Docket No. SA-538

Exhibit No. 2-A

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Group Chairman's Factual Report

(91 Pages)

(12 Photos)

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 31, 2014

Group Chairman's Factual Report

OPERATIONAL FACTORS

DCA13MA133

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A. ACCIDENT

Operator: United Parcel Service (UPS)
Registration: N155UP
Type: Airbus A300-600
Flight: UPS #1354
Location: Birmingham, Alabama
Date: August 14, 2013

B. OPERATIONAL FACTORS GROUP MEMBERS

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Captain Michel Bonnifet
Airbus Test Pilot
Airbus S.A.S.
1Rond-point Maurice Bellonte

[1] Dr. Wilson was the NTSB Human Performance Group Chairman. Operations and Human Performance Group activities were combined during the on scene activities in Birmingham, AL, and follow up work in Louisville, KY and Toulouse, France.
[2] Captain de Ziegler and Captain Bonnifet were Technical Advisors to the French Accredited Representative.

31707 Blagnac Cedex, France

C. SUMMARY

On August, 14, 2013, at about 0447 central daylight time (CDT)[3], United Parcel Service (UPS) flight 1354, an Airbus A300-600, N155UP, crashed short of runway 18 while on approach to Birmingham-Shuttlesworth International Airport (KBHM), Birmingham, Alabama. The two flight crew members were fatally injured and the airplane was destroyed. The cargo flight was operating under 14 Code of Federal Regulation (CFR) Part 121 and originated from Louisville International-Standiford Field Airport (KSDF), Louisville, Kentucky.

D. DETAILS OF THE INVESTIGATION

The National Transportation Safety Board (NTSB) investigators on the Operations and Human Performance Groups traveled to Birmingham, Alabama on Wednesday, August 14, 2013. The groups conducted the initial field phase of the investigation on scene at KBHM from August 14, 2013 to August 18, 2013.

On August 14, 2013 the Operations and Human Performance Group Chairmen arrived on scene at KBHM airport and conducted an initial examination of the wreckage. The Operations Group was formed with party members from the FAA, UPS and IPA.

On August 15, 2013, the Operations Group conducted a documentation of the cockpit and recovered flight documents and manuals. The aircraft's maintenance logbook, flight release, dispatch paperwork and approach charts were also recovered and documented. The flight crew's personal effects were recovered, inventoried and documented. ATC[4] tapes were reviewed with the ATC Group Chairman. An interview schedule was established, and requests were made to the FAA for flight crew medical and certification records, and to UPS for flight crew training and personnel records, required company manuals, checklists, and crew schedules.

On August 16, 2013, the Operations Group toured the UPS facilities at KBHM and examined and documented an exemplar UPS A300 airplane on the ramp at KBHM. Interviews were conducted with UPS personnel stationed at KBHM, the flight crew who flew the accident captain on his commute to KSDF, ground crew in KSDF and Rockford, Illinois who serviced the accident airplane, the crew's hotel van driver, the flight operations administrator who checked both pilots into their sleep rooms, and the load supervisor in KSDF for the accident flight. Requests were made for statements from the contract ground workers who were on the ramp at KBHM and witnessed the accident, and additional requests were made to the FAA regarding specifics for the instrument approach conducted by the accident flight. Additional manuals and documents were received from UPS.

[3] All times listed are CDT unless otherwise noted.
[4] Air Traffic Control.

From August 17, 2013 to August 18, 2013, the Operations Group conducted additional interviews with UPS pilots, collected statements from UPS ground workers and other airline personnel, and received support material and manuals from Airbus. Field notes were completed and delivered to the Investigator in Charge (IIC), and the on scene portion of the Operation Group's investigation concluded on August 18, 2013.

From August 25, 2013 to August 30, 2013, the Operations Group conducted a series of interviews and simulator work at the UPS Training Facility in Louisville, Kentucky. The group conducted interviews with UPS training personnel who conducted training and evaluations of the accident crew, UPS training and flight operations leadership, UPS safety department personnel, and the accident flight's dispatcher. The group also interviewed personal acquaintances of the accident crew, and other airline pilots who flew into KBHM on the morning of the accident. The group was provided a presentation on UPS procedures for non-precision[5] approaches in the A300 simulator by the UPS and IPA party members on the group. On August 29, 2013 the group concluded its activities in KSDF with a tour of the flight operations briefing area and crew rest facilities.

During September and October 2013, the Operations Group conducted additional follow-up interviews with UPS training personnel and other airline personnel, and continued to review flight documents and manuals (the federal government shutdown occurred from October 1, 2013 through October 16, 2013 and no investigative activities were conducted).

On October 28, 2013, the Operations Group Chairman accompanied the NTSB Systems Group Chairman to KSDF and assisted in A300 simulator work at the UPS Training Facility conducted as part of the Systems Group review of downloaded FMC[6] data retrieved from the accident airplane.

From December 2, 2013 to December 5, 2013, the Operations Group conducted a series of interviews and simulator work at the UPS Training Facility in Louisville, Kentucky. Technical Advisors for the French Accredited Representative (BEA and Airbus) also joined the Operations Group in Louisville. The group conducted follow-up interviews with UPS training personnel and UPS training department leadership, UPS flight operations leadership, UPS crew services personnel, the accident flight's dispatcher, and UPS/IPA members of the Fatigue Working Group. On December 4, 2013, the group conducted FAA interviews of the UPS Principal Operations Inspector (POI) and the A300 Aircrew Program Manager (APM) at the FAA Certificate Management Office (CMO) in Louisville, Kentucky. In addition, on December 4, 2013, the Operations Group provided a tutorial on UPS non-precision approach procedures to party members, and conducted additional simulator documentation.

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[5] A non-precision approach is any instrument approach that does not incorporate ground-based vertical guidance. The NavAid used for the approach provides lateral guidance only. These NavAids include: NDB, VOR, Loc-only, VOR-DME, LOC BCK CRS, and GPS LDA. Source: UPS Pilot Training Guide (PTG), Section 02.04.01.02 "Definition."

[6] The Flight Management Computer (FMC) is part of the Flight Management System (FMS), an integrated system, consisting of airborne sensor, receiver, and computer with both navigation and aircraft performance databases, which provides performance and RNAV guidance to a display and automatic flight control system (AFCS). Source: FAA Advisory Circular (AC) 90-101A. For additional information, see Systems Group Chairman's Factual Report.

On December 12, 2013, the Operations Group conducted interviews of UPS Flight Control dispatch personnel, as well as the FAA Aviation Safety Inspector (ASI) designated with oversight of the UPS dispatch operations. The Operations Group Chairman also assisted the Human Performance Group Chairman's next-of-kin interviews in November and December.

From January 7, 2014 to January 10, 2014 the Operations Group traveled to Toulouse, France to participate in presentations made by Airbus training and standards personnel, and conduct simulator evaluations in the Airbus A300 full flight simulator and engineering simulator.

On January 30, 2014, the Operations group traveled to the UPS Flight Control Center in Louisville, Kentucky to observe and document dispatcher duties and procedures.

E. FACTUAL INFORMATION

1.0 History of Flight

The accident crew began their duty day at Chicago/Rockford International Airport (KRFD). The ramp supervisor at KRFD who brought the crew their paperwork told NTSB Staff that the crew was early, did not appear rushed, and were generally "happy." The flight departed KRFD at 2134[7] and arrived at General Downing - Peoria International Airport (KPIA) at 2209. The UPS ramp specialist at KPIA who worked the flight from KPIA to KSDF stated that nothing was unusual, and it was a normal flight. The crew departed KPIA at 2255 and arrived in KSDF at 2357. The crew had 3 hours and 58 minutes in KSDF while they waited for the scheduled 0349 scheduled departure for flight 1354. According to UPS, both crew members checked into individual crew rest facilities located near the flight operations area during their break in KSDF.[8]

The UPS van driver who worked in UPS flight control administration who picked the crew up at the UPS flight operations and drove them to N155UP for flight 1354 was the same van driver who picked the crew up on their inbound arrival from KPIA. He characterized their mood as "normal," and stated nothing was out of the ordinary. At 0316, the crew acknowledged that they had the most current Operational Flight Plan (OFP version 7) via ACARS[9], and two minutes later the crew received an automated ATIS[10] via the onboard ACARS system, indicating information Alpha (A) was current, and the weather indicated winds from 010 degrees at 9 knots, 10 statute mile visibility with clear skies, temperature 15° Celsius (C), dew point temperature 10° C,

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[7] Times are listed in CDT for clarity and consistency. KSDF is located in the eastern time zone (UTC-4) and KPIA, KRFD, and KBHM are located in the central time zone (UTC -5). UTC is Coordinated Universal Time.
[8] For additional information on the crew's activities, see the Human Performance Group Chairman's Factual Report.
[9] Aircraft Communication Addressing and Reporting System (ACARS) is a digital datalink system for transmission of short, relatively simple messages between aircraft and ground stations via radio or satellite.
[10] Automatic Terminal Information Service (ATIS) is the continuous broadcast of recorded noncontrol information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. The information is continuously broadcast over a discrete VHF radio frequency or the voice portion of a local NAVAID. Arrival ATIS transmissions on a discrete VHF radio frequency are engineered according to the individual facility requirements, which would normally be a protected service volume of 20 NM to 60 NM from the ATIS site and a maximum altitude of 25,000 feet AGL. Source: Aeronautical Information Manual, Section 4-1-13.

altimeter 30.08 inches of mercury (Hg). Departures were anticipated for runways 35R and 35L at KSDF.[11]

At 0319, the crew received a pre-departure clearance (PDC) for a routing cleared as filed, with an expected initial climb to 5,000 feet, [12] and a transponder code of 4016. The routing filed with ATC for UPS1354 was to BWG (Bowling Green, Kentucky) then direct to EWO (New Hope, Kentucky), then direct to BNA (Nashville, Tennessee), then direct to RQZ (Rocket - Huntsville, Alabama), and finally direct to KBHM (Birmingham, Alabama). Hartsfield - Jackson Atlanta International Airport (KATL) was the filed alternate for the flight per 14 CFR 121.619.

The UPS load supervisor who worked UPS1354 in KSDF briefly met and spoke with the crew. He stated the first officer (FO) was already in her seat working the radios as the captain was walking out of the cockpit. He delivered the crew their paperwork around 0343, spent only a few minutes in the cockpit, and characterized the captain's mood as "normal."

UPS1354 began taxiing to runway 35R in KSDF at 0356, and at 0402, UPS1354 departed KSDF on runway 35R and was cleared by ATC to climb to 10,000 feet. At 0406 CDT, UPS1354 was given a clearance to fly direct to Bowling Green (BWG). At 0406, UPS1354 contacted Indianapolis ARTCC[13] and was given a climb clearance to 23,000 feet and cleared direct to KBHM. According to downloaded FMC data, the crew programmed the FMC to fly direct to KBHM using the NAV[14] function of the auto pilot.

At 0412, UPS1354 sent an ACARS in-range[15] downlink message that included the text message "call hotel van."[16] According to a UPS Gateway Part Time Supervisor at KBHM, the message was received with an estimated arrival time of 0451 for UPS1354, and the crew did not report any issues. At 0413 UPS1354 contacted Memphis ARTCC as they climbed to their final cruising altitude of 28,000 feet, and at 0427 they reported they were level at 28,000. According to recorded data, prior to the top of descent the crew received the current ATIS information Papa (P)[17] and the captain planned and briefed the localizer (LOC) 18 non-precision Profile approach at KBHM.[18]

Approximately 19 minutes later, at 0432, UPS1354 began its descent from 28,000, and then checked on with a separate Memphis Center ARTCC frequency descending to 24,000 feet.

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[11] For additional information on ACARS data received by the accident flight, see Attachment 12 – ACARS Data.
[12] Altitudes are mean sea level (msl) unless otherwise noted.
[13] Air Route Traffic Control Centers (ARTCC) are established primarily to provide air traffic service to aircraft operating on IFR flight plans within controlled airspace, and principally during the en route phase of flight. Source AIM Section 4-1-1.
[14] The Navigation (NAV) mode allows the FMS to couple with the auto pilot/flight director system (AFDS) in lateral axis, so that the FMS automatically controls the lateral navigation. Source: Airbus A300 Flight Crew Operating Manual (FCOM), "Systems Interfaces", page 1.20.21.
[15] According to the UPS FOM, Section 07.01.01.02.07 "In-Range Report", an in-range report will be made to the Company approximately 20 minutes before landing.
[16] To view ACARS in-range message, see Attachment 12 – ACARS Data.
[17] For detailed information on ATIS information Papa (P), see Section 7.0 "Meteorological Information" of this Factual Report.
[18] For additional information see Attachment 7 – AOM Approach Briefing Guides.

UPS1354 was further cleared to descend to 11,000 feet at the pilot's discretion, and UPS1354 acknowledged the clearance by stating they would continue the descent to 11,000 feet.

At 0441, while flying level at 11,000, UPS1354 checked on with KBHM Approach Control advising that they had the ATIS information Papa (P), and requested a lower altitude.[19] The KBHM Approach Controller acknowledged UPS1354, issued a descent clearance to 3,000 feet, and said "…uh, runway six is still closed, you want do you want uh the localizer one eight?"[20] UPS1354 responded with "yes sir, the localizer one eight will work." ATC voice transmissions and a review of recorded information indicated that the captain was the pilot flying (PF) and the FO was the pilot monitoring (PM).

A LabCorp pilot, flying a PA-31 Piper Navajo with the call sign of "Skylab 301" (airplane registration N3589X) from Nashville, Tennessee (KBNA) to KBHM, landed at approximately 0417 (about 30 minutes prior to the accident) on runway 18 using the LOC 18 approach. The LabCorp pilot, who was familiar with operations into KBHM, told NTSB Staff he remembered being in visual weather conditions "most of the time" while on the approach, and that he could see the airport from about 6 miles out and on the approach at 2,300 feet. He did not report any problems with the localizer approach.[21]

At 0442, ATC told UPS1354 to "turn ten degrees right, join the localizer, maintain three thousand." About one minute later, while UPS1354 was about 11 from the BASKN[22] final approach fix (FAF) on the localizer, ATC transmitted "UPS thirteen fifty four heavy, one one miles from BASKN, maintain two thousand five hundred till established on localizer, cleared localizer one eight approach," and UPS1354 acknowledged the clearance.

At 0445 UPS1354 contacted the KBHM Tower Controller, was given a landing clearance for runway 18 with calm winds, and the clearance was acknowledged by UPS1354. Radar data and flight data recorder (FDR) information indicated that UPS1354 intercepted and tracked the localizer to 18, and subsequently crossed the BASKN intersection at an altitude of approximately 2,500 feet, and then began a vertical speed descent from 2,500 feet after passing BASKN. FDR data further indicated that the vertical speed increased to about 1500 feet per minute (fpm) along the approach inside the FAF, and UPS1354 descended through the decision altitude (DA)[23] of 1,200 feet at a vertical speed of approximately 1500 fpm.

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[19] Information Papa included weather conditions of a 1,000 foot ceiling and 10 statute miles visibility. It also included notification of the closure of runway 6/24. For additional information, see Section 7.0 "Meteorological Information" of this Factual Report.

[20] For additional ATC information, see ATC Group Chairman's Factual Report.

[21] In addition, NTSB Staff received statements from a Southwest Airlines flight crew who landed on runway 18 from a visual approach at 2100 CDT on August 13, 2013. Both pilots stated there was nothing unusual about their approach to runway 18.

[22] BASKN was the final approach fix (FAF) and identified on the KBHM LOC18 approach chart as 6.0 miles DME (distance measuring equipment) on the localizer. The BASKN intersection was 4.7 miles from the end of runway 18. The minimum crossing altitude for BASKN depicted on the 11-2 Jeppesen KBHM LOC 18 approach was 2,300 feet.

[23] In an approach with vertical guidance, DA is a specified altitude expressed in feet above mean sea level at which a missed approach must be initiated if the required visual references to continue the approach have not been established (Source: FAA Advisory Circular 90-105). The Jeppesen chart for the KBHM LOC18 used by UPS1354 showed the DA of 1,200 msl would position the airplane 556 feet above the touchdown zone for runway 18. For

At about 0447, FDR data indicated that the crew received an EGPWS[24] aural "sink rate" alert at a recorded radio altitude of 235 feet while descending at a recorded value of 1,536 feet per minute. About 7 seconds after the "sink rate" alert, the airplane impacted trees and terrain approximately 1.2 miles from the end of the runway, and portions of the airplane came to rest approximately 3/4 of a mile from the end of runway 18. The airplane was destroyed by impact with the terrain and post-crash fire, and both flight crewmembers were fatally injured.[25]

2.0 Flight Crew Information

The accident crew consisted of a captain and a first officer as required by the limitations of the FAA approved Airplane Flight Manual and Section 01.00.01.02 (Certification Status) of the UPS A300 Aircraft Operating Manual (AOM). There were no jumpseaters or other occupants onboard the airplane.

2.1 Pairing History

The captain was initially assigned UPS A300 pairing S30158, originating on August 10, 2013 with a flight from KSDF to San Antonio International Airport (KSAT) departing at 0356 and arriving at 0617. On August 9, 2013 the captain contacted UPS crew scheduling to call off sick for the first portion of the pairing, and advised the scheduler that he would pick up the pairing on August 13, 2013 with flight 618 from KSDF to KPIA with a scheduled departure of 0314.[26] On August 12, 2013 the captain commuted to work as a jumpseater on UPS flight 1285 from Charlotte/Douglas International Airport (KCLT) to KSDF, arriving at 2232 to position him to operate flight 618 on the morning of August 13, 2013

The FO was assigned UPS A300 pairing S30158, originating on August 10, 2013 with a flight from KSDF to KSAT. According to interviews with the FO's spouse, the FO drove to KSDF from her home in Lynchburg, Tennessee. Flight 784 departed KSDF at 0357 and arrived in KSAT at 0610 CDT, with a subsequent rest period of 62 hours and 28 minutes. The FO continued operating the pairing with flight 789 from KSAT to KSDF on August 12, 2013, departing at 2151 and arriving at 0022 on August 13, 2013.

The accident crew began flying together on August 13, 2013 with flight 618, departing KSDF at 0326 and arriving KPIA at 0447. This was the first time the accident crew had flown together at UPS. According to UPS records, the captain was the PF on this leg. The crew then continued flight 618, departing KPIA at 0523 and arriving KRFD at 0553. According to UPS records, the

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more information on approach procedures, see Section 14.0 "Relevant Procedures" of this Factual Report

[24] Enhanced Ground Proximity Warning System. For more information, see Systems Group Chairman's Factual Report.

[25] Approximately 21 minutes after the accident, at 0508, a Federal Express B757 (Fedex1488) landed on runway 6 at KBHM. The Fedex captain told NTSB Staff he had encountered a solid layer of clouds on descent from 20,000 feet and did not break out of the clouds until 300 feet agl for the ILS approach to runway 6. In addition, a UPS Aircraft Maintenance Technician stated said it started raining (light drizzle) on the UPS ramp shortly after the accident. See Attachment 1 – Interview Summaries.

[26] For additional information, see Human Performance Group Chairman's Factual Report.

FO was the PF on this leg. The crew had a 14 hour and 28 minute rest period in Rockford, Illinois.

On August 13, 2013, the crew flew flight 617, departing KRFD at 2134 and arriving KPIA at 2209. According to UPS records, the captain was the PF on this leg. They then continued flight 617, departing KPIA at 2255 and arriving KSDF at 2357. According to UPS records, the FO was the PF on this leg. The crew had 3 hours and 58 minutes off while in KSDF before operating flight 1354 from KSDF to KBHM (the accident flight).[27] Flight 1354 departed on August 14, 2013 at 0355 (6 minutes after the scheduled departure time of 0349), and the accident occurred at approximately 0447.

2.1.1 Accident Pairing and 14 CFR Part 117

On January 4, 2012, the FAA published a final rule entitled ''Flightcrew Member Duty and Rest Requirements'' (77 FR 330). In that rule, the FAA created a new part, 14 CFR Part 117, which replaced the then-existing flight, duty, and rest regulations for 14 CFR Part 121 passenger operations. As part of that rulemaking, the FAA also applied the new 14 CFR Part 117 to certain 14 CFR Part 91 operations, and it permitted all-cargo operations (like UPS) operating under 14 CFR Part 121 to voluntarily opt into the 14 CFR Part 117 flight, duty, and rest regulations.

The final rule that created 14 CFR Part 117 provided that all-cargo operations that do not choose to operate under 14 CFR Part 117 would be able to operate under the same flight, duty, and rest rules that they operated under prior to the creation of 14 CFR Part 117.1 (CFR Part 121.470(b)). Implementation date of 14 CFR Part 117 was January 4, 2014. UPS did not plan to operate under 14 CFR Part 117.

According to the UPS Air Division Manager Crew Services, UPS performed a post-accident 14 CFR Part 117 comparison of the accident pairing to see if it would have been legal under those rules, and told NTSB Staff that up to the point of the accident, the pairing would have complied with 14 CFR Part 117.

2.2 Crew Experience with KBHM Airport

According to the UPS Flight Administration Manager and flight records reviewed by NTSB Staff, the captain had flown into KBHM 123 times as a 727 F/O between February 1998 and March 2001, 42 times into KBHM as an A300 F/O between May 2004 and March 2009, and 10 times (not including the day of the accident) into KBHM as an A300 captain between January 2010 and June 2013.

The FO had flown into KBHM 1 time as an A300 FO (not including the day of the accident) on December 3, 2012.

It could not be determined if any of these flights were conducted to runway 18 at KBHM or the instrument/visual approach used by the crew.

[27] For information on the crew's activities in KSDF, see Human Performance Group Chairman's Factual Report.

