them not work if they were armed.

He was asked if he had ever had an experience where autobrakes were set to max for a landing on contaminated runway and they had not activated or their activation had been delayed. Captain Morris answered "No, never."

Captain Morris was asked he had any experience with maintaining directional control on landing in a contaminated runway or crosswind situation. He said yes, multiple times. The reversers on the MD88 could kick up, plus add in a gust and one could have directional control problems. Pilots needed to be familiar with how the reversers worked and that they could spool up at different times.

He was asked if in his 10 years of flying the MD88 had he had landed in many challenging runway environments. Captain Morris answered that there were definite control issues that he had encountered over the years and that one of the things he loved about the MD88 is that it was not boring.

He was asked to describe a circumstance when it had been challenging to maintain directional control when using reverse. Captain Morris said that because of spool rates the reversers did not always go up uniformly nor were they always consistent from one airplane to the next in terms of how much force was required to pull. A pilot is looking to see how they responded and if he got one engine spooling up more than the other, that would raise an asymmetrical thrust issues and if there was more than 1.3 EPR there could be blanking of the rudder. If things were not going straight down the runway you would have to avoid putting in too much reverse thrust and might have to put in some ailerons too if you had a good crosswind.

Captain Morris was asked to imagine himself in a cockpit, landing on a contaminated runway with possible windy conditions and he was the pilot monitoring. He was asked about what advice he would give to the pilot flying in that situation on the use of reversers. If he and the other pilot had already flown the aircraft he might remind the other pilot to be careful that a left or right one came up fast. If this was the first time flying that aircraft, he would say to be cautious with the use of the reversers and to make sure that the spoilers deployed on landing. He would encourage max autobrakes and say not to land long. If a pilot has 1.3 EPR and was going down the runway they could add a little more reverse EPR if things are going well, if needed. However he stated that if there was trouble with directional control to be prepared to come out of reverse.

He was asked if he had ever seen reverse EPR that was higher than 1.3 EPR and how he would handle this situation. Captain Morris said that he would give a command like "watch your left EPR" to help the pilot flying adjust the EPR setting as needed. If the pilot did not react in an expeditious manner he would adjust or take over if necessary. Captain Morris commented that he had had to say that a couple of times to a copilot, usually to a new one. Newer pilots to the

aircraft might miss it in their crosscheck and he might tap their hand and have them push it down a little but he had never had to take control of the airplane before.

He was asked if he had ever gotten into rudder blanking before. Captain Morris did not know if he had ever had blanking. He was aware of some of the details of accident and did not know that he had ever experienced it or could really tell if he had gotten into it.

He was asked what the max EPR recommendations were. Captain Morris responded that that they were 1.3 for contaminated runway and a max of 1.6 as a target EPR setting for dry runway. Max is max EPR. The reason for the 1.3 was to cover the issues he had already mentioned for rudder blanking, and to make sure the aircraft was going straight before you went past 1.3.

He was asked what the max EPR was for reverse. Captain Morris responded that it was engine go around EPR. Pilots had the ability to pull reverse past 1.6 and could use a higher EPR up to but short of getting an overboost.

Captain Morris was asked how he felt about the braking action reports in general, at LGA. He responded that it was a very high interest item that all were aware of it industry wide. There was lots of work at Delta to become more standardized and they had gotten a lot more tools available to them. There was a SWOA program with guidance there. There was also lots of emphasis on the landing data chart in the front of the ODM. Captain Morris stated that braking action reports were by nature very subjective and he stated that the decision tree in the ODM emphasized that if the report was more than an hour old pilots should get something better. Conditions could change dramatically over short periods of time in bad weather.

Captain Morris commented that the MD88 was like his old F16 and not designed for easy landings and that the 737 seemed much easier. Landing the MD88, one took landing very seriously, especially with that type of challenging conditions.

He was asked if he had any special concerns with LGA and he responded that with the short runways, water, very busy airspace and airport a pilot had to be on guard with their "A" game.

Asked if the braking action reports at LGA were okay, Captain Morris responded that it was no different there than any other airport. He always took these reports with a grain of salt as to who said it, how long ago, and how fast it was changing. He had no personal experiences there that were different than at any other northern city airport.

