NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

December 13, 2001

Group Chairman's Factual Report

HUMAN PERFORMANCE

DCA01MA056

A. ACCIDENT

Operator:	Piedmont Airlines dba. USAirways Express, Inc.
Location:	Ronald Reagan Washington National Airport, Washington, D.C.
Date:	August 5, 2001
Time:	1740 eastern daylight time (edt[1])
Airplane:	De Havilland DHC-8-100

B. HUMAN PERFORMANCE GROUP

Malcolm Brenner, Ph.D, Chairman
National Transportation Safety Board, Washington, D.C.

David Byers,
Metropolitan Washington Airports Authority Police Department, Dulles, VA

William Kivlehan, Tom Mason
Piedmont Airlines, Salisbury, MD

Dale L. Nelson,
Federal Aviation Administration, Flight Standards District Office, Dulles, VA

Capt. Stephen A. Ormsbee, Capt. Chris Raskov
Air Lines Pilots Association, Piedmont Airlines

[1] All times edt unless otherwise noted.

C. SUMMARY

On Sunday, August 5, 2001, about 1740, a US Airways Express/Piedmont ramp agent was fatally struck by the propeller blades of the right engine during taxi operation. The US Airways Express flight number 3340 de Havilland Dash 8, N935HA, was intending to depart from Ronald Reagan National Airport to White Plains, New York when the accident occurred. The marshaller signaled for the aircraft to stop because the nose wheel chocks were not clear of the right main landing gear. The ramp agent, who had removed the chocks prior to taxiing, was fatally injured when he moved forward attempting to remove the chocks from the front of the airplane.

D. DETAILS OF INVESTIGATION

The Human Performance Group met on August 9-10, 2001 at the USAirways Express Operations Office, Ronald Reagan Washington National Airport, Washington, D.C. (DCA). The group conducted two visibility tests on the ramp of the airport and completed interviews of several individuals related to the accident. On August 15, 2001, the group conducted an additional interview of a family member of the ramp agent. Relevant background documents were reviewed.

The Human Performance group examined issues related to the background and activities of the ramp agent, medical factors, ramp safety training, procedural differences between Dulles International Airport (IAD) and DCA, weather factors, conspicuity, and industry experience with propeller-to-person accidents.

D.1 Background and activities of the ramp agent

According to company records, the ramp agent was hired on September 26, 2000 as a part-time ramp employee at IAD. Under company procedures, his responsibilities included baggage handling, marshalling airplanes, towing, and lavatory services as part of a team of ramp agents. He worked two days per week (Sundays and Monday). On July 8, 2001 he was transferred to DCA due to USAirways Express operations being relocated to DCA. The accident day was his first work day at DCA following transfer and personal medical leave.

Company records indicate that the ramp agent satisfactorily completed all initial and recurrent training. The records indicate that he was written up for one corrective action on February 4, 2001 for being tardy ("1 hour 20 min. late. Car problems"), that he received a commendation from a supervisor on February 11, 2001 ("going above and beyond when needed on a poorly staffed day") and

shared a group commendation on March 4, 2001 (good baggage handling operations in the previous month).

According to his wife, the ramp agent worked at the airline job largely to obtain travel benefits (which they used for vacations). His primary occupation was as a real estate agent, and he often worked irregular hours depending on the need to show real estate property. He also worked as an X-ray technician as a "fall back" occupation when the real estate work was quiet and, at the time of the accident, was working part-time as an X-ray technician to fulfill the hours-of-service requirements to maintain his X-ray license.

Other ramp agents, who worked with the ramp agent operation at IAD, described him favorably. One co-worker described the agent as gregarious, very competent, and professional. He said the ramp agent was "always willing to help you work on an airplane," and that "you didn't have to wave to [him] if you were buried in bags and he was done. He would take the initiative to help you." Another co-worker described the ramp agent involved in the accident as laid back and a good colleague who "would help out at any time." A third ramp agent, who helped train the agent involved in the accident, described him as a nice fellow, cooperative and very safety conscious. He said the ramp agent took his time, worked quietly, and did not get annoyed with other workers.