2.3 The Captain

The captain was 58 years old and resided in Matthews, North Carolina. His date of hire with UPS was October 29, 1990, and he was based in KSDF as an A300 captain. He began his career at UPS as a B727 Flight Engineer (FE), transitioning to B727 FO in August 1994. He attempted to upgrade to captain on the B757 in July 2000 and September 2002, voluntarily withdrawing from training on both occasions and returning to the position of B727 FO both times.[28] In April 2004 he transitioned to FO on the A300, and upgraded to captain on the A300 in June 2009.

Prior to UPS, the captain was employed by Trans World Airlines (TWA) in New York, New York as a flight engineer on the B727 since November 1989. On his UPS application for employment, the captain listed the specific reason for his leaving TWA as "seeking career stable employment." Previously he was a SD360 first officer for CCAir in Charlotte, North Carolina from October 1987 to November 1989, and a flight instructor for Tar Heel Aviation from June 1987 to October 1987.

The captain held an Airline Transport Pilot (ATP) certificate with type ratings on the A310[29] and SK65 and a First Class Medical Certificate. He also held a Flight Engineer Certificate (Turbojet) and a Flight Instructor Certificate (Airplane Single Engine, Instrument Airplane).

The captain was current and qualified under UPS and FAA requirements. A review of FAA records found no prior accident or enforcement actions, and one incident.[30] A search of records at the National Driver Registry (NDR) found no history of driver's license revocation or suspension. UPS reported the captain had no recorded disciplinary actions.

2.3.1 The Captain's Pilot Certification Record

FAA records of the captain indicated the following:

Flight Engineer – Turbojet certificate issued January 11, 1989.

Notice of Disapproval for Flight Instructor certificate issued March 26, 1985 (Oral and Flight); Areas of reexamination: Complete Flight Test.

Flight Instructor –Airplane - Single Engine (expires April 30, 1987) certificate issued April 4, 1985.

[28] According to UPS, the training department did not retain the training records for the captain's two B757 attempts that were not completed due to his voluntary withdrawal from training. For additional information, see Attachment 4 – Crew Records.

[29] According to FAA Order 8900.1, Figure 5-88 "Pilot Certification Aircraft Type Designations – Airplane," the A-300-600R and A-310 are common type ratings.

[30] On August 20, 2010, the captain was involved in an incident where the A300 (UPS Flight #1286, Aircraft Registration N163UP) he operated as PIC departed a taxiway after landing in KCLT. The incident was accepted into the ASAP program, and according to the FAA records, remediation was accomplished by the UPS A300 Chief Pilot.

Flight Instructor – Airplane – Single Engine - Instrument Airplane (expires May 31, 1989) certificate issued May 30, 1987.

Private Pilot – Airplane Single Engine Land certificate issued January 8, 1979.

Commercial Pilot – Rotocraft Helicopter – Instrument Helicopter; Private Pilot Privileges - Airplane Single Engine Land certificate issued December 22, 1982.

Commercial Pilot – Rotocraft Helicopter – Instrument Helicopter; Airplane Single Engine Land (Not valid for carriage of persons for hire in airplanes on cross-country flights of more than 50 nautical miles) certificate issued February 8, 1983.

Commercial Pilot –Airplane - Single Engine Land; Rotocraft Helicopter; Instrument – Helicopter and Airplane certificate issued July 22, 1983.

Commercial Pilot –Airplane - Single Engine Land; Rotocraft Helicopter, SK-65; Instrument – Helicopter and Airplane certificate issued August 11, 1986.

Commercial Pilot –Airplane - Single and Multiengine Land; Rotocraft Helicopter, SK-65; Instrument – Helicopter and Airplane certificate issued March 21, 1987.

Airline Transport Pilot – Airplane Multiengine Land; Commercial Privileges – Airplane Single Engine Land; Rotocraft Helicopter, SK-65; Instrument – Helicopter certificate issued September 7, 1989.

Airline Transport Pilot – Airplane Multiengine Land – A310 (A310 SIC Privileges only; A310 Circ. Apch – VMC Only); Commercial Privileges – Airplane Single Engine Land; Rotocraft Helicopter, SK-65; Instrument – Helicopter certificate issued May 9, 2006.

Airline Transport Pilot – Airplane Multiengine Land – A310 (A310 Circ. Apch – VMC Only) ; Commercial Privileges – Airplane Single Engine Land; Rotocraft Helicopter, SK-65; Instrument – Helicopter (English Proficient) certificate issued June 2, 2009.

2.3.2 The Captain's Certificates and Ratings Held at Time of the Accident

Airline Transport Pilot (issued June 2, 2009)
Airplane Multi-Engine Land
A-310 (A-310 CIRC. APCH – VMC ONLY)
Commercial Privileges Airplane Single Engine Land; Rotocraft – Helicopter, SK-65, Instrument Helicopter – English Proficient

Flight Engineer (issued February 12, 2009)[31]
Turbojet

[31] Original Flight Engineer certificate (issued January 11, 1989) was replaced February 12, 2009 to add English Proficiency.

Medical Certificate - First Class (issued April 16, 2013)
Limitations: Must have available glasses for near vision.

2.3.3 The Captain's Training and Proficiency Checks Completed[32]

Date of Hire (UPS)	October 29, 1990
Date Transitioned to A300 (FO)	April 7, 2004
Date Upgraded to Captain on A300	June 2, 2009
Date of Initial Type Rating on A300 (SIC)	May 9, 2006
Date of Most Recent Proficiency Check (CQ)[33]	June 26, 2013
Date of Most Recent Proficiency Training	June 26, 2013
Date of Most Recent PIC Line Check	March 21, 2013

2.3.4 The Captain's Flight Times

The captain's UPS flight times provided to the NTSB:[34]

Total pilot flying time	6,406
Total Pilot-In-Command (PIC) time	1,516
Total A300 time	3,265
Total A300 PIC time	1,516
Total flying time last 24 hours	3
Total flying time last 30 days	41
Total flying time last 60 days	72
Total flying time last 180 days	138
Total flying time last 12 months	407

2.3.5 The Captain's 72-Hour History

For information on the captain's 72 hour history, see Human Performance Group Chairman's Factual Report.

2.4 The First Officer

The first officer (FO) was 37 years old, and resided in Lynchburg, Tennessee. Her date of hire with UPS was November 16, 2006, and she was based in KSDF as an A300 FO. She began her

[32] Information provided to the NTSB by UPS.
[33] A300 CQ (annual recurrent) curriculum prerequisites. To be eligible for AQP CQ, an individual must have successfully completed either AQP Qualification or CQ within the preceding 12 calendar months in that same duty position and on that same aircraft type. Source: UPS Advanced Qualification Program (AQP) Manual Volume 6, Chapter 8, page 3.
[34] A review of the captain's employment records did not list flight times at his previous employers or the military. On April 16, 2013, the captain listed "8,600 hours" as his total time for his First Class Medical application. Times listed here are UPS flight times only, and derived from UPS flight records and NTSB Form 6120.

career at UPS as a B727 FE. She transitioned to B757 FO on October 30, 2007, followed by a transition to B747 FO on June 29, 2009 and a transfer to the Anchorage (ANC) base. On June 7, 2012 she transitioned to FO on the A300, and was based back in KSDF.

According to UPS personnel records, previous to UPS she was a pilot for Volaer in Smyrna, Tennessee since May 6, 2006. On her UPS application for employment, the FO listed the specific reason for her leaving Volaer as "currently employed." She was also employed twice as a pilot for Fraction Air in Nashville, Tennessee, once from November 1, 2004 to May 1, 2006, and from January 1, 2003 to October 1, 2004. She also listed employment with ExpressJet in Houston, Texas from October 1, 2004 to November 15, 2004.

She held an Airline Transport Pilot certificate with type ratings on the A-310 (SIC), B-747-4, B-757, B767, BE-400, HS-125, and MU-300 and a First Class Medical Certificate. She also held a Flight Engineer Certificate (Turbojet).

The FO was current and qualified under UPS and FAA requirements. A review of FAA records and PRIA[35] records on file with UPS found no prior accident, incident or enforcement actions. A search of records at the National Driver Registry (NDR) found no history of driver's license revocation or suspension. UPS reported the FO had no recorded disciplinary actions.

2.4.1 The First Officer's Certification Record

FAA records of the first officer indicated the following:

<u>Flight Engineer – Turbojet</u> certificate issued January 22, 2007.

<u>Private Pilot – Airplane Single Engine Land</u> certificate issued March 17, 1995.

<u>Private Pilot – Airplane Single Engine Land; Instrument Airplane</u> certificate issued May 27, 1999.

<u>Commercial Pilot – Airplane Single Engine Land; Instrument Airplane</u> certificate issued June 6, 2000.

<u>Commercial Pilot – Airplane Single and Multiengine Land (Airplane Multiengine VFR Only); Instrument Airplane</u> certificate issued July 20, 2000.

<u>Commercial Pilot – Airplane Multiengine Land;</u> Instrument Airplane certificate issued September 21, 2000.

[35] Pilot Records Improvement Act of 1996. PRIA requires that a hiring air carrier under 14 CFR parts 121 and 135, or a hiring air operator under 14 CFR part 125, request, receive, and evaluate certain information concerning a pilot/applicant's training, experience, qualification, and safety background, before allowing that individual to begin service as a pilot with their company.

Airline Transport Pilot – Airplane Multiengine Land – BE-400, MU-300; Commercial Privileges – Airplane Single Engine Land certificate issued March 6, 2004.

Airline Transport Pilot – Airplane Multiengine Land – BE-400, MU-300, HS-125; Commercial Privileges – Airplane Single Engine Land certificate issued February 27, 2006.

Airline Transport Pilot – Airplane Multiengine Land – B-757, B-767, BE-400, MU-300, HS-125 (B-757, B-767 Circ. Apch. – VMC Only); Commercial Privileges – Airplane Single Engine Land certificate issued November 30, 2007.

Airline Transport Pilot – Airplane Multiengine Land – B-747-4, B-757, B-767, BE-400, MU-300, HS-125 (B-747-4, B-757, B-767 Circ. Apch. – VMC Only); Commercial Privileges – Airplane Single Engine Land (English Proficient) certificate issued June 29, 2009.[36]

Airline Transport Pilot – Airplane Multiengine Land – A-310, B-747-4, B-757, B-767, BE-400, MU-300, HS-125 (A-310 B-747-4, B-757, B-767 Circ. Apch. – VMC Only; A310 SIC Privileges Only); Commercial Privileges – Airplane Single Engine Land (English Proficient) certificate issued June 7, 2012.

2.4.2 The First Officer's Certificates and Ratings Held at Time of the Accident

Airline Transport Pilot (issued June 7, 2012)
Airplane Multiengine Land
A-310, B-747-4, B-757, B-767, BE-400, MU-300, HS-125 (A-310 B-747-4, B-757, B-767 CIRC APCH – VMC Only; A310 SIC Privileges Only);
Commercial Privileges – Airplane Single Engine Land - English Proficient

Flight Engineer (issued November 2, 2009)[37]
Turbojet

Medical Certificate - First Class (issued January 7, 2013)
Limitations: None

2.4.3 The First Officer's Training and Proficiency Checks Completed[38]

Date of Hire (UPS)	November 16, 2006
Date Transitioned to A300 (FO)	June 7, 2012
Date of Initial Type Rating on A300 (SIC)	June 7, 2012
Date of Most Recent Proficiency Check (CQ)	June 26, 2013
Date of Most Recent Proficiency Training	June 26, 2013

[36] The FO's ATP certificate was reissued June 15, 2010 with the FO's married name.
[37] Original Flight Engineer certificate (issued January 22, 2007) was replaced November 2, 2009 for an address change.
[38] Information provided to the NTSB by UPS.

2.4.4 The First Officer's Flight Times

The accident first officer times provided to the NTSB:[39]

Total pilot flying time	4,721
Total Pilot-In-Command (PIC) time	1,764
Total A300 time (SIC)	403
Total flying time last 24 hours	3
Total flying time last 30 days	31
Total flying time last 60 days	54
Total flying time last 180 days	132
Total flying time last 12 months	335

2.4.5 The First Officer's 72-Hour History

For information on the FO's 72 hour history, see Human Performance Group Chairman's Factual Report.

2.5 Flight Crew Duties and Responsibilities

The UPS Flight Operations Manual (FOM)[40], Section 02.01.01.04 defined the duties of the flight crews at UPS, and stated:

> *ALL CREWMEMBERS*
> *All crewmembers are expected to use proper judgment at all times to ensure the safe conduct of the flight.*
>
> *CAPTAIN*
> *• Allow only current and qualified crewmembers (same aircraft type) to occupy a control seat.*
> *• Occupy a control seat during takeoff and landing.*
> *• On flights with an augmented or heavy crew, determine each pilot's rest period after due consideration of individual desires and regulatory requirements.*
> *• Assume final responsibility and authority for the safe operation and conduct of the flight, at all times, including inflight rest periods.*
> *• Resolve all maintenance discrepancies and MEL[41] considerations to his satisfaction.*
> *• Make the final decision regarding inflight diversion.*

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[39] Based on UPS employment records, the FO had 3,468 total hours and 1,764 PIC hours prior to being hired by UPS. Those hours were added to the flight times accrued at UPS, derived from flight records and NTSB Form 6120, for total pilot flying time and total PIC times listed here.

[40] The FOM includes regulations, policies and procedures that pertain to the conduct of flights and are designed primarily for crewmembers and dispatchers. Information from applicable UPS Operations Specifications (OpSpecs) and other required and appropriate sources are included.

[41] Minimum equipment list.

FIRST OFFICER
The First Officer's and IRO's (if applicable) primary responsibilities are to assist the Captain in the safe and efficient operation of the aircraft while performing assigned duties. They are also charged with the responsibility of immediately informing the Captain of unsafe conditions or improper handling which could place the aircraft or flight crew in jeopardy.

3.0 Accident Dispatcher

The accident dispatcher for UPS1354 was 53 years old and his date of hire with UPS was June 4, 2012. According to UPS personnel records, prior to UPS the dispatcher was an independent consultant for Atlas Air Worldwide, employed by The Premier Group in White Plains, New York since August 2011. His resume on file with UPS also listed employment as an independent consultant for Baltia Air Lines in Jamaica, New York from December 1998 to February 2012, and as a the Director and Senior Manager of Flight Dispatch Ops at Atlas Worldwide Holdings from December 1998 to July 2011. On his UPS application for employment, the dispatcher listed the specific reason for his leaving Atlas as "company lay off."

He received his training as a dispatcher from Phoenix East Aviation in Daytona Beach, Florida in 1996. He was a licensed pilot, and held a Commercial Pilot Certificate with instrument multi and single engine land ratings. He told NTSB Staff he had not flown in over 20 years.

3.1 Dispatcher Responsibilities

Flights operating under the provisions of 14 CFR 121 (such as the accident flight) were required to comply with 14 CFR 121.593 "Dispatching authority: Domestic operations" which states the following:

Except when an airplane lands at an intermediate airport specified in the original dispatch release and remains there for not more than one hour, no person may start a flight unless an aircraft dispatcher specifically authorizes that flight.

The dispatcher and pilot in command (PIC) shared equal responsibility for the operational safety of a flight under the provisions of 14 CFR 121.597 "Flight release authority: Supplemental operations," which states:

(a) *No person may start a flight under a flight following system without specific authority from the person authorized by the operator to exercise operational control over the flight.*[42]
(b) *No person may start a flight unless the pilot in command or the person authorized by the operator to exercise operational control over the flight has executed a flight release setting forth the conditions under which the flights will be conducted. The*

[42] According to the UPS RCPM-OPS Volume11 – Flight Control, Section 05.01.01.20 "Flight Control Aircraft Dispatcher Job Description," the Flight Control Aircraft Dispatcher responsibilities included the following: Must possess a FAA Aircraft Dispatcher Certificate and be authorized by UPS to exercise full operational control over any flight.

pilot in command may sign the flight release only when he and the person authorized by the operator to exercise operational control believe that the flight can be made with safety.

The UPS FOM Volume 2,[43] Section 02.01.01.01 "Domestic/Flag Joint Responsibility and Authority" stated, in part:

For Domestic and Flag Operations, the Captain and Flight Dispatcher:
• Are jointly responsible for the safe operation of each flight
• Have the responsibility for determining the suitability of weather, airport, traffic conditions and airway facilities

3.2 Dispatcher Duties

The dispatcher duties and responsibilities at UPS were outlined in the Flight Operations Manual (FOM) Volume 2. The Flight Control volume of the Regulatory Compliance Procedures Manual - Flight Operations (RCPM-OPS) Volume 11 provided an overview of the administration of the Flight Control department and documented the organizational plans for accomplishing the Flight Control department's mission.

Dispatchers at UPS used the Lufthansa Systems Lido Operations Center (Lido) flight planning system to flight plan UPS1354. According to the UPS Flight Operations Compliance Supervisor, dispatchers would use the first two hours of their shift for set up and turnover brief. Their workload was established by a list of flights populated from Network Planning. Dispatcher's used Flight Explorer and Lido IFM (Inflight Monitor) for flight following. For weather planning, dispatchers could use WSI (Weather Services International) or Aviation Sentry online weather services to review current and forecasted weather. Both services provided airport METARs[44] that included remarks. The WSI and Aviation Sentry products were used by the dispatcher to review weather. However, the weather printed on the pilot's Flight Briefing Package and delivered to the pilots originated through the Lido flight planning system. The METARs produced by the Lido system did not include the remarks section of the METAR.[45]

A review of the dispatch package provided to the flight indicated that the KBHM METAR weather was provided for the 0712Z (0212 CDT) and 0734Z (0234 CDT) observations. The flight had a scheduled departure of 0849Z (0349 CDT). There were no remarks included in the METAR observations included on the dispatch package provided the crew of UPS1354, either for the departure airport, destination airport, or destination alternate airport(s).

[43] The FOM at UPS was made up of two volumes. Volume 1, consisting of five chapters, is only available on the Flight Operations website, Library tab. This volume contains administrative information focusing on the operation of the airline and administrative tasks. Volume 2, consisting of 12 chapters, is available on the Flight Operations website, Library tab, and on all aircraft as a printed manual. This volume contains information pertinent to the dispatcher and pilot on the planning and operation of a flight.
[44] Aviation routine weather reports (METAR) are taken manually by NWS, FAA, contractors, or supplemental observers. METAR reports are also provided by Automated Weather Observing System (AWOS), Automated Surface Observing System (ASOS), and Automated Weather Sensor System (AWSS). Source: AIM 7-1-1.
[45] For additional information, see Section 8.1 "METARs Remarks Removal" of this Factual Report.

The dispatcher told NTSB Staff the flight was planned to tanker fuel to KBHM for the turn, and he planned about 58,000 pounds of fuel onboard. Prior to the flight, the load supervisor called the dispatcher and told him the cargo load would be heavier than expected, and the cargo weight went from 80,000 pounds to 103,000 pounds, and they defueled the airplane to 34,600 pounds of fuel. The flight had an extra 7,000 pounds of fuel on board.

The estimated arrival time into KBHM required the flight to land on runway 18 (7,099 feet long) because the longer runway (runway 6/24 which was 11,998 feet long) was NOTAM out of service due to maintenance being conducted on the runway lighting system, and would not re-open until 0500 CDT (10 minutes after the scheduled arrival of UPS1354 into KBHM).[46] A review of the pilot's Flight Briefing Package created by the dispatcher through the Lido flight planning system[47] contained the NOTAM for the 6/24 closure from 0400 to 0500, and landing performance data for runway 18 was included in the paperwork. The dispatcher told NTSB Staff he was aware of the NOTAM closing runway 6/24, and had planned on the flight to land on runway 18.[48]

The dispatcher also told NTSB Staff that he reviewed the localizer approach to runway 18 at KBHM prior to dispatching UPS1354 using the Jeppesen E-link to view the approach chart, and determined that the localizer approach to runway 18[49] was not legal due to the note in the minimums section of the chart stating the approach was not authorized at night.[50]

The dispatcher further told NTSB Staff the RNAV approach was available to the crew, and that was the legal basis for him dispatching the flight to BHM, and there was nothing in the paperwork advising the crew that there was only one approach available to them.

14 CFR 121.601 "Aircraft dispatcher information to pilot in command: Domestic and flag operations" states, in part:

> *(a) The aircraft dispatcher shall provide the pilot in command all available current reports or information on airport conditions and irregularities of navigation facilities that may affect the safety of the flight.*

The UPS Flight Control Shift Manager told NTSB Staff that dispatchers at UPS could speak to the crew via multiple means, including via cell phone or land line, satellite communications (Satcom), the Aircom Server on most airplanes, and the ACARS.[51] The communications would be available to the dispatcher while he was at his desk, and they also had a phone patch capability. She said dispatchers were encouraged to contact flight crews through their training and "while on the floor."

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[46] For additional information, see Survival Factors Group Chairman's Factual Report.

[47] For additional information on the Lido flight planning system used by UPS, see Section 8.0 "Lido Dispatch Program" of this Factual Report.

[48] There were two instrument approaches to runway 18 at KBHM; the LOC18 approach and the RNAV 18 approach.

[49] For additional information, see Section 11.2 "Charts" of this Factual Report.

[50] Sunrise for Birmingham, AL was 0609 CDT. Night conditions prevailed at the time of the accident.

[51] According to the UPS A300 Systems Manual, Section 05.01.02.03, the A300 also has SECAL (Selective Calling system) capability that allows the crew to communicate with ATC, either through VHF or HF radio, or with the company through ACARS.