This concluded the interview.

9.0 Interviewee: Curtis Roger Lindskog, Delta MD88 First Officer

Represented by:	**Thomas Tobin**
Date and Time:	**March 11, 2015, 10:40 EDT**
Location:	**Delta Air Lines Offices, Atlanta, GA**
Present:	**Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steve Acalin, Delta; Brian Teske, ALPA James Brocksmith, Boeing**

During the interview, FO Lindskog stated the following:

He stated that he was 59 years of age and his current position for Delta was an MD88 First Officer and that he had been in that position since early 2005.

He was asked about his date of hire with Delta and he stated that Delta Express hired him in May of 2000 where he flew a Boeing 737 based in Orlando, Florida. He was based there for about a year and a half, and then came to the MD88 in Atlanta. He was furloughed from September 2002-2004 and when he returned from furlough he flew the Boeing 737NG and the MD88. He said that while in the Air Force he initially flew C-141s and then he had transitioned to flying VIP personnel in King Airs. He stated that he had also flown some reconnaissance missions and he had flown Lear Jets out of Stuttgart. He had also flown out of Andrews Air Force Base in the 89th Wing.

When asked about his flights with Captain Ted Lauer, he stated he had flown with Captain Lauer a couple of times. He last flew with Captain Lauer on February 10, which was a four-day trip. He said that it was an uneventful rotation. He stated that Captain Lauer was a little more senior than he was, so they had not usually bid together, but he was the kind of guy he thought would make this a good rotation. He said that he had always enjoyed flying with Captain Lauer.

When asked if there was anything unusual about the rotation. He said that there was a short layover in Austin. It was uneventful and unremarkable. They arrived in the evening and as it was a short layover they did not go to dinner. The following day they flew to Kansas City. He had coordinated with Captain Lauer then went to work out and then got something to eat at Constantino's. They did not meet up for dinner. He said that the following day they went to Boston, where they did have dinner at the Rock Bottom Brewery, "Ted bought the appetizer, good guy." He stated that over dinner they had a normal conversation. They then returned to the hotel where they went to bed. He stated that the next morning it had snowed in Boston and they were de-iced prior to their departure to ATL.

He was asked if he had executed any landings on contaminated runways with Captain Lauer. He stated could not remember any of the previous rotations with him other than a general idea that he had enjoyed flying with him. He stated that the only contamination during that rotation had been in Boston and they had to deice the aircraft due to frost on the aircraft rather than any contaminants on a runway. He stated that Ted was a policies and procedures kind of guy. He was asked about the approaches and landings Ted flew and whether Captain Lauer had used auto brakes. He said that he had no recollection about the specific approaches and did not remember there having been an instance that required more than medium auto brakes.

He was asked if there was anything unusual about how Captain Lauer had utilized reverse thrust. He said, no. He was asked if during that rotation there had been any landings with a significant crosswind. He stated that there was nothing remarkable that he could remember. He was asked if he had ever experienced any directional control problems when he had landed an MD88. He said, no.

He was asked to recall if he had landed on contaminated runways. He stated that he could not recall. He could not recall landing in conditions like those that had been present in LaGuardia (LGA) with falling snow. He stated that he had done several deicing events throughout the course of the winter, but not a runway that had clutter on it or had been contaminated with snow. He stated that he had had pretty good luck this winter.

He was asked whether in all the time that he had flown the MD88 he had ever remembered a time when he had experienced rudder blanking. He stated that it may have been possible; however no specific instance had come to mind.

He was asked about his understanding of the company procedure for the use of reverse thrust upon landing. He stated that when a runway was contaminated, asymmetric thrust would be a consideration. He said that the engines had a tendency to spool up differently. He stated that he would attempt to attain the target EPR settings in a contaminated situation. He said that he would ideally shoot for 1.3 EPR. If you needed more, you needed more. That was kind of a target. That target was for a contaminated scenario. He stated that for a dry runway the target EPR was 1.6.

He was asked about how he had set reverse EPR. He stated that would watch as the mains touched down and bring the reversers to idle. As the nose contacted the runway he would then adjust the reversers. He stated that if he had noticed that one of the reversers had an uneven EPR that he would make a callout of high EPR. He stated that he would make the appropriate callouts such as 80 knots so that they could reduce reverse thrust to the reverse idle regime.