According to his wife, the ramp agent tended to go to bed between 2300-2400 and wake up about 0900 when he did not have work demands. On Thursday, August 2, the wife believed that the ramp agent awoke between 0730-0800, worked at his real estate office between about 1000 and 1700, and also worked 3 or 4 hours as an X-ray technician. She believed he watched late-night television, and fell asleep between 0100-0300. On Friday, August 3, she did not know when he awoke, believed he worked at the real estate office from about 0830-0900 until 1400, and did not know when he went to sleep. On Saturday, August 4, she believed he may have awaken between 0730-0800, and attended church in the morning. She believed he relaxed around the house for the rest of the day and went to bed early, perhaps around 2200, in preparation for working at the airline.

On Sunday, August 5, his wife indicated that the ramp agent awoke early for his first day at DCA. Company records indicated that he logged into work at 0835. A co-worker, who worked with him in the morning and saw him during the day, said the ramp agent was in good spirits and appeared normal. It was a reasonably busy day, and he saw the ramp agent off-load baggage from numerous airplanes.

About 1540-1545, the ramp agent complained of a headache and received two Advil tablets and a can of Sprite soda from the crew of an earlier flight he was working. Because the earlier airplane was delayed by a mechanical problem, he rested inside the airplane cabin to escape the outside heat until

about 1558. According to a flight attendant of the earlier flight, he looked tired and rested with his eyes closed but, when he left, acted normally and appeared to be completely aware of his surroundings. About 1620-1630, the captain of the earlier flight observed the ramp agent lying in the baggage compartment of the airplane with his legs out the door while waiting for a tug to help him off-load baggage. The captain spoke to him, received no response, and had the impression that the agent was napping.

A co-worker worked with the ramp agent loading two airplanes just before the accident and said that the agent's mood was good and that he was working fine. Another co-worker said that the ramp agent asked him to accompany him to the edge of the ramp area to get water shortly before the accident, but the co-worker was busy and declined. The co-worker (who marshaled the accident flight) stated that, just before the accident, the ramp agent looked a little fatigued. This was based on the way he moved. His physical condition appeared fine, and he was sweating like everyone else. The noise level was very loud, and he thought that the ramp agent was not wearing ear protection.

According to a ramp agent, it was the usual practice to attempt to have two agents available to marshal an airplane. One would act as a marshaller, while the other would pull the chocks and might wait to collect paperwork from the door. According to a company representative, there would normally be two and sometimes three ramp agents assigned to a flight while on the ground. They would all be trained and qualified in aircraft servicing, which included, but was not limited to, setting up ground power, lavatory servicing, window washing, baggage handling, and marshaling of aircraft. No individual ramp agent would be specifically assigned to each task, but the ramp agents would work as a team and perform the function necessary at that time.

In the case of the accident flight, the marshaller stated that he was not assigned to marshal the accident flight. He was working at the rear of the airplane and went up front to assist. He did not have marshalling wands and the ramp agent (the one involved in the accident), who was also at the front of the airplane, handed him some. He had worked with the ramp agent marshalling airplanes at IAD, but this was their first experience marshalling an airplane together at DCA. According to the marshaller, the captain gave him a signal to remove the chocks, and the ramp agent removed the chocks to assist him. The ramp agent picked up the chocks and tossed them to the side. There was no string connecting the chocks. According to the marshaller, the captain signaled that he was ready to taxi, the marshaller signaled a go-ahead, and the airplane moved. The marshaller stated that the airplane came forward and he signaled it to stop to prevent the wheel from hitting the chocks. He said that he and the ramp agent shared a glance, since they both realized that the chocks were not thrown far enough from the airplane. The marshaller stated that he intended to signal the pilot to cut the engines when he saw the ramp agent moving to reach the chocks. He said that he yelled at the top of his lungs for the ramp agent to

stop. Another co-worker, located behind the accident airplane, stated that he observed the marshaller stop the accident airplane and, before the marshaller could stop the engines, observed the ramp agent "dart in there" reaching down and forward for the chocks. He stated that the marshaller tried to stop the ramp agent, and that he himself yelled and honked the horn of his tug to make the agent stop. He indicated that the ramp agent made a bad judgment call, saying that "the procedures were good but [the agent involved in the accident] did something stupid." The co-worker said that he never before saw the ramp agent involved in the accident do a "dumb thing."

D.2 Medical information

According to his wife, the ramp agent lost weight during the past 12 months and learned that he had a medical problem involving the thyroid. His physician prescribed two medications: Tapazole, to inhibit thyroid stimulation, and propranolol, to reduce heart rate. Except for the thyroid problem, according to his wife, the agent experienced good health and no major health changes during the previous 12-months. The wife stated that he did not use corrective lenses for vision, that his hearing was excellent, that he drank little alcohol and did not use tobacco or coffee. She indicated that he would have had no reason to take any drugs that might have affected his performance in the 72 hours before the accident.