The dispatcher of UPS1354 told NTSB Staff he did not speak with the crew of UPS1354. He did not advise the captain of UPS1354 the status of the localizer approach, telling NTSB Staff he did not know if he would tell the crew that approach was not authorized at night because "professional to professional they would probably be insulted for me saying that." He assumed the crew knew about the chart since they used the charts every day. The dispatcher also told NTSB Staff that he generally did not talk to the pilots, and usually the reasons he would talk to them was during the initial boarding after the crew discovered an MEL not on the flight plan, something new on the airplane, or they would talk about significant weather enroute or at the destination.

The UPS Flight Control Shift Manager told NTSB Staff if there was one approach to that runway that the dispatcher was informed was illegal for the runway, the dispatcher would "absolutely" be required to inform the crew.

3.3 Dispatcher Certification Records

Dispatchers were certified under the provisions of 14 CFR 65.55 "Knowledge requirements" and 14 CFR 65.57 "Experience or training requirements," and qualified to dispatch under 14 CFR 121 per 14 CFR 121.463 "Aircraft dispatcher qualifications."

The accident dispatcher held an FAA Aircraft Dispatcher certificate, dated December 7, 2005.

According to the FAA, there were no PTRS[52] records or enforcement actions related to the accident dispatcher.

3.4 Dispatcher Training

Flight dispatchers were required to be trained under the provisions of 14 CFR 121.415 "Crewmember and dispatcher training requirements" and 14 CFR 121.422 "Aircraft dispatchers: Initial and transition ground training." The training curriculum for dispatchers was outlined in the UPS Flight Operations Training Manual (FOTM). According to a UPS Flight Control Shift Manager, after initial training, general subjects and all classroom instruction, the dispatcher went on the floor for specific training on the job and "apply what you do." They were required to spend a specific number of days on the desk, as well as go through a written oral and practical exam. The oral was 9 hours long, and dispatchers would go through the entire training curriculum that they had been trained on in the FOTM. They did performance problems, looked at MEL problems and explained what they would do and how they would apply those penalties and restrictions. The Shift Manager told NTSB Staff that the oral exam was a "rehash" of the written test. The practical test was where the dispatcher sat down with one full time supervisor

[52] The Program Tracking and Reporting Subsystem (PTRS) is a comprehensive information management and analysis system used in many Flight Standards Service (AFS) job functions. It provides the means for the collection, storage, retrieval, and analysis of data resulting from the many different job functions performed by Aviation Safety Inspectors (ASIs) in the field, the regions, and headquarters. This system provides managers and inspectors with current data on airmen, air agencies, air operators, and many other facets of the air transportation system. Source: FAA.

and dispatched "live" flights under the name of the dispatcher who was giving the practical test, which lasted 9 hours.

Flight dispatchers were also required to receive recurrent training to the requirements specified in 14 CFR 121.427 (a)(b)(c) and 14 CFR 121.463(c). The course must provide refresher training in those subjects and procedures as required by 14 CFR 121.422(a) and 14 CFR 121.629. Recurrent dispatcher training was required each twelve (12) months by 14 CFR 121.433(c)(1)(ii), and the UPS dispatcher initial and recurrent training curriculums were outlined in the UPS FOTM. According to the UPS Flight Control Shift Manager, dispatchers had a fall and spring recurrent. Recurrent was for 1 day in spring and 1 day in the fall for a total of 2 days each year.

Dispatchers were also required to receive an annual competency check. According to information provided to the NTSB by UPS, the process that the checking supervisor followed when conducting Competency Checks was as follows:

> *Once the check is completed and scored, the Dispatcher and the Supervisor goes to an office or conference off the floor and out of the core. In this private setting they review the questions that were missed to ensure that the Dispatcher has an understanding of why they missed the question. The correct answer is reviewed in detail.*

3.5 Dispatcher's Training Records

The training records for the accident dispatcher provided by UPS indicate the following:

UPS Date of Hire	June 4, 2012
Dispatch Basic Indoctrination	August 31, 2012
Recurrent Ground Training (Day 1)	November 2, 2012
Recurrent Ground Training (Day 2)	January 24, 2013
A300	August 31, 2012
Weight and Balance/Lido Training	August 31, 2012
Recurrent Competency Check	August 23, 2013
EWINS[53]	N/A

3.6 Dispatcher Duty Times and Rest Requirements

Dispatcher duty times were governed under the provision of 14 CFR 121.465 "Aircraft dispatcher duty time limitations: Domestic and flag operations", which states, in part:

[53] Enhanced Weather Information System (EWINS) is an FAA approved proprietary system for tracking, evaluating, reporting, and forecasting the presence or lack of adverse weather phenomena. An EWINS is authorized to produce flight movement forecasts, adverse weather phenomena forecasts, and other meteorological advisories. For more detailed information regarding EWINS, see the Aviation Weather Services Advisory Circular 00-45 and the Air Transportation Operations Inspector's Handbook 8900.10. Source: Aeronautical Information Manual (AIM), Chapter 7, Safety of Flight, Section 1 "Meteorology." The accident dispatcher was not EWINS certified.

(a) Each certificate holder conducting domestic or flag operations shall establish the daily duty period for a dispatcher so that it begins at a time that allows him or her to become thoroughly familiar with existing and anticipated weather conditions along the route before he or she dispatches any airplane. He or she shall remain on duty until each airplane dispatched by him or her has completed its flight, or has gone beyond his or her jurisdiction, or until he or she is relieved by another qualified dispatcher.

(b) Except in cases where circumstances or emergency conditions beyond the control of the certificate holder require otherwise—

(1) No certificate holder conducting domestic or flag operations may schedule a dispatcher for more than 10 consecutive hours of duty;

(2) If a dispatcher is scheduled for more than 10 hours of duty in 24 consecutive hours, the certificate holder shall provide him or her a rest period of at least eight hours at or before the end of 10 hours of duty.

(3) Each dispatcher must be relieved of all duty with the certificate holder for at least 24 consecutive hours during any seven consecutive days or the equivalent thereof within any calendar month.

Dispatchers at UPS were scheduled according to the FOM Volume 2 (Section 03.01.03.08), 14 CFR 121.465, and the working agreement between UPS and the Transport Workers Union (TWU), which represented the dispatchers. The current working agreement between UPS and the TWU expires March 1, 2015. Dispatchers at UPS were also covered under the ASAP[54] safety reporting program.

According to the FOM Volume 2, Section 01.01.01.01 "General", each dispatcher on a given shift was assigned a finite number of flights to pre-plan, release, monitor, inform and control, as defined in 14 CFRs 121.533 and 121.535. The number of Flight Dispatchers assigned to each shift depended on the timing of the particular shift as well as the frequency and number of planned flights (scheduled, supplemental and non-revenue) as needed. The actual number of flights each dispatcher handled varied with time of day, geographic area and concentration of flights during their duty period.

According to the UPS Flight Control Shift manager, UPS had a total of about 67 dispatchers who were members of the TWU, and 14 management dispatchers. UPS Flight Control also had 3

[54] Aviation Safety Action Program. According to the FAA Advisory Circular 120-66B "Aviation Safety Action Program (ASAP)", the objective of the ASAP is to encourage air carrier and repair station employees to voluntarily report safety information that may be critical to identifying potential precursors to accidents. The Federal Aviation Administration (FAA) has determined that identifying these precursors is essential to further reducing the already low accident rate. Under an ASAP, safety issues are resolved through corrective action rather than through punishment or discipline. The ASAP provides for the collection, analysis, and retention of the safety data that is obtained. ASAP safety data, much of which would otherwise be unobtainable, is used to develop corrective actions for identified safety concerns, and to educate the appropriate parties to prevent a reoccurrence of the same type of safety event.

Shift Managers, 1 Standards Manager, 10 Supervisors (6 Shift Coordinators, 4 Standards Supervisors), 5 Meteorologists and 2 Administrative Assistants.[55]

The total number of dispatchers working at any one time varied with the time and the shift.[56] They would have about 14 dispatchers for the second shift, 14-15 for the 3rd shift, and about 10-12 for the day shift. Dispatchers worked 9 hour shifts, which included 4 days worked, 3 days off, 4 days worked and 3 days off. The Shift Manager said UPS complied with the CFRs, but UPS was even more restrictive than the CFRs regarding duty times.[57]

The accident dispatcher told NTSB Staff that he was scheduled to work the domestic desk on the night of the accident, and it was a midnight shift that went from 11pm to 8 am, which included 1 hour for turnover and briefing. At the time of accident, he was working 20 flight plans, and flight watched 10-15 flights. He said he was a "relief dispatcher" and had a standard schedule. He filled in for vacations and sick calls, and said he never worked the same shift or same time period.

3.7 Dispatcher Resource Management Training

Dispatchers were required to receive Dispatch Resource Management Training per 14 CFR 121.404 "Compliance dates: Crew and dispatcher resource management training," and 14 CFR 121.422(a)(1)(ix) "Approved dispatcher resource management (DRM) initial training." According to the UPS FOTM, Section 1 "Crew Resource Management (CRM) and Dispatch Resource Management Training, " CRM/DRM referred to the effective use of all available resources; human, hardware, and information, and was one way of addressing the challenge of optimizing the human/machine interface and accompanying interpersonal activities. These activities include communication, team building, situational awareness, problem solving, conflict management, and decision making. Each component must be introduced, discussed, and continually renewed.

According to UPS, the airline utilized various instructional techniques including open forum, role playing, and video presentation were employed to generate in-depth discussions on various behavioral styles and their effects on crew effectiveness. In addition, dispatchers were also introduced to the NASA Fatigue Countermeasures program and operational fatigue management techniques.

According to the UPS FOTM, DRM training at UPS was comprised of five components:

(a) Initial indoctrination and awareness.
(b) Operational familiarity and practice during On-Job-Training.
(c) DRM Seminar.

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[55] Source: UPS Flight Control Work Schedule and Department of Defense Master UPS Survey 2013.
[56] 14 CFR 121.395 "Aircraft dispatcher: Domestic and flag operations" states "Each certificate holder conducting domestic or flag operations shall provide enough qualified aircraft dispatchers at each dispatch center to ensure proper operational control of each flight."
[57] The duty time and rest requirements for dispatchers at UPS were included in the Flight Control volume of the Regulatory Compliance Procedures Manual - Flight Operations (RCPM-OPS) Volume 11, Section 02.01.01.

(d) Recurrent practice and feedback.
(e) Continual reinforcement in all facets of operations.

The UPS FOTM, Chapter 19, page 6 stated the following objectives for their DRM training:

> *(1) UPS DRM training has been developed to prevent aviation accidents by improving dispatcher performance through better coordination.*
> *(2) All dispatchers must understand that while high technical proficiency is an absolute must in commercial aircraft operations, it alone does not guarantee safe operations in the absence of effective coordination.*
> *(3) DRM is centered on optimizing communication between diverse groups within an airline and the related interpersonal issues while using available resources.*
> *(4) Two expected benefits of DRM training to the aircraft dispatcher are:*
> *(a) Better management of information that has a direct impact on safe flight operations; and*
> *(b) Better interface with each PIC, consistent with the joint responsibility concept outlined in part 121.*

According to the UPS FOTM, initial DRM training for dispatchers consisted of a 14 hour seminar on DRM. Recurrent training for dispatchers at UPS included a 1 hour module on DRM. The dispatchers at UPS did not conduct DRM training with the pilots. The FAA ASI with oversight responsibilities for dispatchers told NTSB Staff that recurrent DRM was not a full DRM course, but rather a "what would you do" training session.

4.0 Medical and Pathological Information

For flight crew medical and pathological information, see Human Performance Group Chairman's Factual Report.

The dispatcher submitted to post-accident drug[58] and alcohol testing on August 14, 2013. Both tests were reported as a negative.

[58] Drug testing included screening for THC, COC, PCP, OPI, and AMP.

5.0 Aircraft Information

Photo 1: Accident Airplane (N155UP)

The accident airplane (Registration N155UP, Serial #0841) was an Airbus A300 F4-622R. The airplane was built in 2004, registered to United Parcel Service Co., and held a transport category airworthiness certificate dated March 24, 2004.

The aircraft was certified in the Transport Category (CFR 25 and CFR 36) for the following types of operation when the appropriate instruments and equipment required by the airworthiness and/or operating regulations were installed and approved and were in operating condition:[59]

- Icing Conditions
- Extended Overwater Flight
- Day and Night VFR
- IFR

6.0 Weight and Balance

The Distributed Weight and Balance (DWB) was the FAA accepted Weight and Balance (W&B) program used by UPS.[60] This system was used to prepare the load manifest for all domestic, flag and supplemental flights. Prior to block-out, the departure gateway was responsible for presenting a complete and accurate load manifest to the flight crew. This manifest was used to determine aircraft performance, reference speeds and trim settings.[61]

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[59] Source: UPS A300 Aircraft Operating Manual (AOM) Section 01.00.01.02 "Certification Status."

[60] Source: UPS FOM 09.01.01 "Distributed Weight and Balance" (DWB).

[61] The weight and balance system was not capable of incorporating MEL/CDL restrictions. It would print a load manifest as long as the load fell within the normal unrestricted aircraft limits. The flight crew must manually check that the actual aircraft weight and/or CG was within limits when restricted by an MEL/CDL item. The accident airplane did not have any open MEL/CDL items listed in the logbook recovered at the accident site.

The following weight and balance information was provided by UPS using data obtained from the DWB computer generated weight and balance for UPS1354 on August 14, 2013.

WEIGHT & BALANCE / PERFORMANCE		
	Basic Operating Weight	179,200
	Passenger Weight	N/A
	Baggage/Cargo Weight (Shown on Form)	89,227
	Baggage/Cargo Weight (Actual Wreckage)	N/A
	Zero Fuel Weight	268,427
	Maximum Zero Fuel Weight	286,600
	Fuel Weight (per defueling slip)	34,650
	Ramp Weight	303,077
	Maximum Ramp Weight	377,870
	Taxi Fuel Burn (per flight release)	1,000
	Actual Takeoff Weight	302,077
	Maximum Takeoff Weight	319,100
	Maximum Structural Weight	375, 880
	Estimated Fuel Burn to Accident Site (flight plan)	10,500
	Estimated Landing Weight	291,577
	Maximum Landing Weight	308,650
	Takeoff CG	28.0
	CG Limits (per flight release)	28.0 – 28.9
	Landing Flaps	40°
	V_{REF}	133
	V_{APP}[62] (per AOM 03.09.01.02) (V_{REF} + 5 minimum)	138

7.0 Meteorological Information[63]

The Terminal Aerodrome Forecast (TAF) issued by the National Weather Service for KBHM and included in the pilot's Flight Briefing Package provided to the crew of UPS1354 called for variable winds at 3 knots, greater than 6 statute miles visibility, and a broken ceiling at 400 feet at the flights estimated time of arrival for UPS1354 (0449).[64] The decision altitude (DA) used by the crew of UPS1354 for the KBHM LOC18 approach was 1200 feet mean sea level, or 556 feet above ground level. According to the UPS Flight Operations Compliance Supervisor, the Lido flight planning system[65] used by dispatchers at UPS had a Planning Parameter screen that would

[62] Final Approach Speed. The FMC computes V_{REF} for Flaps 30/40 based on projected aircraft landing weight. This value is then used to display V_{APP} (15/20 or 30/40) on the CDU TO/APPR page.
[63] For additional information, See Meteorology Group Chairman's Factual Report.
[64] 14 CFR 121.613 states "Except as provided in §121.615, no person may dispatch or release an aircraft for operations under IFR or over-the-top, unless appropriate weather reports or forecasts, or any combination thereof, indicate that the weather conditions will be at or above the authorized minimums at the estimated time of arrival at the airport or airports to which dispatched or released."
[65] For more information on the Lido flight planning system, see Section 8.0 "Lido Dispatch Program" of this Factual Report.

issue an “unsuitable” message if the ceilings were forecast below the lowest DA/MDA[66] for an approach to the destination airport. The accident dispatcher was asked by NTSB Staff if he recalled seeing any “unsuitable” messages for the accident flight, including an “unsuitable” message for low ceilings, and he said that while he “diligently” checked and followed up on these types of messages, he could not recall seeing any “unsuitable” messages for UPS1354.[67]

KBHM had a Federally installed and maintained Automated Surface Observation System (ASOS) at the airport and a certified National Weather Service (NWS) observer on site. The official observations surrounding the period were as follows:

METAR KBHM 140753Z 00000KT 9SM OVC008 23/22 A2996 RMK AO2 CIG 007V011 SLP137 T02330217=
SPECI KBHM 140848Z 33003KT 10SM OVC010 23/22 A2997 RMK AO2 CIG 006V013=
METAR KBHM 140853Z 00000KT 10SM BKN010 OVC075 23/22 A2997 RMK AO2 CIG 006V013 SLP138 T02330217 52000=
SPECI KBHM 140904Z 00000KT 10SM SCT010 BKN075 23/22 A2996 RMK AO2=

Accident occurred at approximately 0947Z.

METAR KBHM 140953Z 34004KT 10SM FEW011 BKN035 OVC075 23/22 A2997 RMK AO2 SLP141 T02330222=

The KBHM special weather observation at 0353 CDT (0853Z) called for winds calm, visibility unrestricted at 10 miles,[68] ceiling broken at 1,000 feet, overcast at 7,500 feet, temperature 23° C, dew point temperature 22° C, altimeter 29.97 inches of mercury (Hg). Remarks from the automated observation system showed a ceiling 600 feet variable 1,300 feet, sea level pressure 1013.8-hPa, temperature 23.3° C, dew point 21.7° C, 3-hour pressure tendency rising and falling 0.00-hPa.

The ATIS received by the crew of UPS1354 as the flight approached KBHM contained this 0353 CDT (0853Z) weather observation, and was as follows:

> *Birmingham Airport information PAPA. Zero eight five three zulu observation. Sky condition ceiling one thousand broken seven thousand five hundred overcast. Temperature two three dew point two two altimeter two niner niner seven. Localizer runway one eight in use. Landing and departing runway one eight. Notice to Airmen runway six/two four closed. All departing aircraft contact tower one one niner point niner for clearance, taxi and takeoff. Advise controller on initial contact you have PAPA.*

[66] Minimum descent altitude.
[67] For further information, see Attachment 18 – Dispatcher Statement and Interviews.
[68] 14 CFR 121.651 states in part that no pilot may continue an approach past the final approach fix, or where a final approach fix is not used, begin the final approach segment of an instrument approach procedure “at airports within the United States and its territories or at U.S. military airports, unless the latest weather report for that airport issued by the U.S. National Weather Service, a source approved by that Service, or a source approved by the Administrator, reports the visibility to be equal to or more than the visibility minimums prescribed for that procedure.” The visibility minimum for the KBHM LOC18 approach was 1 5/8 miles (Category C based on an approach speed of between 121 and 140 knots). The approach speed for UPS1354 was 138 knots.

The remarks section of the 0353 CDT (0853Z) weather observation that included the automated observation of a 600 foot ceiling variable to 1,300 foot ceiling was not included in the ATIS received by UPS1354.

8.0 Lido Dispatch Program

According to UPS, in 2004 the UPS Flight Control department began using the Lufthansa Systems Lido Operations Center (Lido) flight planning system developed by Lufthansa.[69] The flight planning system calculated the most efficient route between two points, based on weather, winds, terrain and other factors. According to the UPS Flight Planning Support Manager, prior to the Lido flight planning system the UPS dispatcher had to rely on a variety of other systems and business applications on the dispatcher's computer station to perform their work planning a flight. The Lido system consolidated multiple applications into a single system.

The UPS Operations Specifications (OpSpecs) A010 "Aviation Weather Information" stated, in part:

> *In accordance with § 121.101, a certificate holder conducting domestic or flag operations is authorized to use the following sources of aviation weather information:*
> *(1) For operations within the 48 contiguous United States and the District of Columbia, use weather reports and forecasts prepared by the U.S. National Weather Service or a source approved by the U.S. National Weather Service, in accordance with §121.101(b)(1).*

The UPS Flight Planning Support Manager and primary user representative for the Lido system told NTSB Staff that the World Area Forecast Center (WAFC) was "the primary source for all the op met data, which included TAFs, METARS, upper air data, and significant weather charts."[70]

The UPS FOM Section 03.01.01.01 "Approved Sources of Weather" stated:

> *Approved sources of weather information used to control UPS domestic, flag or supplemental flights include:*
>
> - *The U.S. Weather Bureau and sources approved by the U.S. Weather Bureau*
> - *The National Weather Service of any other nation*
> - *Specific contractual weather services*
>
> *Specific contractual weather services are listed in Operations Specification (OpSpec) A010. Weather sources other than those listed in OpSpec A010 should be used for information only.*

[69] The UPS IT department holds the Lido contract.
[70] For additional information, see Meteorology Group Chairman's Factual Report.

8.1 METARs Remarks Removal

On March 7, 2011, UPS Flight Planning Support sent an Information Services Appropriation Request Form (Change Request) to the Lido Airline Solutions support team to "update Lido weather feed to exclude METARs with appended RMK info."[71] The description given in the request stated the following:

> *UPS had a requirement for LIDO to provide an alert in the IFM[72] for a METAR (Aviation Routine Weather Report)anytime Remarks were added. This has proven to create too many alerts and messages for the dispatchers and crewmembers. To reduce duplicate METAR messages: Remove the feature to send the METAR with remarks.*

According to the UPS Flight Planning Support Manager, weather remarks were not included in the METAR data for the weather briefing.[73] One of the issues within a part of the application called the inflight monitor was that the dispatchers were receiving redundant METARs for every relevant airport, and to solve that issue and cut down the METARs that were displayed, the METAR with the relevant remarks "went away." The change went into effect September 2011, and the remarks section was removed from METAR weather disseminated by the Lido system.[74] The current Flight Control Shift Manager (previously with Flight Control Training and Standards) was asked if there was any weather information produced by the Lido system that included the remarks section of the METAR, and she said no.