Asked if he had ever had auto brakes not work when set for landing, he stated that he had never had a problem. There were occasions when you would touch down and the pilot flying would initiate braking prior to activation of the auto brake system, but in a contaminated situation, where they had felt setting auto brakes was a requirement, he would say no, he have never seen a failed auto brake system.

He was asked if he had ever experienced a failure of the auto spoiler system to deploy upon landing. He said no, and added that sometimes one had a very light touchdown and might be reaching for them but then one got wheel spin-up they would deploy.
He was asked how he would evaluate Captain Lauer's performance relative to others. He stated that Captain Lauer was a professional guy. They had a lot of policies and procedures to make things better and Captain Lauer would always be up on the latest. If something came down the pike that needed to be implemented, he would be the guy leaning forward and make sure it happened.

He was asked about Captain Lauer's aircraft handling skills. He stated that they were unremarkable and he was very standardized.

He was asked how he would have recognized if the auto brakes had been de-activated manually. He answered that a yellow light on the dash would come on.

He was asked if he had observed a situation where Captain Lauer had received an annunciator light and Captain Lauer should have responded by referring to the QRH but rather chose not to refer to the QRH. He stated, no, he had never seen something that Captain Lauer had blown off like that.

He was asked if he had ever experienced the airfoil abnormal pressure light and what would have been done to extinguish the light. When the light came on it was accepted practice to continue. He stated that he had experienced the light being illuminated often. When that occurred, one would look at throttle position. If the throttles were back one would monitor the condition, but if the power was up, there was something not working properly and they would pull out the QRH, but he had never known Captain Lauer to ignore something like that.

He was asked whether if he had encountered an abnormal pressure light, he would have landed with snow and ¼ mile visibility, and whether he would have raised a concern with the Captain. He responded that it was a tough call he would look at the QRH and he could not give a solid answer without knowing the absolute configuration and contingencies.

He was asked a question which had referred to the cold weather section in Volume 1 of the FCTM. Asked whether he had ever seen or read about the practice of having to run the APU on approach to a contaminated runway, He stated that he had heard of that procedure however he was not sure how it had been exactly worded. He could recall that it was a technique but could not recall why.

He was asked if he had ever had directional control issues and if so, what he would have done to regain aircraft control. He stated that he would remove the input that had caused the aircraft to deviate laterally. He stated that he would have reduced the amount of reverse thrust and if necessary he would have returned reverse thrust to idle to regain control. If using max auto brakes, it would have used the braking system to its maximum and a pilot could not do better.

He was asked if he would have chosen to close the reversers to forward idle. He stated that he would have only taken them to reverse idle and he would not have brought them forward out of reverse because one was committed to the landing once one had the reversers out.

He was asked if there was anything he had not been asked that could be relevant to the accident and he said no.

He was asked if he had ever experienced the airfoil anti-ice annunciator light having come on and remained on. He stated that he had not, as far as he could recall. He was asked again if he had ever seen an instance where there was an indicator light and Captain Lauer should have pulled out the QRH and he did not, he responded never.

10.0 Interviewee: Charles Alex Davenport, Delta MD88 First Officer

Represented by:	**John P. Kelley**
Date and Time:	**March 11, 2015, 1540 EDT**
Location:	**Delta Air Lines Headquarters, Atlanta, Georgia**
Present:	**Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steven Acalin, Delta; Brian Teske, ALPA; James Brocksmith, Boeing**

During the interview, FO Davenport stated the following:

He was 50 years of age and an MD88 FO and simulator instructor. He had been an instructor for 4 ½ years. He had been on the MD88 since 2003. His date of hire at Delta was January 15, 1998. He had been a B727 second officer (SO) and FO, and had also been a DC8 SO and B757 FO at UPS airlines. He had flown the RF4C and KC135R in the Air Force as PIC. His total flight time was approximately 11,000 hours, of which about 5,000 hours was on the MD88.