Toxicological tests were conducted on a urine sample obtained posthumously from the ramp agent by the FAA's Civil Aeromedical Institute (CAMI). The sample tested positive for propranolol and negative for ethanol and a wide screen of legal and illegal drugs. Attachment 3 contains the test results.

According to the Autopsy Report prepared by the Office of the Virginia State Medical Examiner, the cause of death was "multiple chop wounds due to airplane propeller." According to the autopsy report, the stomach contained about 150 ml of partly digested vegetable meal. The autopsy did not note the presence of ear protection equipment. Toxicological tests were conducted on a blood sample by the Forensic Science Laboratory and were negative for ethanol, opiates, cocaine and benzoylecgonine but were positive for ibuprofen. Attachment 4 contains the test results.

According to his wife, the ramp agent asked his physician for a few days rest before transferring to his new airline assignment at DCA because he felt that DCA was a big airport and consequently would be very busy and challenging. The physician provided a medical note that allowed the agent to obtain leave from his airline job for two work cycles (July 22-30) before returning on August 5. Company records indicate that the physician of the ramp agent provided a note approving his return to work on August 5. Medical records from the physician of the ramp agent are pending.

D.3 Ramp safety training

According to the Assistant Training Coordinator of USAirways Express (who provided new employee training on ramp operations), ramp agents received four days of initial classroom training of which three classroom hours were devoted to ramp safety. Students were shown a 16-minute safety video and participated in a "Jeopardy-style" interactive video that required them to identify unsafe practices. Further, the training curriculum emphasized propeller safety in several modules. One module contained propeller safety rules and provided four examples of real life incidents where ramp workers were killed or nearly killed by propellers, while another module stressed the importance of maintaining mental alertness while working on the ramp and provided information relating directly to propeller safety. Students were required to score a cumulative 90% score, including a 100% on the safety test, to pass the course. Attachment 5 contains training records for the ramp agent involved in the accident, while Attachment 6 provides selections from the initial training curriculum for ramp agents related to propeller safety issues.

According to the coordinator, additional on-the-job training was provided at the station level and recurrent training was given every quarter. Safety bulletins were posted regularly that addressed propeller safety and other ramp safety issues.

According to ramp agents, a new agent would have another agent working with them "one-on-one" for on-the-job training. One ramp agent stated that all agents received training on propeller safety, including movies on propeller safety, diagrams depicting "danger areas" around props and talk among workers and by supervisors. Training that "you never approach a propeller" was always brought up in quarterly safety meetings. Another ramp agent stated that at IAD, there were safety briefings twice per week, 30-60 minutes long, and issues such as propeller safety were discussed. According to this agent, all ramp agents received training on propellers before they came to the ramp and were constantly briefed on propeller safety.

According to a company representative, the DCA station held two daily safety briefings that were conducted by a supervisor designated by the station manager. One meeting covered ramp safety and the other meeting covered safety issues inside the terminal. The company representative stated that prop safety was addressed several times per week during the ramp safety meeting. The company representative stated that there was also a Safety Committee that met monthly at DCA to discuss issues raised in the daily safety briefings and other ramp safety issues. This committee was comprised of ramp agents, ramp supervisors and a manager. The minutes of this meeting were made available to

all employees and contained a recap of safety issues raised and what was done to correct any problems, according to the company representative.

According to his co-workers, the agent involved in the accident received on-the-job training when he began at IAD and was experienced and fully qualified for ramp duties, including marshalling.

The USAirways Express Ramp Operations Manual, Section 5-5-4, "Propeller Safety," contained the following information:

1. Approach the aircraft from the nose when engines are running.
2. Never chock the main landing gear while the engines turning.
3. Do not apply the prop tie until the propeller completely stops spinning.
4. Never attempt to stop a propeller manually.
5. Never walk through the prop arc.
6. Do not allow passengers behind the wing.
7. Always keep carry on baggage clear of the prop arc.
8. Do not open any cargo, passenger, or service doors while the engines are running.
9. Observe the prop areas before signaling clear for engine start.
10. Always be sure the propellers are secured before allowing passengers to enplane or deplane.
11. Use hearing protection when engines are running.
12. Do not position ground equipment such as baggage carts, bobtails, or catering trucks while the engines are running (Exception – Ground Power Units).