According to UPS, although the dispatchers were aware of the problem and solution with regards to the METAR remarks, UPS could not locate any official or unofficial communication (i.e. bulletin, Chief Pilot Hotline, AirUPSers.com[75] article, etc.) that communicated the change to the pilots at UPS. The UPS Director of Flight Operations told NTSB Staff that the issue of METAR remarks being removed was new to him. UPS pilots did have access to the Aviation Sentry product online that included METARs with remarks. According to UPS, after departure, pilots seeking information on the "non-prevailing conditions" at an airport would have to query the dispatcher. Further, the accident dispatcher told NTSB Staff that he did not know how the pilots would get the remarks section of the METAR from ACARS other than if they asked him directly if there were any remarks on the METAR. 14 CFR 121.599 "Familiarity with weather conditions" states:

> (a) *Domestic and flag operations. No aircraft dispatcher may release a flight unless he is thoroughly familiar with reported and forecast weather conditions on the route to be flown.*
> (b) *Supplemental operations. No pilot in command may begin a flight unless he is thoroughly familiar with reported and forecast weather conditions on the route to be flown.*

[71] See Attachment 20 – Lido METAR Remarks Removal.
[72] In flight monitor.
[73] The UPS Flight Planning Support Manager told NTSB Staff he was the "primary user representative" for Lido.
[74] See Attachment 20 – LIDO METAR Remarks Removal.
[75] AirUPSers.com is a focused employee website for UPS employees in the company's flight district, particularly pilots. AirUPSers.com features flight-related news and information and several job aids, such as route cards for international flights. Source: UPS.

14 CFR 121.601 "Aircraft dispatcher information to pilot in command: Domestic and flag operations" states, in part:

> *(b) Before beginning a flight, the aircraft dispatcher shall provide the pilot in command with all available weather reports and forecasts of weather phenomena that may affect the safety of flight, including adverse weather phenomena, such as clear air turbulence, thunderstorms, and low altitude wind shear, for each route to be flown and each airport to be used.*
> *(c) During a flight, the aircraft dispatcher shall provide the pilot in command any additional available information of meteorological conditions (including adverse weather phenomena, such as clear air turbulence, thunderstorms, and low altitude wind shear), and irregularities of facilities and services that may affect the safety of the flight.*

The UPS FOM 03.01.01.03 "Enroute Weather Information" stated, in part:

> *During flight, the Flight Dispatcher will provide the Captain any additional information of meteorological conditions including adverse weather phenomena, such as clear air turbulence, thunderstorms and low altitude winds hear, and irregularities of facilities and services that may affect the safety of the flight.*

The UPS FOM Section 03.01.01.02 "Weather Transmissions Methods" stated, in part:

> *Regulations intend that identical weather information be available to the Captain and Flight Dispatcher for domestic and flag flights. Methods used to transmit information to satisfy this requirement include Flight Crew Briefing Package, facsimile, telephone, radio, telegraph and UPS Flight Operations internet (click Aviation Sentry in the pull down menu at the bottom of the Flight Ops website).*

The UPS Director of Flight Operations and the UPS Flight Standards and Training Manager both told NTSB Staff they were unaware that METARs provided by the Lido flight planning system did not include the remarks section of the METARs in the weather reports. The UPS A300 Standards and Training Manager could not recall if they saw the remarks included with the METARs in LOFT[76] training. The FAA Dispatch ASI told NTSB Staff it would be a surprise to him if the METAR remarks were not being included in the weather, but he would not necessarily look for those remarks. He said the remarks section of a METAR could include important information for the pilot.

The UPS FOM Volume 2, Section 06.02.01.16 "Remarks" provided multiple examples of different remarks that could follow a METAR, and included the following note:

> *Remark, gives additional details or clarifying information*

The Federal Meteorological Handbook No.1, (FCM-H1-2005), page A-7, defined the remarks portion of a METAR as:

---

[76] Line Oriented Flight Training.

Plain language or coded data added to the body of the METAR/SPECI to report significant information not provided for in the body of the report.[77]

The FAA-H-8083-25A, "Pilot's Handbook of Aeronautical Knowledge", page 12-8, stated, in part:

The remarks section always begins with the letters "RMK." Comments may or may not appear in this section of the METAR. The information contained in this section may include wind data, variable visibility, beginning and ending times of particular phenomenon, pressure information, and various other information deemed necessary.

8.2 ACARS Weather Uplink

The UPS A300 was equipped with an ACARS data link system which enabled the exchange of data and messages between an aircraft and a ground based operation station, over an ARINC[78] VHF radio network.[79] UPS pilots were able to send/receive text messages between the airplane and the dispatcher utilizing the ACARS system. Weather requests sent to the dispatcher were returned to the airplane automatically and required no action on the part of the dispatcher. The accident dispatcher told NTSB Staff that when a pilot requested weather while in flight via the ACARS system, he got copied on it as well, but the system automatically sent the weather, and he would only see that the crew requested the weather. The dispatcher further said he had no weather concerns regarding the accident flight, and the crew of UPS1354 never requested additional weather en route, and they never made contact with him via phone or ACARS.

NTSB Staff reviewed the ACARS uplink data transmissions from the accident airplane on August 14, 2013, and at 0904Z (0404 CDT, 43 minutes prior to the accident), while airborne and enroute to KBHM, the crew of UPS1354 sent a request for the current KBHM weather via ACARS. The ACARS uplink sent to the accident airplane at 0904Z (0404 CDT) was as follows:

```
†éQU QXSXMXSÚ.SDFER5X 140904/AUG13ÚWXR RESP Ú******************  WEATHER
UPLINKED TO FLIGHT CREW   ******************ÚÚTAIL #:  N155UP
AIRPORT REQUEST:  SA   M    WEATHER REQUEST:  ETAR KÚÚWEATHER SENT TO
CREW: ÚÚBHM 140853Z     Ú   00000KT 10SM BKN010 Ú   OVC075 23/22
A2997=ÚSPECI KBHM 140848Z     Ú   33003KT 10SM OVC010 Ú   23/22
A2997=ÚMETAR KBHM 140753Z     Ú   00000KT 9SM OVC008  Ú   23/22 A2996Ú
```

[77] For additional information, See Meteorology Group Chairman's Factual Report.
[78] Aeronautical Radio, Incorporated (ARINC).
[79] Source: Airbus A300 Flight Crew Operating Manual (FCOM), "Communications", page 1.05.70.

The weather uplinked (received) by the accident airplane (tail # N155UP) indicated that the most current weather at KBHM was a special weather observation for 14 August at 0853Z (14 August at 0353 CDT) and showed calm winds, visibility 10 miles, a ceiling broken at 1,000 feet, overcast at 7,500 feet, temperature 23° Celsius (C), dew point temperature 22° C, and the altimeter 29.97 inches of mercury (Hg).

The official 0853Z (0353 CDT) weather observation recorded by the KBHM Automated Surface Observation System (ASOS) system was as follows:

> *METAR KBHM 140853Z 00000KT 10SM BKN010 OVC075 23/22 A2997 RMK AO2 CIG 006V013 SLP138 T02330217 52000=*

Remarks on the official 0853Z weather included an automated observation indicating a ceiling of 600 feet variable 1,300 feet.[80]

The 0853Z weather provided in the ACARS uplink sent to the accident airplane was identical to the official 0853Z weather reported at the airport. However, the remarks section indicating the ceiling 600 feet variable 1,300 feet was not included in the ACARS uplink and not received by the UPS1354 flight crew via ACARS.

9.0 Aids to Navigation[81]

UPS1354 flew a localizer approach to runway 18 at KBHM. The localizer transmitter operated on a frequency of 111.30 MHz and provided the pilot with course guidance to the runway centerline.

According to the Aeronautical Information Manual (AIM) Section 1-1-9 "Instrument Landing System (ILS)" the localizer provided course guidance throughout the descent path to the runway threshold from a distance of 18 NM from the antenna between an altitude of 1,000 feet above the highest terrain along the course line and 4,500 feet above the elevation of the antenna site.

10.0 Communications

There were no known communication difficulties.

11.0 Airport Information[82]

Birmingham-Shuttlesworth International Airport was located about 4 miles northeast of Birmingham, Alabama at a field elevation of 650 feet msl, and at a latitude/longitude of N33º33.83´ W86º45.14´. The Airport had a continuously operated FAA Control Tower.

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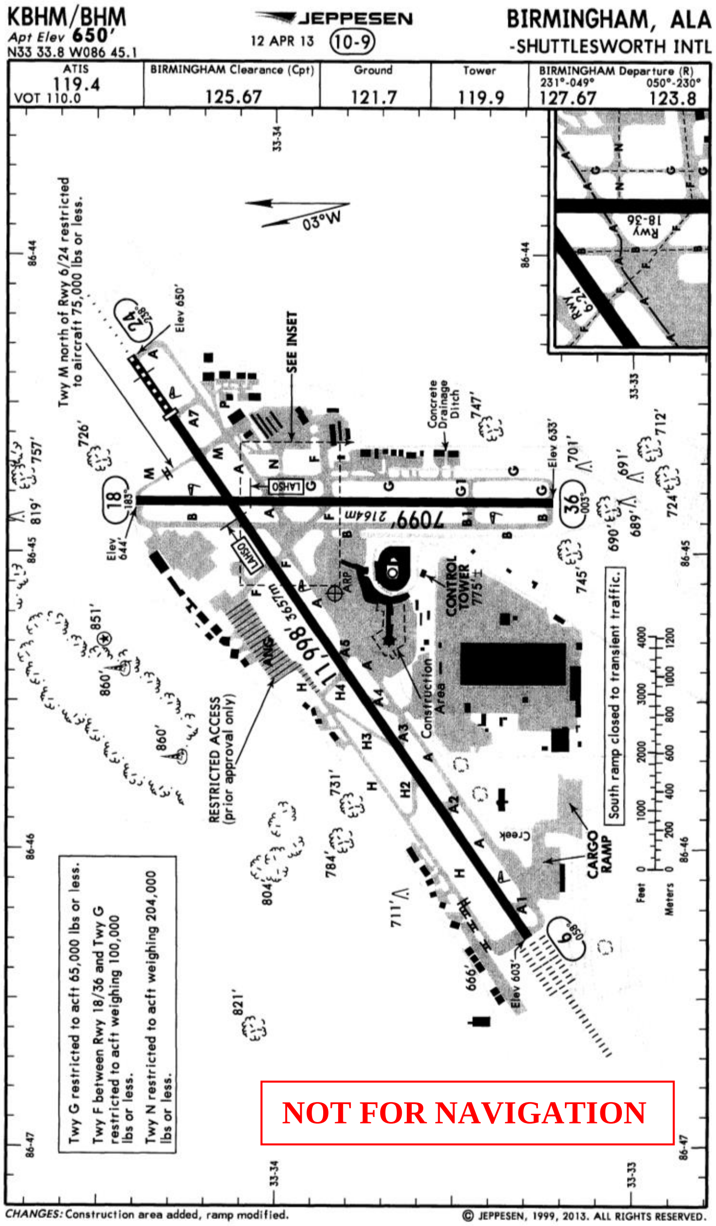
[80] For additional weather information, see Weather Group Chairman's Factual Report.
[81] For additional information, see Survival Factors Group Chairman's Factual Report.
[82] Airport information was obtained from the Federal Aviation Administration's National Aeronautical Charting Office (NACO) Terminal Procedures Publication (TPP) and Airport Facility Directory (AFD).



[83]

11.1 Runway Information

KBHM had two runways. Runway 6/24 was the longer of the two runways, was asphalt grooved, and was 11,998 feet long and 150 feet wide. Both runway 6 and 24 were served by instrument landing systems (ILSs) and RNAV (GPS) approaches. At the time of the accident, runway 6/24 was NOTAM closed for maintenance on the runway lighting system, from 0400 to 0500.

[83] Source: Jeppesen.

Runway 18/36 was asphalt grooved and was 7,099 feet long and 150 feet wide. Runway 18 was served by two instrument approaches, a Localizer 18 and an RNAV (GPS) 18.

Runway 18 was also served by a Precision Approach Path Indicator (PAPI)[84] on the left side of the runway, with a 3.2° angle that resulted in a threshold crossing height (TCH) of 48 feet.[85]

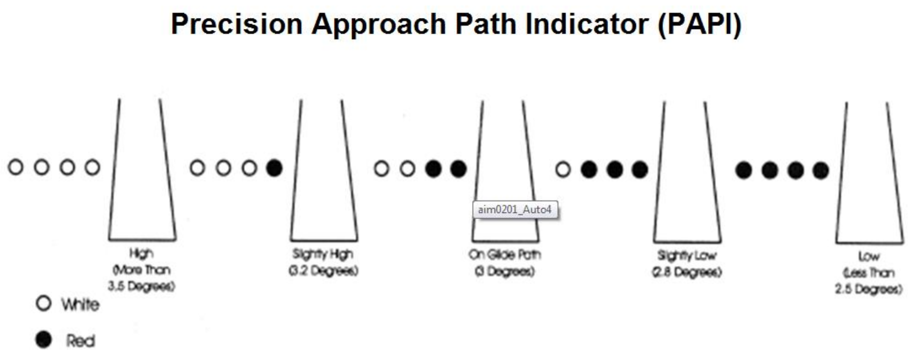


Figure 1: Precision Approach Path Indicator (PAPI)[86]

According to the UPS A300 AOM, Section 03.11.01.01 "Visual Approach Standard Callouts" stated, in part:

> *The flight path angle provided by a PAPI provides obstacle clearance within 3.5 NM and 10° of the runway threshold.*

The same section contained the following warning (ALL CAPS included in text):

> *THE VNAV[87] PATH DOES NOT GUARANTEE OBSTACLE CLEARANCE DURING A VISUAL APPROACH. TERRAIN AND OBSTACLES MUST BE VISUALLY ACQUIRED AND ADEQUATE SEPARATION ENSURED BY THE FLIGHT CREW.*

The UPS A300 Pilot Training Guide (PTG), Section 02.04.03.05 "Visual Segment Obstacle Clearance" stated, in part:

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[84] According to the AIM (Chapter 7), the precision approach path indicator (PAPI) uses light units similar to the VASI but are installed in a single row of either two or four light units. These lights are visible from about 5 miles during the day and up to 20 miles at night. The visual glide path of the PAPI typically provides safe obstruction clearance within plus or minus 10 degrees of the extended runway centerline and to 4 SM from the runway threshold. Descent, using the PAPI, should not be initiated until the aircraft is visually aligned with the runway. The row of light units is normally installed on the left side of the runway and the glide path indications are as depicted. Lateral course guidance is provided by the runway or runway lights. In certain circumstances, the safe obstruction clearance area may be reduced due to local limitations, or the PAPI may be offset from the extended runway centerline. This will be noted in the Airport/ Facility Directory.
[85] For additional information, see Survival Factors Group Chairman's Factual Report.
[86] Source: AIM Chapter 7, figure 2-1-5.
[87] Barometric Vertical Navigation (baro-VNAV) is a function of certain RNAV systems which presents computed vertical guidance to the pilot referenced to a specified vertical path. The computed vertical guidance is based on barometric altitude information and is typically computed as a geometric path between two waypoints or an angle based on a single waypoint (Source: FAA Advisory Circular 90-105). A Profile approach, as conducted by the UPS A300, is a form of vertical navigation (VNAV), and the terms are interchangeable in this Factual Report.

An obstacle clearance assessment has been accomplished for all runways which have published VNAV minima to ensure that obstacle clearance can be maintained during the execution of a missed approach from the decision altitude. However, to land from a non-precision approach the aircraft must descend below the DA once visual reference has been established. The area on the approach below the MDA/DA beginning at the VDP and continuing to the runway threshold is referred to as the Visual Descent Area (VDA). Terrain and obstacle clearance is not always guaranteed when operating in the VDA even when on a nominal 3° glide path or the VNAV path contained in the FMC NAV database. Terrain and obstacles must be visually acquired and avoided when operating in the VDA.

A glide path provided by a Visual Glideslope Indicator (VGSI) (VASI or PAPI) must always be followed when operating below DA/D-DA or for a MDA during V/S approaches. The glide path of a VASI provides safe terrain and obstruction clearance within 4 NM of the runway threshold, while a PAPI provides safe terrain obstruction clearance within a 3.5 NM of the runway threshold.

11.2 Charts

UPS used Jeppesen approach charts, as approved in OpSpecs A009 (Airport Aeronautical Data). UPS pilots were in the process of transitioning to EFB (electronic flight bag) and a number of pilots were part of a test program to view Jeppesen charts via an iPad. UPS pilots who had completed the required training and received certification, were authorized to use the Apple iPad EFK (Electronic Flight Kit) during all phases of flight and were not required to carry hard copies of their respective AOM and Jeppesen coverage in accordance with UPS FOM, Document UPS3510 procedures.

Non-EFK qualified Flight Crews were required to maintain and carry hard copies of their respective AOM and applicable Jeppesen coverage as per UPS FOM.[88] According to UPS, the accident pilots were not participating in the EFB program at the time of the accident, and the Jeppesen charts for the LOC 18 approach to KBHM and required manuals were recovered at the accident site.

11.2.1 Chart NOTAM[89]

The Jeppesen 11-2 KBHM LOC18 approach chart used by the crew of UPS1354 (effective date August 17, 2012) had the following chart note:

When VGSI[90] Inop, Procedure NA at Night

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[88] Source: UPS OpSpecs A061, Use of Electronic Flight Bag.

[89] A Notice To Airmen or NOTAM is a notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of , or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations. Source: FAA.

[90] Vertical Glide Slope Indicator. Runway 18 at KBHM had an operable Precision Approach Path Indicator (PAPI).

The PAPI for runway 18 at KBHM was operational at the time of the accident. However, the same chart indicated in the minimums section that night minimums was "NA" (not authorized), indicating that the LOC18 instrument approach to KBHM was not authorized to be used at night.

In December 2011 the FAA issued FDC NOTAM[91] number 1/3755 (amendment 2A) that stated:

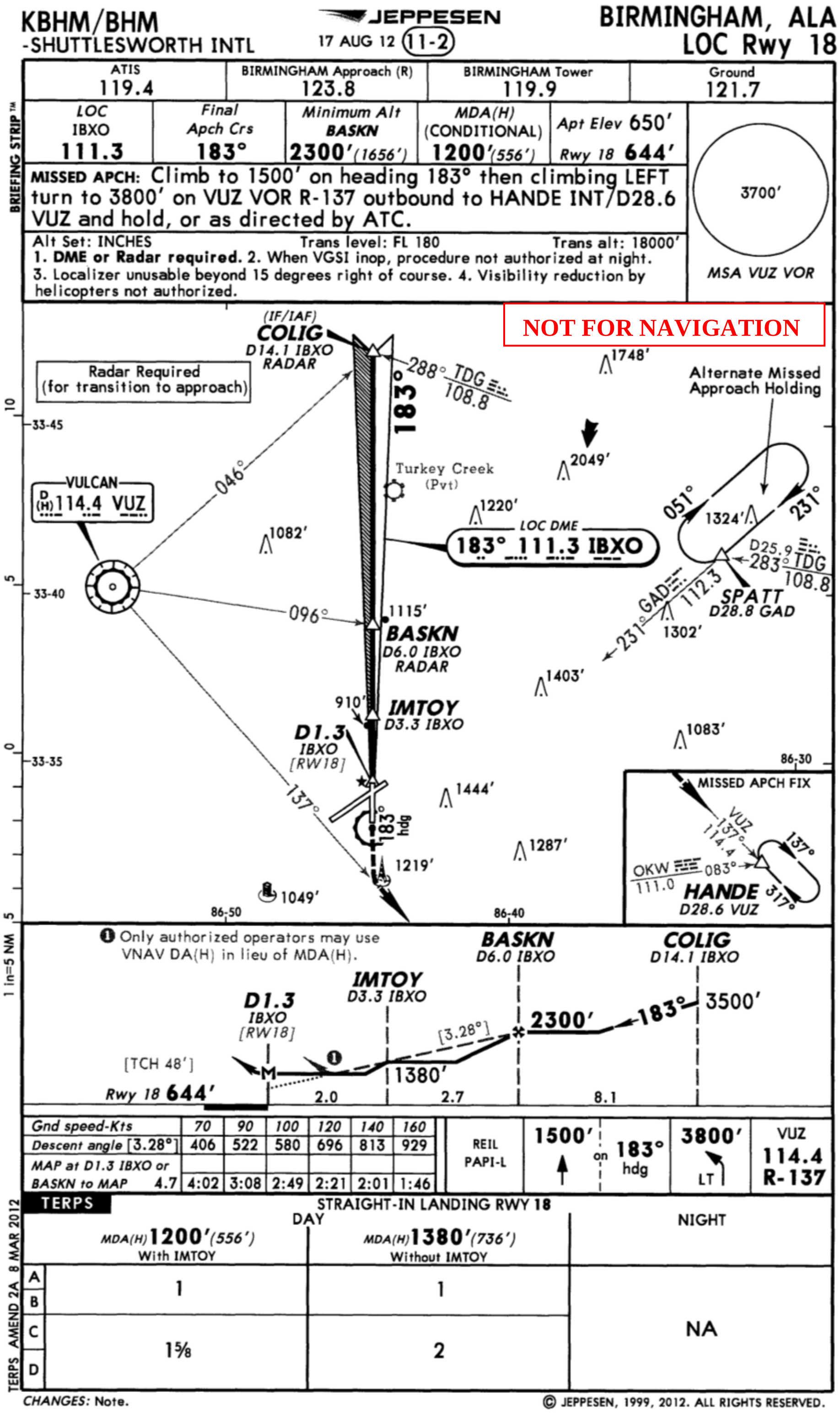
> *Delete note: procedure NA at night. Chart note: When VGSI inop, procedure NA at night.*

According to the FAA, NOTAM 1/3755 was cancelled on March 8, 2012. The Jeppesen 11-2 KBHM LOC18 chart used by the crew of UPS1354 indicated that NOTAM 1/3755 (amendment 2A) was incorporated, however the minimums section of the chart was not changed to reflect the NOTAM. Following the accident, Jeppesen reissued the 11-2 KBHM LOC18 chart on September 13, 2013 that removed the night NA restriction in the minimums section of the chart.[92]

[91] FDC NOTAMs refer to information that is normally regulatory in nature, and includes instrument flight procedure changes to include special instrument flight procedures, standard instrument approach procedures (SIAP), textual and graphic obstacle departure procedures (ODP), standard instrument departures (SID), and standard terminal arrivals (STAR). Refer to FAA Order 8260.19, Flight Procedures and Airspace, for policy guidance and procedures for the issuance, tracking, and cancellation of FDC NOTAMs relating to instrument flight procedures.