FO Davenport had flown with Captain Lauer on the line. He had conducted a module 642 training event with Captain Lauer in November 2014. It was a recurrent validation/ train to proficiency type training event. FO Davenport did not recall the specific mission, but he recalled Captain Lauer was very well prepared. His performance totally matched the experience FO Davenport remembered he had seen Captain Lauer show on the line. He was experienced and had a great personality and worked well with people. FO Davenport could not remember specifics of Lauer's performance. There was nothing specific.

FO Davenport was asked to describe the maneuvers normally accomplished in the training event. He stated they would depart Jacksonville (JAX) and fly the LOC / GS-out approach to runway 8 at JAX, followed by a vector to a no flap approach and visual landing. They then flew a Cat II ILS runway 8 set up from a dogleg to final with a landing. They did an engine failure on takeoff (V1 cut) followed by an engine out landing, and they also accomplished a rejected takeoff (RTO).

Asked if he ever failed the auto spoilers on this training, he said he would have to check the instructor guide. Regarding the reverse thrust EPR he expected to see on a normal dry landing, he said it would be 1.6 EPR target with a minimum 1.3 EPR target. Asked if he observed pilots exceeding the EPR targets, he said yes, occasionally. Asked what pilot monitoring (PM) responses he would expect if reverse thrust exceeded target, he stated he would give the pilot feedback to reduce EPR verbally. The FCTM provided guidance on use of thrust reversers, and in the event of problems with directional control on landing pilots should reduce EPR.

Asked if he conducted SPOT training on contaminated runways, he stated he vaguely remembered doing such training several cycles previously. He did not know the reason that SPOT training was done.

FO Davenport stated he flew the line one month per quarter and he averaged 80 hours per month on the months he flew, and this resulted in an annual total of about 320 hours.

Asked if he had experienced an MD88 auto spoiler failure to deploy, he said no. He also stated he had not experienced a failure of the autobrakes to work when they were armed and he had not experienced any difficulties with directional control in the MD88 when landing on a contaminated runway.

11.0 Interviewee: Matthew Howard Franks, Delta MD88 First Officer

Represented by: Rachel Semuda, ALPA
Date and Time: March 12, 2015, 1015 EDT
Location: Delta Air Lines Headquarters, Atlanta, Georgia
Present: Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steven Acalin, Delta; Brian Teske, ALPA; James Brocksmith, Boeing

During the interview, FO Franks stated the following:

His age was 37 and he was an FO on the MD88. He had been in that position since November 2014. Prior to flying the MD88 he had been an FO on the 757, and prior to that he had been again an FO on the MD88 as a new hire.

First Officer Franks listed his date of hire as October 11, 2010 with a total flying time of roughly 8,000 hours. He stated that he had roughly 700 hours on the MD88 and that was a very rough estimate. He was on reserve for a long time.

His background in flying was as a civilian trained pilot who had flown turboprops. FO Franks stated that he had been a Check Airman on a turboprop for a United Express carrier flying out of Denver and also flew the EMB170/175 for one of the Delta Regional carriers. He stated that he had been a Captain on all of those aircraft.

He was asked if he had ever flown with Captain Lauer and he answered that that was correct.

FO Franks was asked when he had flown with Captain Lauer most recently. He said that it was a rotation on February 4, 2015, which was a 3-day trip. His records indicated that the rotation included the following legs:

Atlanta – La Guardia - Atlanta – Nashville
Nashville – Atlanta – Dallas
Dallas - Atlanta – New Orleans – Atlanta

FO Franks was asked for his general impression of Captain Lauer's flying practices and skills. He responded that he had that thought long and hard about that rotation and nothing significant stood out. If Captain Lauer had deviated from Delta standards, or not complied with standing operating policies, or had poor stick and rudder skills that would have stood out to him and he would remember that. The only thing that FO Franks recalled was going to the gym with him

during the Nashville layover and working out together. Captain Lauer impressed him as a very health conscious guy and good family guy and that he did not recall much of the flying parts.

He was asked if he recalled what the weather conditions with the flight were in and out of LGA and he responded no, he did not remember and nothing stood out about the LGA flight.