The manual provided additional information on propeller safety in Section 5-30-1 which included diagrams of propeller safety zones. According to a company representative, the Ramp Operations Manual was kept in the Supervisor's office and was accessible to all employees. Attachment 8 contains selections from the USAirways Express Ramp Operation Manual related to propeller safety. Attachment 9 contains a company Safety Bulletin for ramp agents related to propeller safety issues.

D.4 Procedural differences between IAD and DCA

According to a ramp agent/instructor, the training for ramp agents who were transferred to DCA consisted of ramp agents being taken around the ramp and shown different locations. He said that the operations at DCA were similar to those at IAD except that DCA was busier. A pilot indicated that the ramp at IAD seemed much more cramped than that at DCA, but a ramp agent stated that the ramp agents did not have more room at either airport and that both airports were busy operations. Another ramp agent said that IAD had more airplane types, but that ramp operations were similar at both airports. According to his wife, the

ramp agent involved in the accident requested a medical leave prior to transferring to DCA because he felt that DCA was a big airport and consequently would be very busy and challenging. However, several witnesses indicated that workload at the time of the accident was normal. The ramp agent who marshaled the accident flight stated that workload was just dying down after a normally busy Sunday operation. He stated that he felt no time pressure to get the accident airplane out.

Two ramp agents indicated that, at IAD, the removed chocks were set in bins or specific staging areas. At DCA, there were no designated areas to put the removed chocks. A company pilot stated that a ramp agent would typically toss the chocks on a tug but, if no tug were present, the agent would typically throw both chocks to the right where, especially at DCA, the chocks commonly ended up in a position close to the right gear where the airplane could taxi over them. According to a company representative, the Ramp Operations Manual did not give agents guidance on where to place the chocks.

Several witnesses indicated that ramp agents at IAD worked as a team and helped each other out. The marshaller of the accident flight stated that ramp agents were supposed to work by zones at DCA, but that ramp agents who had transferred from IAD (including the agent involved in the accident) continued to work as a team. According to a company representative, zones were physical places on the ramp, and the DCA ramp contained three zones.

D.5 Weather information

DCA weather on the day of the accident was reported at 1751 edt as: wind 190 at 9 knots, visibility 5 miles, haze, clouds 4,300 few 15,000 scattered, temperature 84F, relative humidity 70%, heat index 91F. All witnesses described the weather as very hot.

According to the Assistant Training Coordinator of USAirways Express, the company did not provide formal training for ramp agents to work in hot weather operations. A co-worker of the ramp agent indicated that there was no formal company policy on drinking water, but that supervisors and ramp workers reminded each other to drink a lot of fluids when they worked out in the heat. Another co-worker stated that the supervisor had told them to drink a lot of fluids when they worked in the heat. Ramp workers indicated that, at DCA, there were two yellow coolers containing drinking water for the use of the ramp workers located at the edge of the ramp area.

According to his wife, the ramp agent involved in the accident complained to his supervisor several weeks before the accident about the difficulty of working outdoors in the sun during a 10-hour shift with only a scheduled ½ hour rest break. A company representative advised the Safety Board that the company

attempted to identify a supervisor who may have received such a complaint, but that two station managers from IAD and one station manager from DCA indicated that they were unaware of any complaints by the accident ramp agent to any of his supervisors about working conditions. According to the company representative, one of the station managers met the ramp agent on a hot day at IAD and noticed the ramp agent was wearing a hat. The ramp agent stated that he wore the hat to block the sun.

D.6 Conspicuity

A co-worker of the agent involved in the accident stated that it was easy to see propellers from the front, but more difficult from the side where only the tips could be seen when the propellers were rotating. However, members of the Human Performance group found it difficult to see the moving propeller blades from front or behind during two conspicuity tests conducted on the ramp (Attachment 1).