[92] According to an email sent to the Operations Group Chairman from the Senior Manager Aviation & Marine Safety at Jeppesen on January 29, 2014, Jeppesen completed an internal review of the circumstances surrounding the discrepancy in the KBHM LOC18 chart, and said "the root cause was human error in not catching the removal of "NA" from the minimums section of the Jeppesen 11-2 LOC RWY 18 for KBHM." The email further stated that Jeppesen was "providing additional training to employees involved in chart analysis, production and verification, and also emphasizing attention to detail as part of upcoming safety awareness campaigns" to "help to mitigate the chance of further errors."

11.2.2 Jeppesen KBHM LOC18 Approach Chart (pre-accident)



[93]

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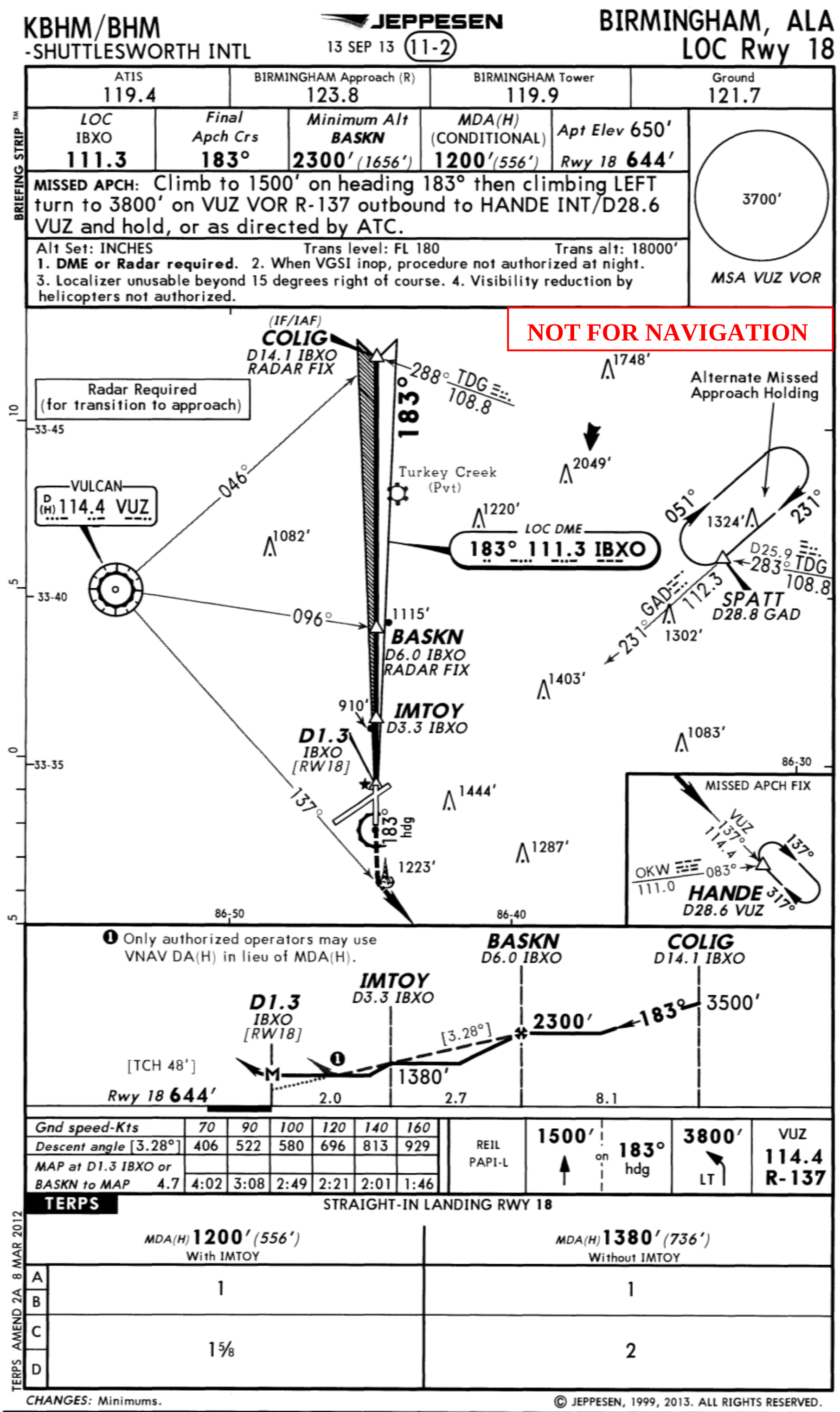
[93] Source: Jeppesen.

11.2.3 Jeppesen KBHM LOC18 Approach Chart (post-accident)



[94]

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[94] Source: Jeppesen.

12.0 Company Overview[95]

United Parcel Service (UPS) was founded in 1907 as a private messenger and delivery service company in Seattle, WA. In 1981, UPS purchased its first aircraft for use in air delivery service, and in 1982 the company began operations from the Louisville air hub. In 1988, UPS received authorization from the FAA to operate its own aircraft, thereby officially becoming an airline (FAA Certificate Number IPXA097B).

The UPS corporate headquarters were located in Atlanta, Georgia, and the airline's headquarters are located in Louisville, Kentucky. UPS had 331,457 total employees, 3,297 Flight District employees, and 2,584 flight crewmembers. The pilots at UPS were unionized, and represented by the Independent Pilot's Association under a collective bargaining agreement (CBA) which became amendable in 2011. UPS pilots also participated in the ASAP program.

Pilot bases were located in Anchorage, Alaska (575 pilots), Ontario, California (207 pilots), Louisville, Kentucky (1,633 pilots), and Miami, Florida (169 pilots). According to the UPS 2012 Securities Exchange Commission (SEC) Form 10-K filing, as of December 31, 2012 UPS had the following fleet breakdown:

Description	Owned and Capital Leases	Short-term Leased or Chartered From Others	On Order
Boeing 747-400F	11	—	—
Boeing 747-400BCF	2	—	—
Boeing 757-200F	75	—	—
Boeing 767-300ERF	51	—	8
Boeing MD-11F	38	—	—
Airbus A300-600F	53	—	—
Other	—	332	—
Total	230	332	8

UPS was an International Air Transport Association (IATA) Operational Safety Audit (IOSA) registered airline. According to the UPS Director of Safety, UPS had completed an IATA LOSA[96] and DOD audit in 2013 year and "scored very well." A Flight Operations Safety Action Group monitored trend data from ASAP and FOQA[97] (85-88% of all UPS flights were covered by FOQA) to recommend changes to policy and procedures.

[95] Source: UPS and company website, http://www.ups.com/content/corp/about/history/index.html?WT.svl=SubNav.
[96] Line Operations Safety Audit. For more information, see FAA Advisory Circular 120-90 "Line Operations Safety Audit."
[97] Flight Operational Quality Assurance (FOQA) is a voluntary safety program designed to improve aviation safety through the proactive use of flight recorded data. Source: FAA.

UPS had not hired line pilots since 2007, and as of December 2012, the airline had 50 pilots on furlough. Previous hiring had been due primarily to growth in international flights and the opening of the Anchorage domicile, and to a small part by retirements. There were no current hiring plans for 2013.[98]

13.0 Relevant Systems[99]

13.1 Flight Management System (FMS)

The purpose of the Flight Management System (FMS) was to provide a complete automation of all the navigation and flight management tasks. It reduced cockpit workload, improved efficiency and eliminated many routine operations normally performed by the pilots.[100]

According to the UPS A300 Systems manual, Section 12.01.01.01 "Overview", the FMS was an integration of the Flight Management Computer (FMC) with many aircraft subsystems to aid the flight crew in controlling the lateral and vertical flight path of the aircraft. Each of the subsystems was designed to allow the flight crew to select the desired level of automation. The integration of the FMC and the subsystems reduced flight crew workload by accomplishing many redundant or routine tasks.

The primary function of the FMC was to provide vertical and lateral navigation guidance, performance optimization and inflight fuel monitoring and predictions. A secondary function of the FMC was to provide a map display on the Navigation Display (ND) for orientation and situational awareness.

The FMC combined flight plan information entered by the flight crew, information stored in the FMC database and data received from the supporting FMS subsystems. The computer used this information to calculate aircraft present position along the vertical and lateral flight paths. With this information the FMC calculated vertical and lateral flight plan corrections, navigation adjustments and thrust requirements to maintain the aircraft on the desired vertical and lateral flight path.

The primary crew interface with the FMC was through the Mode Control Panel (MCP) and two Control Display Units (CDUs). The navigational information selected by the flight crew was displayed on two NDs and CDU displays.

The UPS A300 Pilot Training Guide, Section 01.03.01.01 "General" stated, in part:

> *The Flight Management System is designed to improve aircraft and crew operational efficiency thus allowing the crew greater Situational Awareness. It is a complicated interaction of many automated systems to include: The Autopilot Flight Director System (AFDS), the Mode Control Panel (MCP), the Flight Management Computers (FMC) and*

[98] Source: Department of Defense Master UPS survey 2013.
[99] For additional systems information, see Systems Group Chairman's Factual Report.
[100] Source: Airbus FCOM Volume 1, page 1.20.11.

Control Display Units (CDU), the Thrust Control Computer (TCC) and the Thrust Rating Panel (TRP).

Properly managed the use of the full-automated capabilities greatly enhances overall situational awareness, CRM and operational efficiency through all phases of flight.

13.2 Mode Control Panel (MCP)

The main interface between the flight crew and the auto flight system on the A300 was through use of the "Mode Control Panel" (MCP)[101] located on the glareshield, in order to:

– engage the A/THR and the AP,
– engage AP/FD modes,
– select guidance target values.

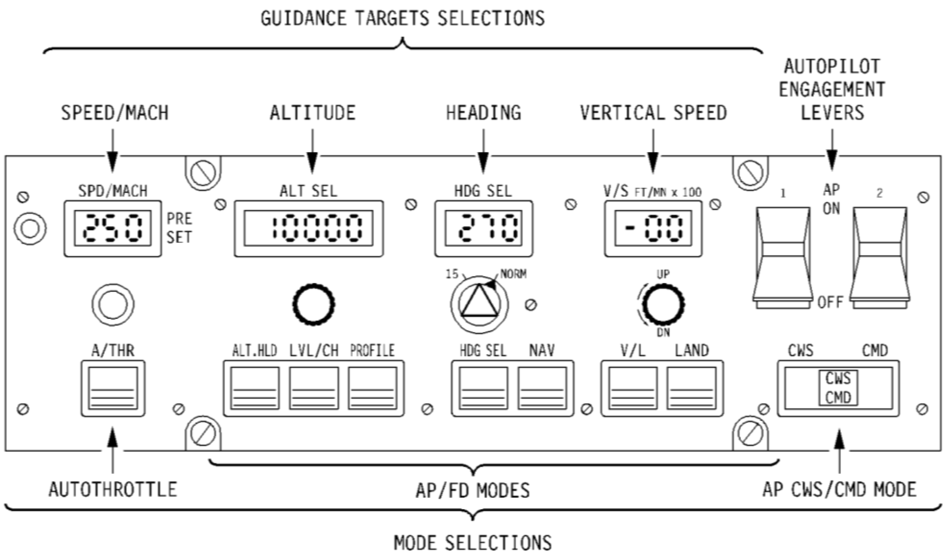

Figure 2: A300 Mode Control Panel (Airbus FCU)[102]

A mode could be armed or engaged by pressing the corresponding pushbutton switch or (for LVL/CH, HDG SEL and V/S modes only) by pulling the corresponding selector knob. If a mode was armed or engaged, pressing its pushbutton switch a second time disarmed or disengaged the mode.

Turning a selector knob clockwise increased the target value, and turning counter clockwise decreased the target value.

The pushbutton switches controlled the corresponding mode. The pushbutton switches included three green bars which illuminate green when the corresponding mode was engaged.

[101] In the Airbus A300 FCOM Section 1.03.12 "Autoflight System AFS – Pilot Interface," the panel is called the Flight Control Unit (FCU). For consistency with UPS manuals and guidance, the term "MCP" will be used in this Factual Report.
[102] Source: Airbus A300 FCOM 1.03.12.

Disengaging a mode by pressing the related pushbutton switch caused a reversion to the corresponding basic mode:

– if the vertical mode was disengaged, V/S engaged,
– if the lateral mode was disengaged, HDG engaged.[103]

13.3 Control Display Unit (CDU)

The CDU provided a full alphanumeric keyboard combined with mode, function, data entry, slew keys, and advisory annunciators. The CDU was the main interface between the crew and the FMC. There were two identical CDUs, located on each side of the pedestal, in front of the throttle levers.[104]

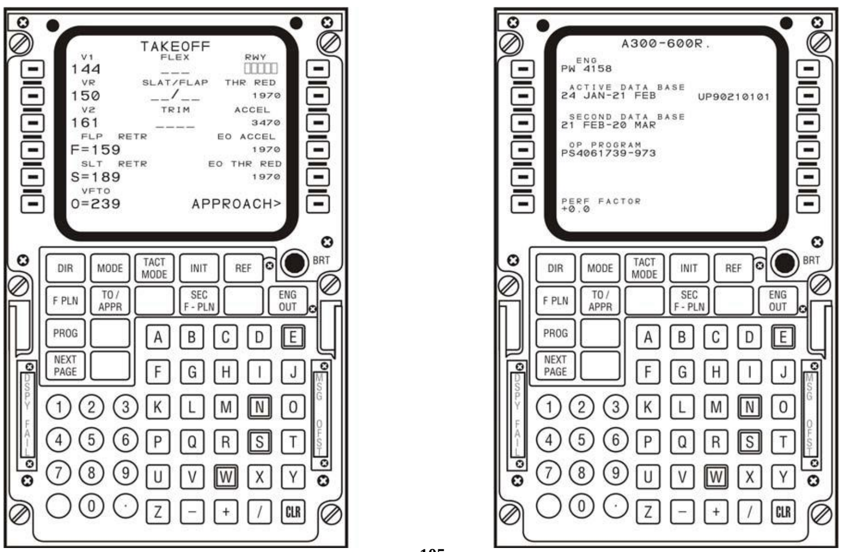

Figure 3: A300 Control Display Unit[105]

13.4 Electronic Flight Instrument System (EFIS)

The UPS A300 utilized an Electronic Flight Instrument System (EFIS) system to display flight and navigational information. The EFIS system provided the flight crew with most of the data needed for flight path and navigation control.[106] The EFIS data were displayed on four Cathode Ray Tubes (CRTs) :

– Two Primary Flight Displays (PFD)
– Two Navigation Displays (ND)

The PFD and ND were displayed as follows :

– upper CRT : PFD

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[103] Source: Airbus A300 FCOM 1.03.12.
[104] For more information on the CDU, see Attachment 26 – A300 Flight Management System.
[105] Source: UPS A300 Systems Manual, Section 12.01.03 "CDU."
[106] Source: Airbus FCOM 1.10.12.

– lower CRT : ND

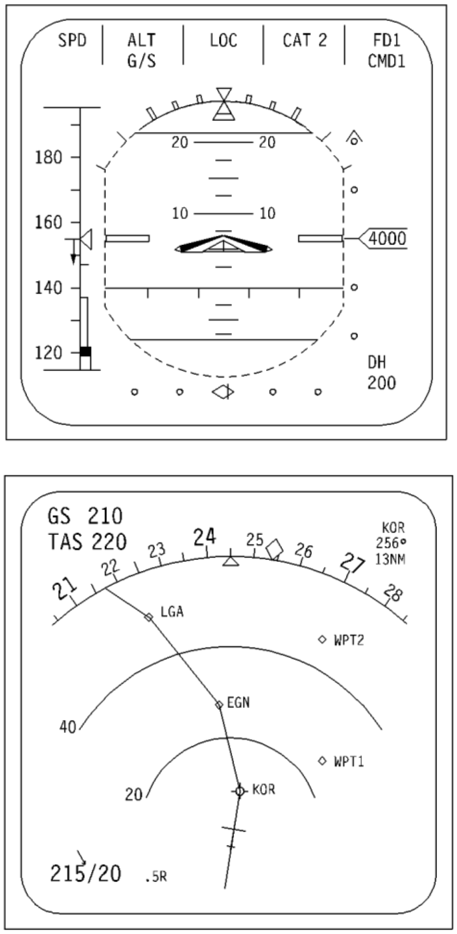

Figure 4: Primary Flight Display (top screen) and Navigational Display (bottom screen)[107]

The Primary Flight Display (PFD) provided the following information in five separate areas :

– Auto Flight System (AFS) modes on the Flight Mode Annunciator (FMA),
– Airspeed (selected speed, IAS, speed trend arrow, green dot speed or S speed or F speed,VLS, VSS).
– Attitude (pitch, roll and heading scales), guidance (Flight Director) and Radio Altitude,
– Vertical deviation from selected altitude or glide slope,
– Lateral deviation from a localizer beam, if selected.[108]

13.5 Flight Mode Annunciator (FMA)

According to the UPS A300 Systems Manual, Section 11.01.06.20 "Flight Mode Annunciator," the annunciation of the various auto flight system modes was displayed at the top of the PFD and

[107] Source: Airbus A300 FCOM 1.10.12.
[108] Airbus A300 FCOM 1.10.12.

was referred to as the Flight Mode Annunciator (FMA). The FMA was divided into as many as five sections depending on the operational mode of the auto flight system. The five sections of the FMA from left to right were:

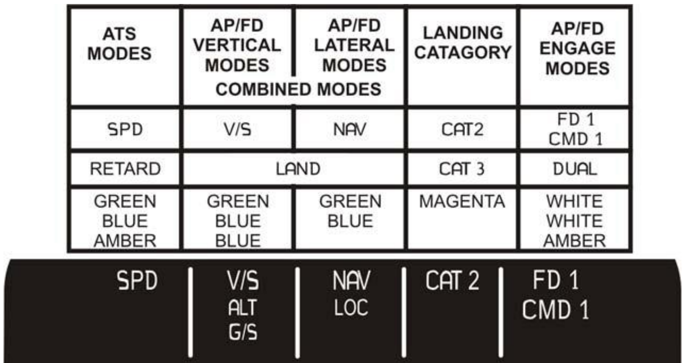

Figure 5: FMA indications.[109]

The FMA was the main interface between the flight crew and the autoflight system in order to confirm the engagement of the selected autothrust and autopilot/flight director mode, and confirmed the status of the selected mode. According to the UPS A300 PTG Section 01.03.02 "Autopilot and Flight Director," the armed and active (engaged) modes of the Autopilot Flight Director System (AFDS) were indicated on the FMA at the top of each PFD. A mode displayed in green indicated an active mode, and a mode displayed in blue indicated an armed mode.[110]

Selected speed and altitude were indicated on the PFD and selected heading was indicated on the Navigation Display (ND). When immediate time constraints precluded making inputs to the Flight Management Computer (FMC) through the Control Display Unit (CDU), the Mode Control Panel (MCP) was the short-term interface between the crew and the FMS. Through the MCP the crew could arm and engage guidance for vertical and lateral navigation, aircraft speed and altitude. The FMA was the primary source for verification of the active and armed modes of the autopilot and flight director.

The UPS A300 PTG Section 01.03.02 "Autopilot and Flight Director" included the following emphasized note:

> ***The FMA is the primary source for verification of the active and armed modes of the AFDS.*** *When inputs are made on the MCP, including any change in autopilot or autothrottle status, the crew should verbally announce the selection(s) made,* ***while verifying the new change on the FMA.***[111]

[109] Source: UPS A300 Systems Manual, Section 11.01.06.20 'Flight Mode Annunciator."
[110] For more information on FMA mode indications, see Attachment 26 – A300 Flight Management System.
[111] Bold font was included in A300 PTG manual. According to UPS A300 Check Airmen and instructors, there was no requirement to verbally confirm FMA mode or status changes.

Photo 2: Photo of the Primary Flight Display PFD (top screen) and Navigational Display (bottom screen). The FMA is indicated by circle.[112]

14.0 Relevant Procedures

14.1 Normal Procedures

14 CFR 121.141 required the FAA Approved Airplane Flight Manual (AFM) or an equivalent manual be carried on board each aircraft. The UPS A300 AOM satisfied the requirement of an equivalent manual, and UPS A300 pilots were required to operate the A300 per the limitations and procedures contained in the UPS Aircraft Operating Manual.