FO Franks was asked if he recalled if he had used reverse thrust and, if so, how much EPR was used to which he responded no, he could not recall. The standard operating procedures called for a target of 1.6 or less on a dry runway and a target of 1.3 or less on a contaminated runway. He could not recall Captain Lauer using reverse any differently than that.

FO Franks was asked if he recalled discussing using an EPR target of 1.3 or 1.6 with Captain Lauer to which he responded that he did not recall.

Asked if he had ever experienced autobrakes when armed not working on landing, he responded no.

Asked if he had ever experienced autospoilers when armed not working on landing, he responded no.

Asked if he had ever experienced a directional control problem on the MD88 on landing, he responded no.

Asked about the training he had received while at Delta on the MD88 related to directional control problems on landing and how he would recover from that situation. He asked for clarification as to what aspect of the landing the question concerned. He said that if he suspected rudder blanking, he would bring the thrust levers back to idle and if the brakes were working fine he would most likely reduce the brakes to straighten out the aircraft and then start everything all over again.

He was asked if he would ever consider taking the reversers to reverse idle and if he was still having a directional control problem close reverse thrust up to forward thrust. FO Franks answered that if he still had control of the aircraft that he would reduce the reverse thrust to idle. If he still had an issue he would also verify that both reversers were still in reverse but the question had too many variables. On a long runway he might go to forward idle, but not on a short runway he would not take it out of reverse. He said he was not real comfortable with the question because it had too many variables.

He was asked if there was anything he had not been asked about that might be relevant to the accident and he answered no.

This concluded the interview.

12.0 Interviewee: David Donn Barber, Delta MD88 First Officer

Represented by:	**Rachel Semuda, ALPA**
Date and Time:	**March 12, 2015, 1040 EDT**
Location:	**Delta Air Lines Headquarters, Atlanta, Georgia**
Present:	**Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steven Acalin, Delta; Brian Teske, ALPA; James Brocksmith, Boeing**

During the interview, FO Barber stated the following:

FO Barber, age 47, had been an FO on the MD88/90 since his date of hire, August 15th, 2010. Prior to joining Delta, FO Barber flew for Mesaba beginning January 8th, 1996. His total flight time was approximately 12,000 hours of which 2,500 hours were on the MD80.

FO Barber flew with Captain Lauer on rotation number 127 which was a 4-day assignment starting February 25th, 2015. He was on reserve and the company sometimes changed rotation numbers.

Asked where he flew on the rotation, he answered they stayed in Louisville twice and he could not remember other details. The rotation was Atlanta to Philadelphia to Atlanta, on the 28th, Atlanta to Minneapolis, which was a deadhead. The trip concluded at 1028 time on the 28th but the flying portion concluded on the 27th.

Asked for impressions of Captain Lauer and his general way of managing the cockpit, he answered that he was very impressed. A number of newer captains who had come through lately had a willingness to ask questions of the FO's and dispatch. They were very careful of everything and they were very open. All were very knowledgeable and willing to ask questions, always searching for other information and carrying packets of information from training and he was impressed how they had all reacted.

Asked about Captain Lauer specifically, he answered that Captain Lauer was very prepared, careful, calm, open to asking questions, always searching for other information, and never in a rush. He was always doing things to standard operating procedures and was very friendly.

Asked if on the MD88 he had ever experienced during landing an occasion when the auto brakes or auto spoilers were armed but did not deploy, he answered no.

Asked if on the MD88 he had ever experienced any difficulties with directional control, he answered yes and said that in his first two months on the MD88 on windy runways it could be difficult if the thrust reversers came up unevenly.

Asked if Delta provided guidance on how to handle directional control in those situations, he answered to put thrust levers to idle, take off the brakes, go straight, then put them back and use reverse again, and on one occasion he made the mistake of putting one reverser to 1.7 EPR and the other reverser to 1.2 ERP and that did not help with directional control.

Asked how he ensured the reverse thrust did not create directional control problems, he said they always looked at the EPRs and if one was too high, they would call out what the readings were for the EPRs, such as "One is 1.7 and the other is 1.2."

Asked if he would just verbalize, he answered yes; he would not grab the power levers.

Asked what would be max reverse on a contaminated runway, he answered max reverse would be 1.7 EPR.