D.7 Industry experience with propeller-to-person accidents

NTSB records indicate eight propeller-to-person accidents among scheduled air carriers in the United States during the period 1990-2001 (prior to the present accident):

- October 1, 1990, Air Midwest, Inc. British Aerospace BAE Jetstream 3201 at St. Louis, Missouri (NTSB accident #CHI91LA001). A newly employed ground agent chocked the nose wheel and then walked under the wing from behind to unload cargo in the fuselage pod. Witnesses said he was struck by the spooling down propeller. He received serious injuries. The NTSB determined that the probable cause of this accident was an inadequate visual outlook by the ground personnel. Contributing factors were lack of total experience in type of operation and a dusk light condition.
- March 22, 1991, Polynesian Airlines, DeHavilland DHC-300 at Apia, WN Samoa (LAX91LA147). A ground guide was not available to direct the airplane to the gate after it landed at night and, as the airplane approached the gate, baggage handlers and a security guard approached it. After engine shut down, the crew discovered that the security guard had been fatally injured by the spinning propeller. The NTSB determined that the probable cause of the accident was the inadequate lighting of the gate at the terminal and inadequate training of the security guard by company personnel. Contributing to the accident was a dark night condition.

- October 12, 1991, Britt Airways, Aerospatiale ATR-42-320 at Bridgeport, Connecticut (NYC92LA005). The airplane was parked on the ramp with the right engine running in preparation for departure. An off duty, non-revenue passenger, who was assisting the station agent prepare the flight for departure, received fatal injuries from contacting the moving propeller. The NTSB determined that the probable cause of the accident was the employee's failure to follow proper procedures and the diversion of her attention that resulted in her being struck by a spinning propeller.
- March 4, 1993, Simmons Airlines, Aeroapatiale ATR-42-300 at Chicago, Illinois (CHI93FA129). A mechanic was working on a problem that involving stopping and running the propellers when a newly employed baggage handler from another airline received fatal injuries from walking into a propeller. The NTSB determined that the probable cause of the accident was the unqualified baggage handler's attempting to load an unfamiliar airplane and inadequate training by the airline that employed the baggage handler.
- June 29, 1993, Bering Air, Inc., Piper PA-31-350 at Gambell, Alaska (ANC93LA105). At a remote village airstrip, a passenger deplaned from one scheduled commuter airplane and intentionally walked into the propeller arc of another commuter airplane with running engines. During medical treatment, the passenger said that she attempted suicide. The Safety Board determined that the probable cause of the accident was intentional personal injury.
- November 5, 1993, Northeast Express Airlines, Inc, Fairchild SA 227-AC, at Newark, New Jersey (BFO94LA002). A ramp agent, preparing a flight that was late for departure, walked under the right wing and received fatal injuries from contacting a moving propeller. The ramp agent received training on ramp safety and was a designated company instructor of ramp safety. The Safety Board determined that the probable causes of this accident were 1) the failure of the ramp agent to follow proper procedures during the servicing of the airplane, and 2) her lack of attention to the hazards surrounding her.
- November 3, 1998, Express Airlines One, Inc., Saab 340A, at Memphis, Tennessee (MIA99LA026). A ground crewmember assisted with the start of the number 2 engine, signaled for the removal of ground power, and walked directly from the front of the airplane toward the ground power unit behind the wing, receiving fatal injuries from the rotating propeller. Toxicology tests were positive for salicylate and brompheniramine in urine. The Safety Board determined that the probable cause of the accident was the ground crewmember's inadvertently walking into the path of a rotating propeller resulting in her being struck and fatally injured.

- July 28, 1999, Continental Express, Inc., Aerospatiale ATR 42-500, at Little Rock, Arkansas (FTW99FA201). The airplane was stopped on the ramp with both engines running when the station manager, attending to a shoulder-mounted radio, inadvertently walked into a moving propeller and received fatal injuries. The NTSB determined that the probable cause of this accident was the station manager's inadvertent encounter with the rotating propeller due to his diverted attention.

[redacted]
Malcolm Brenner
National Resource Specialist—Human Performance

12/14/01

LIST OF ATTACHEMENTS

1. Summary of visibility tests conducted by the Human Performance Group (2 pages).
2. Summary of interviews conducted by the Human Performance Group (11 pages).
3. Toxicology results by the Federal Aviation Administration Civil Aeromedical Institute (1 page).
4. Toxicology results conducted by the Commonwealth of Virginia Division of Forensic Science Laboratory (2 pages).
5. Training records for the ramp agent involved in the accident (6 pages).
6. Selections from the Piedmont Airlines, Inc. Customer Service Training curriculum, from Section Seven "Aircraft Familiarization " and Section Nineteen "Ramp Safety" (12 pages).
7. Selections from the Piedmont Airline, Inc. (US Airways Express) Operations Manual, from Sections Five "Ramp Procedures" and Section Six "Ground Handling" (2 pages).
8. Sample of Piedmont Airline, Inc., Safety Bulletin (1 page).