In addition, A300 pilots could reference the guidance contained in the UPS A300 Pilot Training Guide (PTG),[113] which outlined UPS policies and recommended techniques to be followed during initial and recurrent training as well as during line operation flying. This manual was a reference guide only to assist crewmembers in flying the UPS A300 aircraft and to provide a basis for standardization, and was not an FAA approved or accepted manual. Information in this manual expanded on procedures in the A300 AOM and was intended to illustrate procedures with further, in-depth explanations in how to execute specific maneuvers.

The UPS A300 PTG, Section 01.01.01.01 "Overview" contained the following note:

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[112] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.

[113] The AOM was an FAA approved manual. For further information, see FAA 8900.1 Volume 3, Chapter 32, Section 2 Approval and Acceptance of Manuals and Checklists.

The PTG is a useful tool for learning and flying the A300. Many useful techniques are contained in the manual. However, the AOM and Flight Operations Manual (FOM) are the controlling authorities for the operation of the A300. Any technique or item in this PTG which you feel conflicts with, or deviates from, the AOM or FOM is to be disregarded. The AOM and FOM documents always take precedence.

14.2 Autoflight and Flight Management System Policy

According to the UPS AOM, Section 03.00.01.04, when an autoflight or flight management system mode change was selected or occurred, appropriate annunciations must be verified on the Primary Flight Display (PFD) Flight Mode Annunciator (FMA) display by both pilots. The PFD FMA display was the primary indication of engaged and armed autoflight system modes.

According to the UPS A300 AOM, flight crews were expected to utilize available automated systems during normal flight operations. In non-normal flight operations, crewmembers should utilize automation capabilities to the extent that use of such systems reduced cockpit workload and allowed compliance with A300 AOM limitations and non-normal procedures. Autoflight control was not intended to correct abnormal or unusual flight situations, i.e., unsafe terrain clearance or unusual flight attitudes. If these flight conditions were encountered, the PF shall immediately resort to manual flight control and comply with established escape or recovery procedures.

The UPS A300 AOM, Section 03.00.01.04 further stated, in part:

Crewmembers must be aware that continual, unquestioned reliance on automated systems may lead to complacency in monitoring autoflight system performance and hamper the ability to recognize a failure or unexpected automation behavior. It is imperative that crewmembers maintain automation mode and flight path awareness at all times. Particular attention must be given to aircraft control and speed awareness when operating the aircraft during periods of split automated system usage (i.e., autothrottles off with autopilot on, etc.). When manually flying the aircraft, the flight directors should be turned off if the provided pitch and roll guidance is not being followed.

The A300 Chief Pilot told NTSB Staff that “we strongly encourage use of the autopilot” at UPS.

14.3 Crew Coordination

14.3.1 Control Display Unit Operation (CDU)[114]

According to the UPS A300 AOM, Section 03.00.01.05, inflight CDU manipulations were normally performed by the PM and verified by the PF. Because the A300 FMC did not incorporate an Execute key, it was possible for modifications to the active flight plan to occur by simply selecting a Line Select Key. According to the UPS AOM, it was imperative that good coordination existed between the PF and PM prior to any action being taken on the CDU which

[114] The FMS CDU was the main interface between the crew and the FMC. There are two identical CDUs, located on each side of the pedestal, in front of the throttle levers. Source: Airbus A300 FCOM, Volume 1, page 1.19.20.

would modify an active FMC mode, function, or route. On FMC functions where a "soft look" was provided, the PM should receive confirmation from the PF prior to activating the function.

According to the UPS A300 AOM, CDU manipulations should be accomplished prior to high workload periods such as departure, arrival or holding. During high workload periods, using autopilot modes such as HDG SEL, LVL CH, and airspeed select features, along with ND switches may be more efficient than making complex FMC modifications.

14.3.2 Mode Control Panel (MCP)

According to the UPS A300 AOM, Section 03.00.01.05, when an autopilot was engaged, the PF should make all MCP mode selections exclusive of the altitude window. It was recommended to verbalize MCP changes to increase the PM's situational awareness. When an autopilot was not engaged, UPS recommended that the PM make all MCP selections at the direction of the PF, and the PM should repeat the PF's commands to ensure that the proper command was executed. The primary method of making AFDS mode selections was using the associated MCP mode pushbutton switch.

14.3.3 Autopilot Operation

According to the UPS A300 AOM, Section 03.00.01.05, an autopilot may be engaged at 1,000 feet AFE[115] after takeoff. It was recommended that each crewmember use the "onside" autopilot (Captain/Autopilot 1, First Officer/Autopilot 2). When autopilot use was desired, the PF stated "Autopilot 1(2) Command," and the PM selected the appropriate autopilot switch to ON. Both pilots should observe FMA indications to ensure proper autopilot engagement. When disengaging the autopilot or autothrottles, the PF shall verbally state that the autopilot/autothrottles are being disengaged to ensure that both pilots are aware of auto flight system status.

If the autopilot was not providing precise aircraft control or maintaining the desired flight path, the PF must immediately disconnect the autopilot and assume manual control of the aircraft. After the aircraft flight path was stabilized, the autopilot may be re-engaged if desired.

14.4 Localizer Approach Setup

14.4.1 Tuning the Localizer

The localizer was tuned by setting the localizer frequency and course (CRS) on the single ILS control panel located on the center pedestal. According to FDR data and radar data, UPS1354 was tracking along the 183° inbound course for the KBHM LOC18 approach (localizer frequency 111.30 MHz).

[115] Above field elevation.

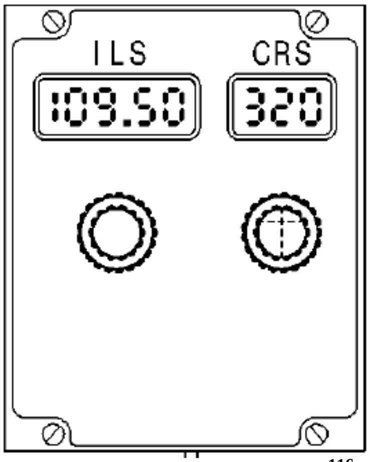

Figure 6: ILS Control Panel.[116]

14.4.2 VOR/NAV/ILS Switch

The VOR/NAV/ILS switches were located on each pilot's secondary EFIS control panel on the glareshield. Selecting the ILS position would allow localizer information to be displayed on the pilot's PFD and ND.

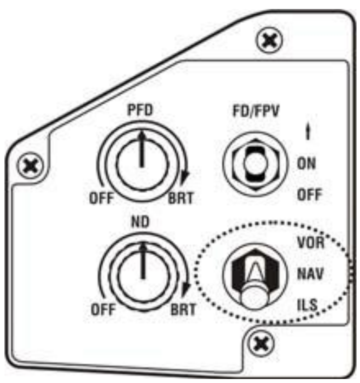

Figure 7: VOR/NAV/ILS switch. [117]

The localizer deviation scale was displayed as four white dots and a yellow center bar. It was displayed at the bottom of the PFD deviation only when the VOR/NAV/ILS switch was in the ILS position.

[116] Source: Airbus A300 FCOM 1.15.30.
[117] Source: UPS A300 Systems Manual, Section 17.01.04.01 "Instrument Landing System."

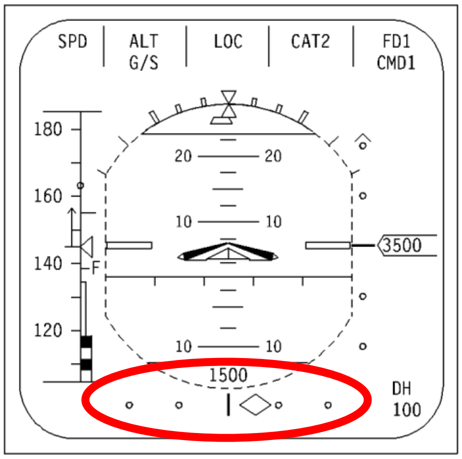

Figure 8: Localizer deviation scale on PFD.

According to documentation of the accident airplane, both pilots' VOR/NAV/ILS switch positions were consistent with being set to the ILS position.

14.4.3 ND Map Mode

According to the UPS A300 PTG, Section 02.04.08.05 "Use of the ND Map Mode," use of the Navigation Display (ND) Map mode was encouraged to the maximum extent possible for greatest Situational Awareness (SA). The ND Map mode provided a "birds' eye" view of the entire approach routing and according to the UPS A300 PTG, "was of tremendous benefit in maintaining a higher level of SA during the progress of the approach." Pilots could select the Map mode from the EFIS Primary Control Panel on the glareshield.

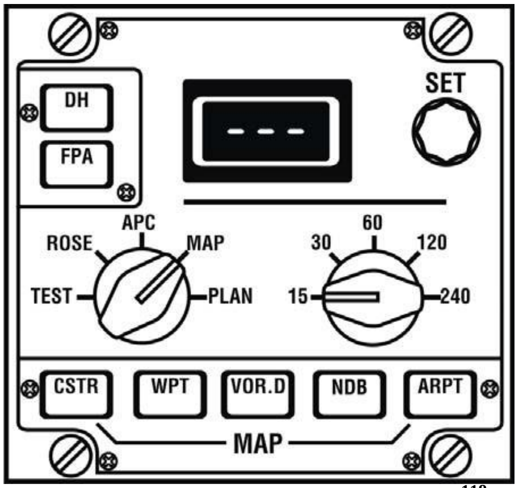

Figure 9: EFIS Primary Control Panel. [118]

[118] Source: UPS A300 Systems Manual, Section 11.01.04.02 "EFIS Control Panel."

According to documentation of the accident airplane, both pilots' EFIS Primary Control Panel switches were consistent with being set to Map mode and the 15 mile scale (as shown in Figure 8).

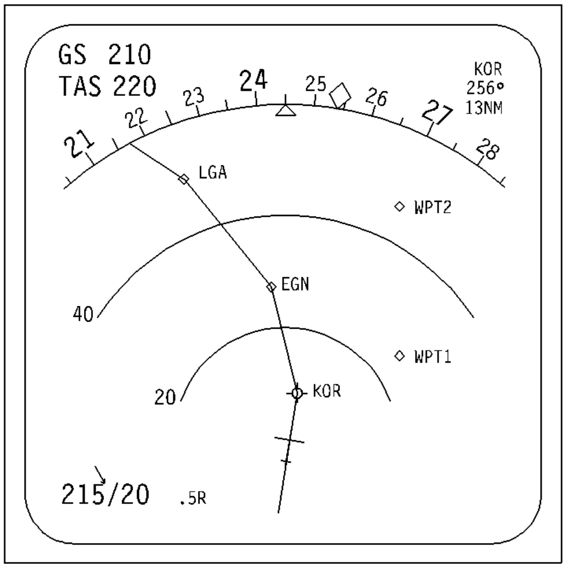

Figure 10: Example of ND Map Mode (60 mile scale).[119]

14.4.4 Distance Displays

There were two possible locations where a pilot could view distance to a specific point. During an approach, the localizer's DME was autotuned by the FMS (provided that the localizer frequency was set on the ILS control panel) and the localizer DME distance was displayed in the lower left corner of both PFD's.[120]Distance could also be viewed on the CDU PROG page.

The name of the next waypoint, and its bearing and distance were displayed in green in the upper right corner of the ND. Distance was displayed in tenth of nautical miles when less than 20 NM from the waypoint. This distance was called the Along Track Distance (ATD), and was the distance to the next waypoint on a properly sequenced FMC flight plan.[121]

[119] Source: Airbus A300 FCOM 1.15.24.
[120] Source: Airbus A300 FCOM 1.15.40.
[121] Source: UPS A300 AOM 04.06.01.02.

Photo 3: PFD (top screen) showing localizer DME. Bottom screen (ND) showing next waypoint distance. [122]

14.5 FMC Setup

FMC downloaded data indicated that the crew of UPS1354 loaded the KBHM LOC18 approach into the FMC through the CDU. Most approaches to airports served by UPS (both destination and alternates) were loaded into the database of the FMC.[123] Pilots accessed this database through the CDU, inserted the approach into the flight plan page, and could view the approach routing on the ND. According to recorded data, while navigating direct to KBHM, the crew of UPS1354 entered the KBHM LOC 18 approach into the FMC, and the approach routing was visible on each pilot's navigational display.

Once an approach was loaded into the flight plan, a F-PLN DISCONTINUITY (flight plan discontinuity) could be created in the flight plan.[124] According to the UPS A300 PTG, Section

[122] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.

[123] The A300 FMC Honeywell database (UP91308001, effective dates 25 July 2013 to 22 August 2013) contained the KBHM LOC 18 approach.

[124] Approaches that had a feeder route segment as a part of the approach would insert the feeder route from the last waypoint in the active flight plan to the initial approach fix (IAF) for the approach, and there would not be a F-PLN DISCONTINUITY in the flight plan. The KBHM LOC 18 approach did not have a feeder route from KBHM, the last waypoint in the active flight plan UPS1354 flew while navigating direct to KBHM.

05.03.02.01 “Loading an approach,” pilots should then use the scroll keys on the CDU flight plan page to review the entire approach and missed approach procedure now displayed after the last waypoint in the original flight plan on the CDU. A F-PLN DISCONTINUITY would be created prior to the first waypoint of the approach procedure. The UPS A300 PTG recommended that the discontinuity not be cleared until radar vectors were given off of the arrival and clearance for the approach was received.

The UPS A300 PTG, Section 05.03.02.01 provided the following caution:

> *CAUTION: WHEN AN APPROACH IS LOADED INTO THE A300 FMC, THE FMC “LOOKS” AT EACH OF THE APPROACH IAF WAYPOINTS AND DETERMINES IF THERE IS A FEEDER ROUTE FROM THE LAST WAYPOINT IN THE ACTIVE F-PLN AND ANY OF THE IAF WAYPOINTS. IF THERE IS, IT ASSUMES THAT YOU WANT TO FLY THE FEEDER ROUTE FROM THE LAST WAYPOINT IN THE ACTIVE F-PLN TO THE IAF AND EXECUTE THE APPROACH AS DEPICTED ON THE APPROACH CHART. THEREFORE THE APPROACH IS LOADED WITH NO DISCONTINUITY BETWEEN THE ACTIVE F-PLN ROUTE AND THE APPROACH.*[125]

The Operations Group conducted a simulator test in an A300 simulator at the UPS Training Facility on December 4, 2013. During the testing, representatives of the Operations Group entered the KBHM LOC 18 approach into the FMC while flying direct to KBHM. There was no feeder route between the last waypoint in the active flight plan (direct to KBMH) and the initial approach fix (IAP) of the LOC18 approach. A F-PLN DISCONTINUITY was shown in the active flight plan following KBHM (see photo 4).[126]

[125] All caps text included in the UPS A300 PTG text.

[126] The FMC will create a FROM waypoint (the fix or turn point - T/P - on the active routing the airplane is flying away from) and a TO point (the fix the airplane would be actively navigating to). When F-PLN page is first displayed (by pressing F-PLN key on the CDU), the FROM waypoint (last crossed fixed waypoint in flight or departure airport on ground) is displayed at the TOP of the page, followed by all waypoints which constitute the F-PLN. The TO waypoint is the first fixed waypoint after the FROM waypoint. The NEXT waypoint is the first fixed waypoint after the TO waypoint. Scrolling (slewing) the flight plan page using the arrow keys of the CDU to subsequent pages of the flight plan will remove the “FROM” fix from view, and a white DSPY (display) light on the left side of the CDU will illuminate, indicating the flight plan has been slewed and/or the display does not indicate the active situation in the FMC. Source: Airbus A300 FCOM, page 1.20.62.

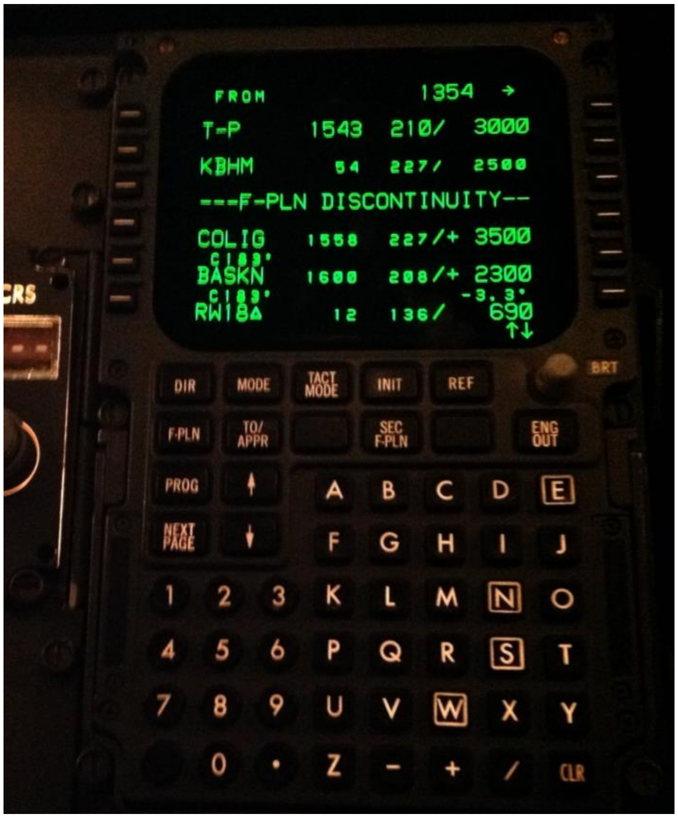

Photo 4: CDU F-PLN page showing flight plan discontinuity.[127]

The Navigational Display also showed the active routing (direct to KBHM) and the approach routing as entered in the FMC, with the F-PLN DISCONTINUITY still in the active flight plan (see photo 5).

[127] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.

Photo 5: PFD and ND with flight plan route discontinuity in the active flight plan.[128]

14.5.1 Activating Final Approach

In order for the A300 to fly a VNAV Profile to a DA, the pilot would be required to first "activate the final approach", and then select the "Profile" button on the MCP, arming the Profile mode to intercept the VNAV path. According to the UPS A300 PTG 02.04.04.04 "Activating Final Approach Mode," Final Approach mode must be activated prior to arming Profile. The pilot would select the approach in the CDU, insert the applicable DA/MDA (in the case of the KBHM LOC 18 approach, this value would be 1200) into the MDA field with the 5 right button, and then line select (LSK) the 6 right button on the Approach page to activate the approach. In the case of the KBHM LOC 18 approach, by selecting the 6 right button, the Approach page title would change from "APPROACH" to "FINAL APPROACH 3.3"[129] (see photos 6 and 7).

[128] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.

[129] The KBHM LOC 18 approach called for a 3.28 degree VNAV path angle from the final approach fix (BASKN) to the threshold crossing height of the runway. The A300 was allowed to fly the VNAV path from within .1 degree difference between the FMC generated path angle and the charted path angle.

Photo 6: CDU prior to activating Final Approach mode[130]

[130] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.

Photo 7: CDU after activating Final Approach Mode[131]

VDEV (Vertical Deviation) was displayed on the CDU's APPROACH and PROG pages in digital format. It was also depicted on each ND Vertical Deviation Indicator (VDI) where 1 dot equaled 100 feet (200 feet full-scale deflection). Once Final Approach mode was activated, the VNAV path computation changed from Performance Descent mode to Final Approach mode. The Vertical Deviation Indicator (VDI) - commonly referred to as the "football" - would appear on the right side of each crewmember's ND.[132] No VNAV path deviation was ever displayed on the A300 PFD.

[131] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.
[132] A note in the UPS A300 PTG, Section 02.04.04.04, stated that Final Approach Mode cannot be activated if Profile is the selected mode. The FMC has a limitation of being unable to go directly from Profile Performance Descent Mode directly to Profile Final Approach Mode. ALT HOLD, LVL CH or V/S will need to be selected on the MCP before the "FINAL X.X°" prompt on the APPROACH page (LSK 6R) will be displayed.

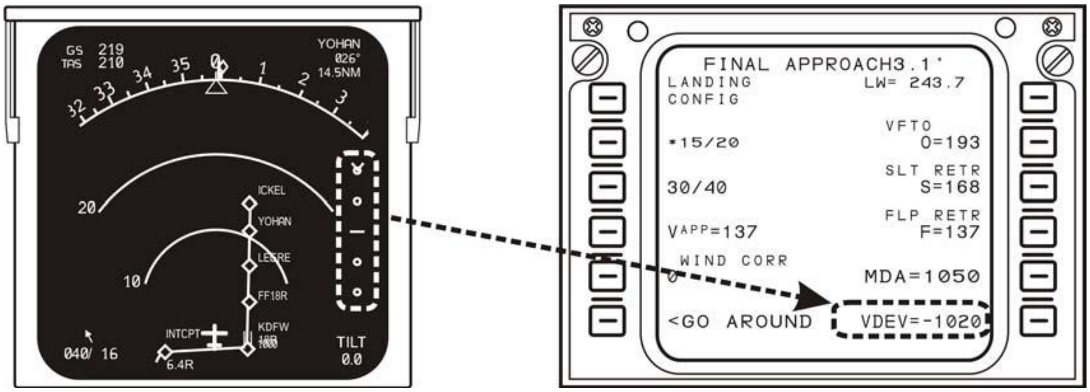

Figure 11: Example of typical VNAV Path Displays (VDI "football" depicted on the ND display).[133]

The UPS A300 AOM stated both pilots must compare PF and PM vertical deviation indicators (VDI) to identify gross errors,[134] stating "monitor deviation from VNAV path (Max +100/-50 feet," and to verify step-down compliance.[135]

According to FMC downloaded data, the crew of UPS1354 activated the Final Approach Mode, and "FINAL APPROACH 3.3" was depicted on the Approach page of the CDUs.