Asked if he had any difficulty monitoring EPR while controlling the airplane while landing in poor weather, he answered it was something you got used to and it was hard to fly the plane while looking down, but it got easier the longer he flew the plane.

Asked if during his approach briefing preceding an approach to a shorter runway, he briefed that the EPRs should be called out, he answered "no, I do not."

Asked the EPR limit for a dry or contaminated runway, he answered the max was 1.7 EPR and if it was dry it was up to the pilot. He stated there was a time when they were supposed to go to 1.3 EPR, and then they changed to 1.6 EPR. The company had changed it back and forth. A lot of guys would use it and just put it up into reverse if it was dry.

Asked if the guidance had changed, he answered that in 2011 or 2012 it had changed to 1.3 EPR although it could have been just technique rather than the book. He would go to 1.3 EPR, and then he remembered a memo coming out saying they could go to 1.6 EPR and he believed from other Captains that that was the way it used to be. He could not be positive about that.

Asked what their manuals said about when to close the reversers, he answered one would go to idle if one was having difficulty. Asked to clarify whether one would close the reversers, he answered that he would like to leave them in the open position, so he could pull them back in.

Asked what the contaminated runway EPR limit was, he answered he did not know for sure, One was supposed to go to max, which he thought it was 1.7 EPR. Dry was 1.6 EPR or 1.7 EPR, and that to get to 1.7 EPR was "pretty darn hard."

Asked if there was anything he could suggest investigators should be looking at, he answered nothing.

This concluded the interview.

13.0 Interviewee: Winford (Jay) Haire, Jr., Delta MD88 Captain

Represented by:	**Rachel Semuda**
Date and time:	**March 12, 2015, 1110 EDT**
Location:	**Delta Air Lines Headquarters, Atlanta, Georgia**
Present:	**Roger Cox, NTSB; William Bramble, NTSB; Michael Nash, FAA; Steven Acalin, Delta; Brian Teske, ALPA; James Brocksmith, Boeing**

During the interview, Captain Haire stated the following:

He was 58 years of age and he was an MD88 captain based in Atlanta. He had been in that position for 4 to 5 years. Prior to that he had been a DC9 captain for 15 years, and had been a line check airman (LCA) and simulator instructor with Northwest Airlines. His approximate total flight time was 20,000 hours (military and airline), of which about 3,000 hours were on the MD88.

He had flown with the accident FO on a one-day trip, which took place on March 1, 2015. They flew four legs, ATL-TLH-ATL-MIA-ATL. The leg from TLH to ATL was a deadhead leg. Asked to describe the accident FO's style of flying and level of proficiency, he stated the FO was excellent and very competent. He was knowledgeable and stayed well ahead of the aircraft. Captain Haire did not recall any unusual events during the flights he flew that day. They had not encountered any contaminated runways that day. He did not recall anything special about his interaction with the FO.

Asked if he had ever experienced a failure of the autobrakes to work when they were armed for landing, he said no. Asked if there was ever any delay in having autobrakes actuate, he stated there was a short inherent delay and it depended on the selection. He had never experienced a failure of the auto spoilers to actuate on landing when armed unless there was an MEL. He had not experienced difficulty in directional control when landing the MD88.

Asked about Delta's guidance regarding landing on contaminated runways, he stated he would refer to the manuals, but he recalled that the reverse thrust EPR setting should not normally exceed 1.3 EPR. Volume 1 provided guidance. There was a possibility of rudder blanking when operating above 1.3 EPR. He did not recall any recent Delta training on the subject of rudder blanking, but he was aware of the possibility of too much reverse thrust in a slippery runway situation. He did not remember all the details but it had been inherent in his knowledge base for a long time.

Captain Haire was asked if, during his experience flying the DC9, he had ever experienced rudder blanking. He said no. He remembered when landing on slippery runways to reduce reverse thrust to get better control. He remembered a time when flying the DC9 as an FO he did that. He did not think stowing the reversers during landing was appropriate. He stated reducing thrust to idle reverse was appropriate but counter intuitive in his opinion.

Asked if he could remember any other details of working with the accident FO, he said he had only flown with him once and did not recall anything specific. It was a typical rotation.

This concluded the interview.