14.5.2 Sequencing the Approach

FMC downloaded data indicated that UPS1354 was navigating direct to KBHM when, at 0442, ATC told UPS1354 to "turn ten degrees right, join the localizer, maintain three thousand." This clearance took the flight off its NAV routing direct to KBHM. According to the UPS A300 PTG, once vectored off of the FMC lateral track, A300 pilots will re-sequence the FMC to reflect the anticipated approach waypoints to be flown. Pilots were guided to use an "H.O.V.E" check to properly sequence an approach in the FMC.[136] The UPS A300 PTG, Section 02.01.07.02 "Initial Approach" stated the following, in part:

> *Proper management of the AFDS significantly enhances the efficiency of the crew when flying any approach. A good "rule-of-thumb" to remember is the "H.O.V.E." check.*
>
> *(H) = HDG/S. HDG/S - mode must be used when being radar vectored in the terminal area to comply with ATC instructions.*
> *(O) = Out of Profile - Once vectored off of the FMC lateral track, PROFILE mode is inaccurate and of little use. Therefore, to comply with ATC altitude instructions, the use of LVL/CH or V/S modes the crew direct control over the vertical path of the aircraft.*
> *(V) = V/N/I switch - Select the V/N/I switch to the appropriate mode for the approach being flown.*

133 Source: A300 CQ Homestudy 2013.
134 One dot on the VDI equaled 100 feet.
135 Source: UPS A300 AOM, Section 04.06.01.06.
136 The H.O.V.E check was found in the UPS A300 PTG Normal Procedures. According UPS A300 instructors and check airmen, the "H.O.V.E." check was to be utilized by A300 flight crews on all normal approaches (precision and non-precision). The check was not unique to non-precision approaches only.

(E) = Extend the Centerline - The Pilot Flying should ask the PM to load the expected approach (or runway if accomplishing a visual approach) and extend the centerline. Once the approach has been properly loaded and verified in the FMC, the F-PLN page should reflect the correct sequence of waypoints and altitudes to be flown on the approach.

During the December 4, 2013 simulator testing in KSDF, representatives of the Operations Group inserted the KBHM LOC 18 approach into the FMC, and applied the "H.O.V.E." check to re-sequence the LOC 18 approach in the FMC. Following the re-sequencing of the approach, the F-PLN DISCONTINUITY was no longer viewed in the active flight plan on the CDU (see photo 8), and the previous navigation path that showed a direct routing to KBHM on the ND was removed (see photo 9).

Photo 8: CDU with re-sequenced flight plan for KBHM LOC18.[137]

[137] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.

Photo 9: PFD and ND with re-sequenced flight plan.[138]

According to downloaded FMC data from the accident airplane, the flight plan for UPS1354 was not re-sequenced prior to executing the KBHM LOC18 approach, and the flight plan discontinuity remained in the flight plan (see photos 10 through 12, taken during the December 4, 2013 simulator testing in KSDF of the PFD/ND and CDU when the KBHM LOC18 approach was not sequenced).[139]

[138] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.
[139] For additional information, see Systems Group Chairman's Factual Report.

Photo 10: PFD/ND with approach not sequenced.[140]

[140] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.

Photo 11: CDU F-PLN page with approach not sequenced.[141]

[141] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator.

Photo 12: CDU FINAL APP page with the approach not re-sequenced.[142]

14.6 Approach and Landing Briefing

UPS pilots were required to conduct an approach briefing, normally accomplished prior to top to descent, and accomplished as early as possible once the landing runway and approach in use were known.[143] The UPS A300 AOM Section 03.01.01.01 "General", stated the following, in part:

> *"Crew briefings are a critical part of the cockpit communications process. They should be used to supplement standard operating procedures; aiding each crewmember in understanding exactly what is expected during taxi, takeoff, approach and landing."*

14.7 Non-Precision Approaches

UPS1354 was given an ATC clearance to conduct a non-precision localizer approach to runway 18 at KBHM. UPS was authorized by the FAA per Operations Specifications (OpSpecs) C052 to conduct non-precision localizer (LOC) approaches.

The UPS AOM, Section 04.06.01 "Non-precision Approaches," stated the following, in part:

[142] Photo taken by Ops Group Chairman on December 4, 2013 in a UPS A300 simulator. Note: According to UPS A300 Check Airmen, the "9990" value in the VDEV (Vertical Deviation) field is the maximum value able to be displayed.
[143] For additional information, see Attachment 8 – Approach and Landing Briefing.

Use of the FMS along with the AFDS and ATS[144] to fly non-precision approaches is the normal (and preferred) method.

To assist in the setup of a certain types of approaches, UPS A300 pilots used specific "approach briefing guides." The UPS A300 AOM had approach briefing guides for both the Profile non-precision approach and the Vertical Speed non-precision approach.[145]

The UPS Pilot Training Guide, Section 02.04.05.02 "Approach Preparation" stated, in part:

It is highly recommended to review the Profile Approach Summary Table and to use the Profile Briefing Guide to ensure the approach is set up properly.

Recorded data indicated that the captain read the Profile Approach Briefing Guide from the UPS AOM prior to briefing the KBHM LOC 18 approach.

Several pilots interviewed by the NTSB stated that non-precision approaches were rarely flown on the line outside of training. A UPS A300 Assistant Chief Pilot stated that pilots flew "…very, very, very, very few non-precision approaches" each year. The UPS Director of Safety stated that there was nothing in the data (ASAP or FOQA) pointing to problems with non-precision approaches, stabilized approaches, or standard callouts in the airline or the A300 specifically.

14.7.1 DA vs. MDA

The Jeppesen BHM LOC 18 chart listed a straight-in MDA of 1,200 feet. A "ball note" on the chart stated "Only authorized operators may use VNAV[146] DA (H) in lieu of MDA (H)." UPS OpSpecs C073 authorized UPS to use a minimum descent altitude (MDA) as a decision altitude (DA)/decision height (DH) with vertical navigation (VNAV) on a non-precision approach (NPA).

Approaches that did not support Profile approaches to a DA (i.e. no "ball note" on the approach chart) may be flown to a Derived Decision Altitude (D-DA). D-DAs were calculated by adding 50 feet to the applicable MDA.[147]

In addition, 14 CFR 91.175 stated the following, in part:

(c) Operation below DA/ DH or MDA. Except as provided in paragraph (l) of this section, where a DA/DH or MDA is applicable, no pilot may operate an aircraft, except a military aircraft of the United States, below the authorized MDA or continue an approach below the authorized DA/DH unless—
(1) The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers, and

[144] Auto-thrust system.
[145] For additional information, see Attachment 7 – AOM Approach Briefing Guides.
[146] Vertical Navigation.
[147] Source: UPS A300 AOM, Section 04.06-4.

for operations conducted under part 121 or part 135 unless that descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing;
(2) The flight visibility is not less than the visibility prescribed in the standard instrument approach being used; and
(3) Except for a Category II or Category III approach where any necessary visual reference requirements are specified by the Administrator, at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:
(i) The approach light system, except that the pilot may not descend below 100 feet above the touchdown zone elevation using the approach lights as a reference unless the red terminating bars or the red side row bars are also distinctly visible and identifiable.

(ii) The threshold.
(iii) The threshold markings.
(iv) The threshold lights.
(v) The runway end identifier lights.
(vi) The visual approach slope indicator.
(vii) The touchdown zone or touchdown zone markings.
(viii) The touchdown zone lights.
(ix) The runway or runway markings.
(x) The runway lights.

14.7.2 Radio Altimeter Usage

According to the UPS A300 Systems Manual, Section 11.01.04.02 “EFIS Control Panel”, the EFIS control panel, located on the glareshield, allowed each crewmember to customize their individual flight displays for various operational requirements. Each EFIS control panel provided the following optional functions:

- Select the decision height for the automatic altitude callout system
- Select the flight path vector angle
- Set the DH or FPV to the desired value
- Select the navigation display modes
- Select different optional display data on the ND
- Select the ND display range

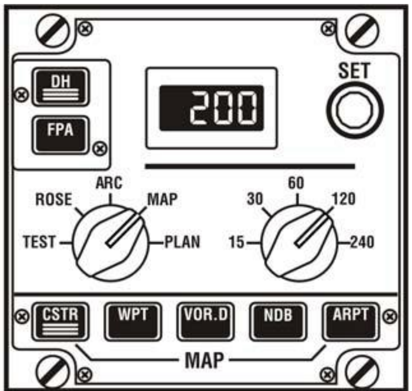

Figure 12: EFIS Control Panel[148]

According to the UPS A300 AOM, the radio altimeter may be used to crosscheck the pressure altimeter over known terrain in the terminal area.

The UPS AOM, Section 03.00.01.06 "Radio Altimeter Usage" stated, in part:

> *For Non-precision approaches, the PFD DH[149] indication will be used* *<u>for reference only</u>* *and set to the HAT[150] value for the MDA/DA/D-DA.*
>
> *Where an HAT value is not a multiple of five, the PFD DH setting will be set to the next higher value.*

According to recorded FDR data, the selected DH on the left side (captain's side) was set to 560 feet, and the selected DH on the right side (FO's side) was set to 555 feet. According to the KBHM LOC18 approach chart, the HAT for the DA (1,200 feet msl) was 556 feet.

14.7.3 Profile vs. Vertical Speed Approach Methods

According to recorded data, the captain planned to execute a non-precision localizer approach, and verbally read the Profile Approach Briefing from the UPS AOM prior to briefing the KBHM LOC 18 approach. FDR and radar data indicated that the flight did not follow the profile path of 3.28° from the final approach fix to the runway, and the vertical speed mode was used to descend from about the final approach fix (BASKN).

UPS pilots executing non-precision localizer approaches on the A300 could choose one of two methods to conduct the approach, Profile or Vertical Speed, both of which required the use of the autopilot or flight director and autothrust (ATS if available) per the UPS AOM. Lateral navigation for both methods was by means of the ground based localizer beam. Pilots would track the localizer by use of the V/L button on the MCP to intercept and track the localizer inbound.[151]

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[148] Source: UPS A300 Systems Manual, Section 11.01.04.02.
[149] Decision height.
[150] Height above touchdown.
[151] If the localizer was based off the localizer DME (distance measuring equipment), as it was for the KBHM LOC 18 approach, the DME would be displayed in the lower left corner of the PFD. Source: UPS A300 Pilot Training

The vertical navigation for the Profile approach method used the FMC Final Approach mode, which allowed the non-precision approach to be flown using VNAV path guidance to a DA in lieu of an MDA. All Profile approaches were conducted to a Barometric Decision Altitude (DA) or a Derived Decision Altitude (D-DA), as applicable. If a Barometric DA or D-DA could not be utilized, the approach was required to be flown to the applicable MDA in Vertical Speed mode.[152] An orange adjustable "bug" on each pilot's barometric altimeter was used to set the DA or MDA for a non-precision approach. Pilot callouts related to the DA or MDA were made by referencing this orange altimeter bug. Initial review of the accident airplane indicated that both pilot's barometric altimeter "bugs" were set consistent to the "200" position on the altimeter.[153]

Pilots executing non-precision approaches on the A300 using the Vertical Speed approach method would still use the localizer beam for lateral guidance, but would instead use the vertical speed pitch mode for vertical guidance. According to the UPS A300 AOM, Section 04.06.01.07 "Vertical Speed Approaches," non-precision approaches must be conducted using the autoflight system's vertical pitch mode if Profile mode was not available. All Vertical Speed approaches were required to be flown to a conventional MDA minima. It was recommended in the UPS AOM that the vertical speed used during the descent to MDA was computed using information available on the approach chart to approximate a continuous descent and prevent EGPWS activation.

The UPS A300 Pilot Training Guide, Section 02.04.01.01 "Non-Precision Approaches – General" stated, in part:

> *Executing a non-precision instrument approach is one of the most demanding tasks placed on a flight crew. The safe execution of non-precision approaches places increased challenges on the aircrew in the areas of:*
>
> - *Strategy and decision making*
> - *Crew coordination (monitoring and callouts)*
> - *CFIT[154] awareness (responses)*
>
> *Non-precision approaches may be flown either using the VNAV guidance (Profile Approach Mode) or a conventional manner using Vertical Speed (V/S Approaches). If available, a Profile Approach is highly recommended over a V/S approach due to having VNAV guidance.*
>
> *Most CFIT incidents and accidents occur during the step-down non-precision approaches. A Mitre Corporation study finds that step-down non-precision approaches account for less than 5% of the total number of approaches flown by U.S. air carriers yet the accident rate is five times higher than precision approaches. The infrequent need to*

Guide, Section 02.04.08.09 "Final Approach."
[152] Source: UPS A300 AOM, Section 04.06-4.
[153] The DA/MDA for the KBHM LOC 18 approach was 1,200 feet.
[154] Controlled flight into terrain.

execute these types of approaches in IFR conditions and the fact that the aircraft is not only in a critical phase of flight, but a much greater demand is placed on the crew's coordination, piloting skills and ability to manage all available cockpit resources are reasons for a much higher accident rate for step-down non-precision approaches. VNAV approaches eliminate the "dive and drive" aspect of non-precision approaches. VNAV, with its defined vertical path and specified vertical angle, provides vertical guidance, enabling a constant rate-of-descent for the final approach segment, much like a precision approach.

The UPS A300 Training and Standards Manager told NTSB Staff that UPS instructed its pilots to fly a profile approach unless it was not available because of meteorological issues, it was deferred for maintenance or it could not be pulled up in the database.

14.7.4 Profile Non-precision Approach Method

14.7.4.1 Barometric VNAV Concept

According to the UPS PTG, Section 02.04.02.01 "Barometric VNAV Concept", Barometric Vertical Navigation was a function provided by the FMC. The A300 FMC provided two VNAV functions: one used during enroute and terminal area operations, called Profile Performance Descent mode and the other to be used during non-precision approaches, called Profile Final Approach Mode.

Profile Performance Descent mode computed a geometric path from an altitude constraint backwards to cruise altitude, resulting in a FMC calculated Top-of-Descent point. This concept was most often used when planning a descent from cruise altitude. It could also calculate a geometric path between altitude constraints defined at two waypoints in the FMC flight plan. This concept was often used when meeting crossing restrictions on a STAR.

Profile Final Approach mode operated using a different concept from Performance Descent mode. Final Approach mode computed a geometric path of fixed angle from a single reference waypoint (usually the Threshold Crossing Height) extending infinitely upward. The Profile Approach VNAV path was independent of all FMC altitude constraints and the MCP altitude window. Profile Final Approach mode was only used to provide vertical guidance during approach and must be explicitly activated by the flight crew.[155]

14.7.4.3 Standard Profile

The standard method of executing a Profile non-precision approach was provided in a diagram in the UPS A300 AOM, Section 04.06.01.06 "Profile Non-precision approach" as follows:

[155] See Section 14.5.1 "Activating Final Approach" of this Factual Report.

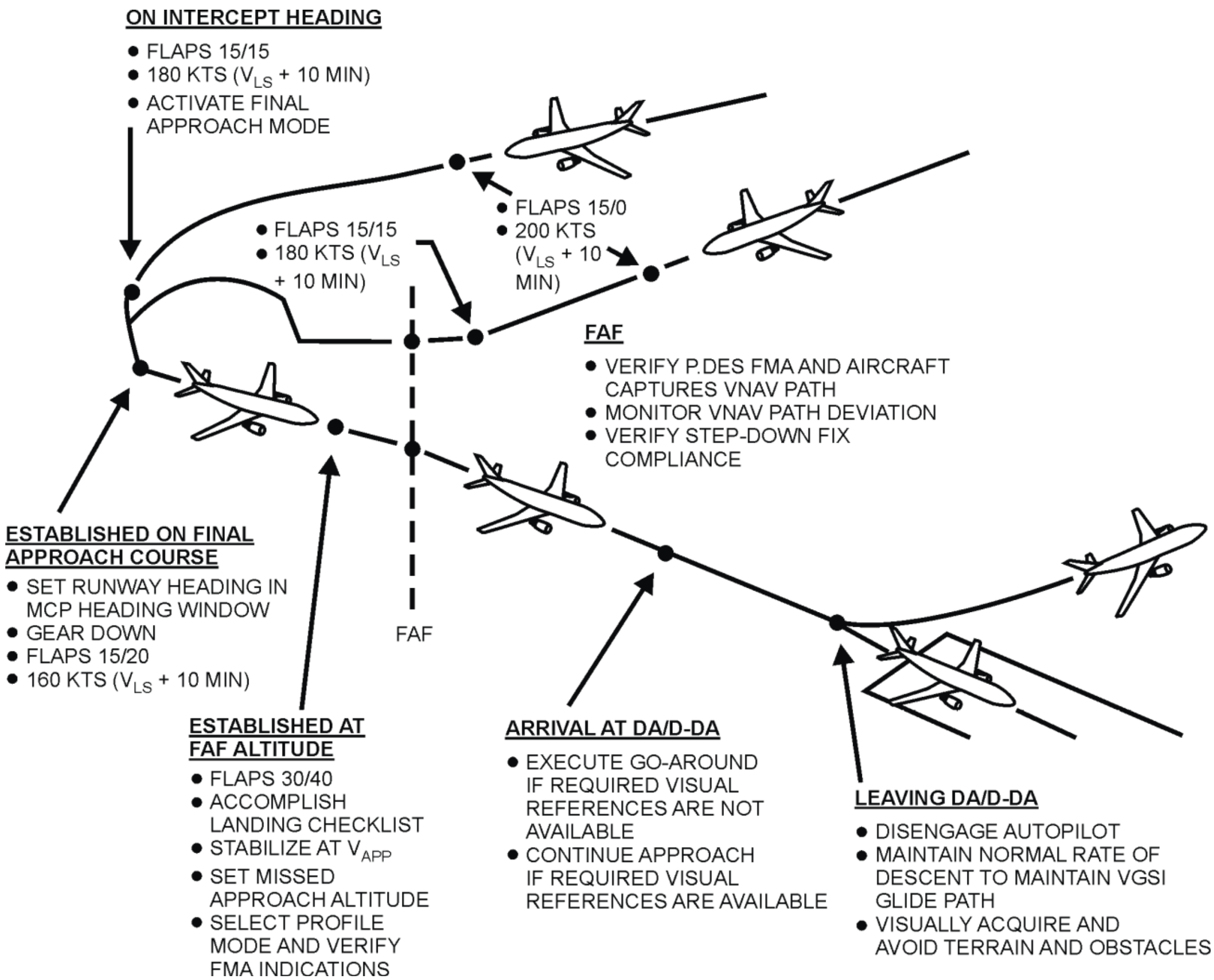

Figure 13: Standard Profile non-precision approach

The UPS A300 PTG recommended the airplane descend to FAF crossing altitude prior to intercepting the VNAV path. Intercepting the VNAV path outside the FAF did not guarantee step down fix compliance.[156] Prior to intercepting the VNAV path, the pilot would be required to arm Profile by selecting the Profile button on the MCP and ensuring that P.DES[157] on the FMA illuminated blue, indicating it was armed.

[156] FINAL APPROACH mode does not respect the MCP Altitude Select Window. The minimum altitude for crossing the FAF on the KBHM LOC 18 approach was 2,300. UPS1354 crossed the FAF at 2,500 feet.
[157] Profile descent.

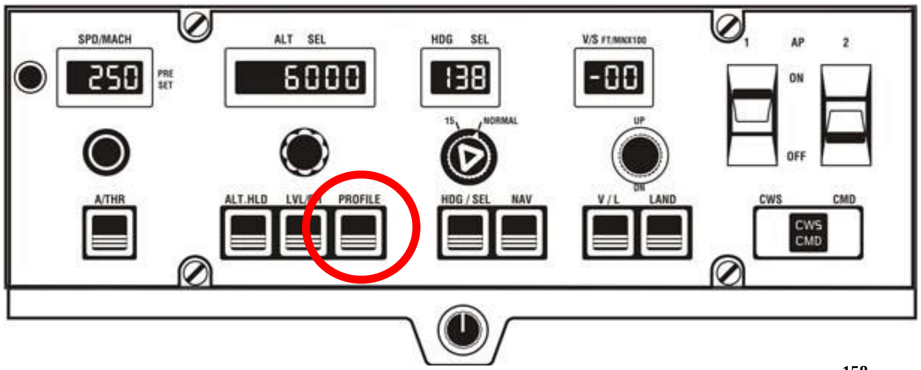

Figure 14: Profile button on the A300 Mode Control Panel (in red circle).[158]

Selecting Profile mode armed the autopilot to capture the VNAV path when intercepted. At VNAV path interception it would disregard the MCP altitude window, allowing the missed approach altitude to be selected in preparation for a potential go-around.[159] The autopilot would remain engaged in ALT HLD or V/S (whichever was engaged when Profile was selected) until the VNAV path was intercepted. P.DES (blue) indicated Profile mode was armed to intercept the VNAV path. [160] P. DES would begin to flash when approaching VNAV path intercept.[161] When the VNAV path was intercepted, the FMA displayed P. SPD and P. DES (green) to indicate Profile mode engagement.

Crossing the FAF, the pilot shall verify the FMA indicated P.SPD and P.DES[162], and the aircraft began descent on the VNAV path.

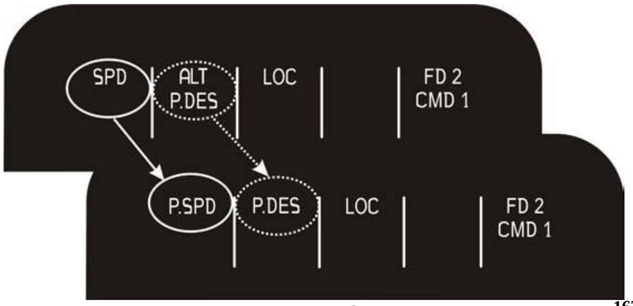

Figure 15: FMA indications of VNAV path engaging.[163]

At arrival at DA/D-DA with the runway environment insight, the pilot shall select FPV[164] or V/S for guidance in the visual segment.[165] The AFDS would mode revert and the autopilot would

[158] Source: UPS A300 Systems Manual, Section 01.02.02.07 "Mode Control Panel."
[159] The missed approach altitude may be set any time after arrival at FAF altitude and FMA indicates ALT not ALT* or interception of the VNAV path.
[160] The UPS PTG, Section 02.04.04.05 had the following note: "Profile mode will arm but not engage unless NAV, LOC or LOC* mode is engaged. With Profile armed, selecting LVL CH or ALT Hold will disarm Profile mode. A V/S descent does not disarm Profile mode. If Profile is selected during ALT*, it will disarm when ALT* changes to ALT.
[161] If Profile is selected with ALT* annunciated on the FMA, Profile will be disarmed when the FMA changes to ALT.
[162] P.DES is Profile Descent. In PROFILE the autopilot will maintain the descent speed, flight path or vertical speed directed by the FMS.
[163] Source: A300 CQ Homestudy 2013.

disengage at 50 feet below DA/D-DA if the DA/D-DA was entered in the Approach page of the CDU. AFDS modes would revert to the HDG and V/S existing at the time of reversion. The ATS mode would also revert to existing speed. UPS required the pilot to disconnect the autopilot when continuing the descent below DA if not done automatically.

14.7.4.4 Failure to Capture Profile Path

According to downloaded FMC data from the accident airplane, the flight plan for UPS1354 was not re-sequenced prior to executing the KBHM LOC18 approach, and the flight plan discontinuity remained in the flight plan as the flight tracked the runway 18 localizer.[166]

During the December 4, 2013 KSDF simulator testing in the A300 simulator, the Operations Group simulated a KBHM LOC 18 approach using the Profile approach method to conduct the approach with a flight plan discontinuity left in the flight plan, simulating a failure to re-sequence the approach. Following localizer capture, the Profile button on the MCP was armed, and the FMA annunciated a blue P.DES, indicating that the VNAV profile was armed for capture. Upon arriving at the VNAV Profile for descent, the Profile mode did not capture, the P.DES remained armed (blue), and the airplane did not descend.[167]

The UPS A300 AOM and the UPS A300 PTG did not include specific guidance to pilots on required crew actions should Profile not capture and begin a descent on the VNAV path. The UPS A300 Training Standards Manager told NTSB Staff that pilots were not taught to intercept a VNAV vertical path from above, and added that if a flight was not on the profile at the FAF he would expect the crew to abandon the approach. The UPS A300 Chief Pilot said, in his opinion, if a pilot flew past the final approach fix and was high he could use vertical speed to intercept a profile approach from above, but he would recommend a go around if the approach was too high. He also stated that if you were just past the final approach fix and it was recoverable it would be a judgment call whether or not to use vertical speed to recover. He said pilots were shown this maneuver in training, but only as it related to ILS glide slope out.

14.7.5 Vertical Speed Approach Method

According to the UPS A300 AOM, Section 04.06.01.07 "Vertical Speed Approaches" non-precision approaches must be conducted using AFDS Vertical Speed pitch mode if Profile mode was not available. All Vertical Speed approaches were required by UPS to be flown to conventional MDA minima. It was recommended that the vertical speed used during descent to MDA be computed using information available on the approach chart to approximate a continuous descent and prevent EGPWS activation.

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[164] Flight Path Vector. FPV could be selected via the FD/FPV toggle switch located on the EFIS secondary control panel on the glareshield, and used to provide assistance to the flight crew to fly a trajectory following a desired FPA and CRS versus the traditional flight director (FD) command bars. There was no requirement to use the FPV over the FD.
[165] Source: UPS A300 AOM, Section 04.06.01.06.
[166] See Systems Group Chairman's Factual Report.
[167] In addition, following the Profile not capturing the VNAV path in the simulator, descent was made using Vertical Speed with the autopilot on. As the airplane descended below the DA for the KBHM LOC 18 approach (1,200 feet), the autopilot remained on and did not automatically disconnect when 50 feet below the DA.

14.7.5.1 Standard Profile

The standard method of executing a Vertical Speed non-precision approach was provided in a diagram in the UPS A300 AOM, Section 04.06.01.0 "Vertical Speed Non-precision Approach Profile" as follows:

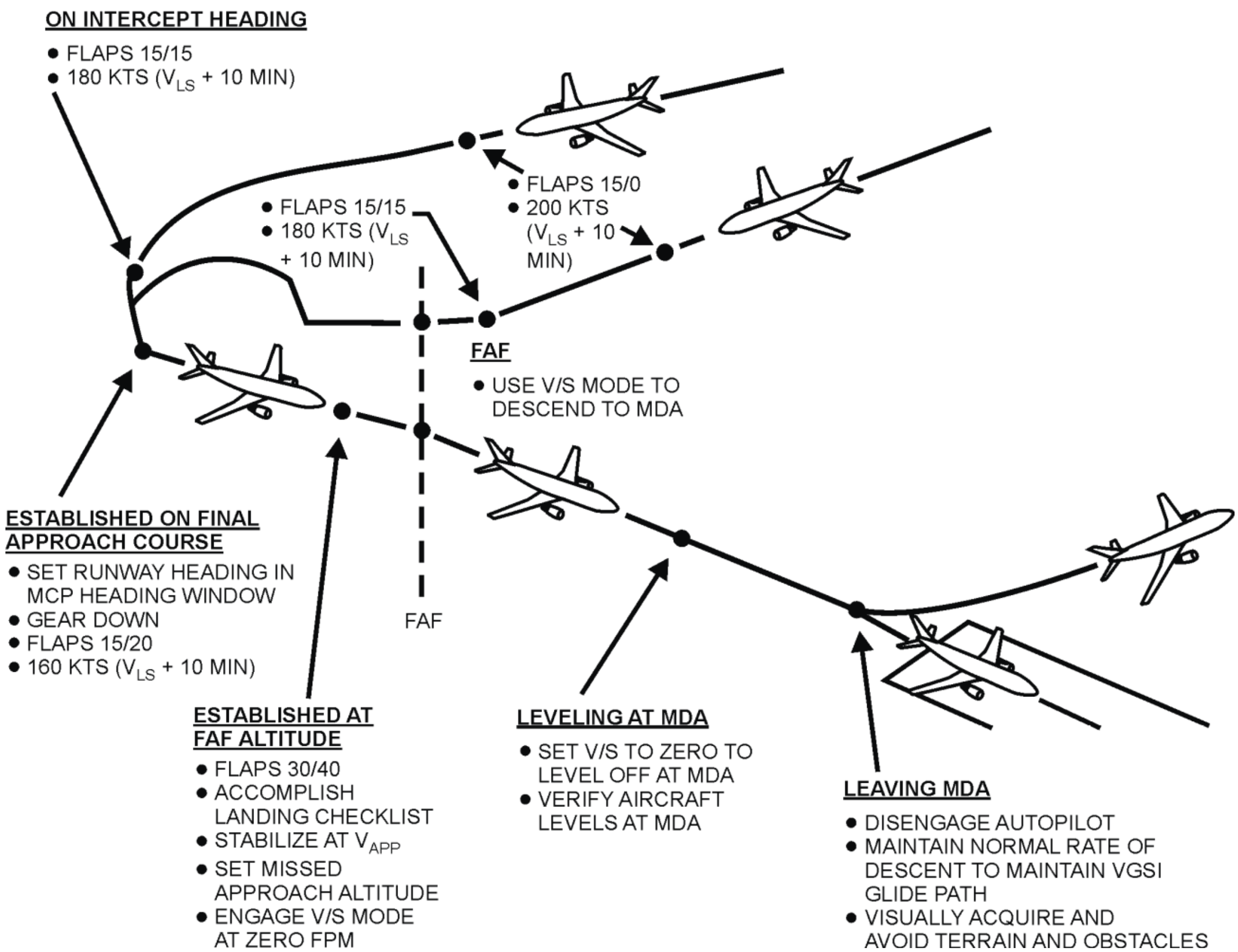

Figure 16: Standard Vertical Speed non-precision approach.

UPS recommended that the aircraft should be fully configured and at V_{APP} speed prior to FAF to ensure stabilized approach criteria are met. The pilot would use vertical speed mode to descend to MDA. Pilots shall not exceed 1500 fpm inside the FAF to 1000 feet HAT, and shall not exceed 1000 fpm below 1000 feet HAT. The selection of vertical speed should allow a continuous descent to MDA.[168]

[168] FAA Advisory Circular 120-108 "Continuous Descent Final Approach" defined a continuous descent final (CDFA) as "a technique for flying the final approach segment of an NPA as a continuous descent. The technique is consistent with stabilized approach procedures and has no level-off. A CDFA starts from an altitude/height at or above the FAF and proceeds to an altitude/height approximately 50 feet (15 meters) above the landing runway

Vertical speed was selected on the MCP and the value of the decent rate selected read in a window above the selector knob. On the A300, the vertical speed rate selected could only be read in this window, was not repeated on the FMA, and required the pilot to look at the vertical speed window on the glareshield to verify the rate selected.

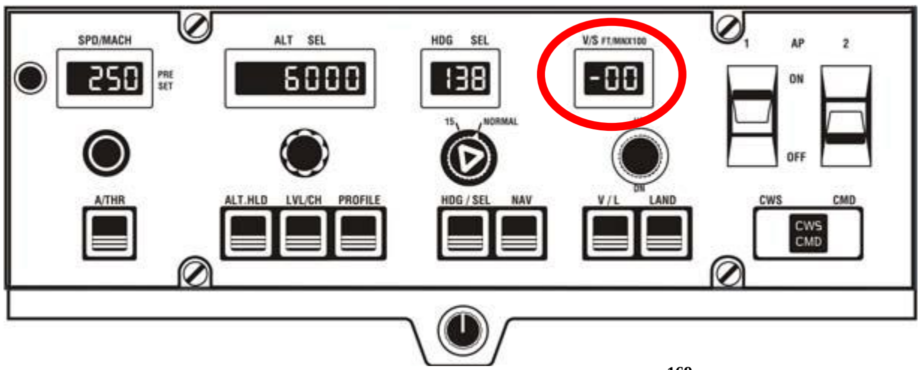

Figure 17: Vertical Speed window on MCP (in red circle).[169]

Prior to arriving at the MDA (using a calculation of approximately 20% of the vertical speed above the MDA), the pilot would select the vertical speed to zero to level the airplane at the MDA.[170] When the airplane reached the visual descent point (VDP)[171] with the runway environment in sight, the pilot would select flight path vector (FPV) or vertical speed to descend to the runway. The autopilot would be required to be disengaged no later than 50 feet below MDA.

Further, the UPS A300 PTG, Section 02.04.08.02 "Constant Angle Final Approaches" stated the following:

> *Nearly 60% of all transport category aircraft CFIT incidents and accidents have occurred during step-down, non-precision approaches when the crew used the "dive and drive" method of descent from the FAF. It is important to note that step-down approaches are based solely on an obstacle clearance profile and are not optimized for modern commercial jetliners. Flying constant angle approaches offers several advantages:*
> - *Provides a stabilized flight path.*
> - *Reduces crew workload in a critical phase of flight.*

threshold or to a point where the flare maneuver should begin for the type of aircraft being flown. This definition harmonizes with the ICAO and the European Aviation Safety Agency (EASA)."

[169] Source: UPS A300 Systems Manual, Section 01.02.02.07 "Mode Control Panel."

[170] Section 04.06.01.09 of the AOM had the following warning: If the MCP altitude is changed while FMA displays ALT*, the AFDS pitch mode will revert to V/S.

[171] The VDP is a point from which a visual, stabilized, normal descent rate can be safely conducted to the landing runway. VDP's may be published on an approach chart or computed by the crew.

- *Decreases the risk of errors in step-down fixes/altitude level offs and the need to level-off at the MDA(H).*

The combination of all these advantages greatly reduces the risk of CFIT incidents and/or accidents.

For these reasons we make every attempt to fly V/S approaches in a constant angle and avoid the dive and drive technique.

14.7.6 Non-Precision Required Crew Callouts

According to UPS, the required crew callouts for both Profile and Vertical Speed non-precision approaches were identical. However, the required callouts were not included in the Profile non-precision approach section of the UPS A300 AOM (Section 04.06.01.06), and only found in the UPS A300 AOM, Section 04.06.01.07 "Vertical Speed Approaches."

The required crew callouts listed in the UPS A300 AOM were as follows:

– 1000 feet above touchdown:

PM - **"One thousand feet, instruments crosschecked/no flags."**

PF - "MDA ____."

– 500 feet above touchdown:

PM - Calls out altitude, existing speed and sink rate. (e.g.,**"500 feet, on speed, sink 7."**)

– 100 feet above MDA:

PM - **"Approaching minimums."**

– At MDA:

PM - **"Minimums."**

PF - **"Landing/Continuing,"** or **"Go-Around Thrust, Flaps."**

In addition, the UPS A300 PTG also had a chart for required crew callouts, found in Section 02.04.06 "Required Crew Callouts." The chart stated that the non-precision approach callout at 1,000 AFE from the PM should be "1000 feet, altitude set, stable."[172]

According to UPS, the airline was in the process of conducting a fleet-wide change to the 1,000 foot callout to include a "stable" call, to be implemented for each individual fleet through the respective fleet AOM revision process. The AOM revision for the A300 (revision 32) was submitted to the FAA in July, 2013 and had not been acted on by the FAA at the time of the accident. The PTG revision that included the "stable" call was made in anticipation of the AOM change, and left in the manual as the airline continued discussions with the FAA on the AOM change. The UPS AOM was the FAA approved manual, and UPS A300 pilots were taught the AOM version of the required 1,000 foot callout ("instruments cross-checked/no flags").

[172] For additional information, see Attachment 23 – Non-Precision Approach Procedures.

According to a UPS A300 Check Airman, the "approaching minimums" callout by the PM would prompt the PF to begin looking outside the cockpit so that upon arrival at the approach minimums, the PF could make the land or go-around decision. According to recorded data, the UPS1354 first officer made the 1,000 foot pilot monitoring callout required by the UPS A300 AOM at approximately 1000 feet radar altimeter (RA), but did not make any further pilot monitoring callouts required by the AOM after that point.

15.0 Stable Approach Criteria

FDR data indicated that the accident flight was in vertical speed mode, descending at about 1500 fpm as the airplane descended through the DA (MDA) of 1200 feet.

FAA Advisory Circular 120-108 "Continuous Descent Final Approach" (dated January 20, 2011) defined a stabilized approach as follows:

> *A stabilized approach is a key feature to a safe approach and landing. Operators are encouraged by the FAA and the International Civil Aviation Organization (ICAO) to use the stabilized approach concept to help eliminate CFIT. The stabilized approach concept is characterized by maintaining a stable approach speed, descent rate, vertical flightpath, and configuration to the landing touchdown point. Depart the FAF configured for landing and on the proper approach speed, power setting, and flightpath before descending below the minimum stabilized approach height; e.g., 1,000 feet above the airport elevation and at a rate of descent no greater than 1,000 feet per minute (fpm), unless specifically briefed. (See AC 120-71.)*

According to the UPS FOM Volume 2, Section 03.07.01.03 "Stabilized Approach Criteria," all approaches must be stabilized by 1,000 feet AFE (above field elevation). At UPS, an approach was considered stable when the following conditions are met.

- Aircraft is in the landing configuration and the landing checklist has been completed
- Airspeed is within +10 or -5 knots of computed final approach speed*
- Sink rate is 1000 feet per minute or less and stable **
- Aircraft is on a stable vertical path that will result in landing within the touchdown zone
- Engine thrust is stabilized at a level that results in target speed (as listed above)
- Aircraft is aligned with the lateral confines of the runway by 200 feet AFE
    - Note: *Airspeed must be within 5 knots of target by 500 feet AFE
    - Note: **Vertical speed up to 1200 feet per minute may be acceptable under approach conditions that require higher airspeed/ground speeds due to non-normal aircraft system configuration

The UPS FOM Volume 2, Section 03.07.01 "Stabilized Approach Criteria" stated:

> *During an instrument approach, crews are encouraged to stabilize the approach prior to 1,000 AFE. However, all stabilized approach criteria must be met no later than 1,000 AFE.*

Under no circumstances will safety-of-flight be compromised. If at any time during the approach the Captain feels that the stabilized approach criteria cannot be achieved or maintained, a go-around must be initiated.

Guidance on stabilized approach criteria was also found in the UPS A300 Pilot Training Guide, Section 02.02.02.03 “Stabilized Approach” which stated, in part:

A good landing begins with a stabilized approach. Stabilized approach requirements are defined in the FOM. All approaches are requried to be stabilized no later than 1000 HAT, in all flight conditions. Below 1000 feet HAT only minimum thrust and pitch changes should be necessary to maintain V_{APP} on a nominal 3° glide path to the runway, to land in the touchdown zone. If an approach becomes de-stabilized below 1000 HAT a go-around is required.

The UPS FOM Volume 2 stated that all aproaches must be stable by 1,000 feet above “field elevation,” and the UPS A300 AOM required the 1,000 foot callout to occur at an altitude “1000 feet above touchdown.”[173] KBHM had a field elevation of 650 feet msl, and the runway 18 touchdown zone elevation was 644 feet msl. According to FDR and recorded data, the accident FO on UPS1354 made the 1,000 foot callout required by the UPS A300 AOM at about 1,000 feet radar altimeter.

15.1 UPS Unstable Approach Data – General

A UPS review of de-identified FOQA data related to unstable approaches indicated that system wide, over the past two years, the system-wide unstable approach rates declined by approximately 21.3%. Unstable was defined as one or more unstable events below 1000 feet. During the same period, the system-wide high risk unstable approach rates declined by approximately 22.2%. High risk was defined as one or more unstable events below 500 feet.

For the A300 fleet, over the past two years, the A300 unstable approach rates declined by approximately 25.0%. Unstable was defined as one or more unstable events below 1000 feet. During the same period, the A300 high risk unstable approach rates declined by approximately 58.3%. High risk was defined as one or more unstable events below 500 feet.

The UPS Director of Safety told NTSB Staff that there was nothing in their Safety data (ASAP or FOQA) pointing to problems with non-precision approaches, stabilized approaches, or standard callouts in the airline or the A300 specifically. He said they looked at stabilized approaches on two fronts, no-fault go-arounds and unstable approaches below 1000 feet. If anything was not stabilized below 1,000 feet, UPS pilots could go around and not fear that they would get a call from the chief pilot’s office. UPS also tracked higher risk unstabilized approaches below 500 feet, and the UPS Director of Safety said the number of unstable approaches below 500 was “very low.”

[173] Source: UPS A300 AOM Section 04.06-11.

15.2 Unstable Approach Data – KBHM

As part of their set of Jeppesen charts, UPS pilots had a tailored Birmingham, AL airport information chart (Chart 10-10, date December 21, 2012) they were required to review. A "Safety Alert" section of the chart stated the following

> *Arrival*
> *- FOQA information indicates a high number of unstable approaches to this Airport.*
> *- ATC may keep aircraft at high altitudes prior to approach.*
> *Departures*
> *- Pushback on Taxiway Alpha requires ATC clearance.*

NTSB Staff requested UPS research the historical data and archived files to support the statement of unstable approaches at KBHM as referenced in the tailored UPS 10-10 chart, and according to UPS, the KBHM 10-10 page "Safety Alert" was requested in October 2005. At that time, multiple Safety Alert updates were requested with the stipulation that they were in priority order and the revisions could be broken into batches. The KBHM 10-10 page Alert as seen on the chart was published September 26, 2006. The alert was audited at the beginning of 2007 and no corrections were needed.

UPS reviewed the archived files and presentations available and were unable to find any information on KBHM being in the top 10 airports for unstable approaches. These archived files only go back as far as 2008. According to UPS, the "Safety Alert" should have been removed in 2008 as there was no data indicating that KBHM was or is a high risk airport for unstable approaches.

The UPS Director of Safety told NTSB Staff that UPS looked at the Birmingham airport post-accident and did not have a reason to look at it pre-accident. According to UPS, data did not exist that would have triggered Birmingham as being high risk based on their data and/or from their pilot's approach perspective.

16.0 Enhanced Ground Proximity Warning System Alerts

FDR data indicated that the crew of UPS1354 encountered an EGPWS "Sink Rate" aural alert prior to contacting trees along the approach to KBHM.[174] A chart in the UPS A300 AOM (Section 02.01.02.01 "GPWS/EGPWS Alert Procedures") listed a "Sink Rate" alert as a "Caution," requiring a crew response to "adjust pitch attitude and thrust to silence the warning."[175] The UPS AOM stated that anytime an EGPWS alert occurred, the PF must take immediate positive corrective action. Further, the UPS A300 PTG "Pilot Response to EGPWS Alerts", Section 03.01.01.08 included the following guidance:

> *If the EGPWS caution alert "SINK RATE, SINK RATE occurs during a VMC approach, the PF must immediately alter the flight path sufficiently to stop the alert. If the alert*

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[174] For additional information on the EGPWS system and aural alerts, see Systems Group Chairman's Factual Report.
[175] See Attachment 28 – EGPWS Alerts.

continues, or the flight is operating in IMC[176] conditions, the PF must execute a go-around or the CFIT Recovery Maneuver as appropriate. Be advised that using an excessive rate-of-descent above 1000 AGL, such as on a non-precision approach, can activate an EGPWS alert.

The UPS A300 AOM, Section 02.01.02.01 "GPWS/EGPWS Alert Procedures" stated, in part:

When any GPWS/EGPWS alert is activated, regardless of its duration, or if any situation is encountered resulting in unacceptable flight towards terrain, <u>take immediate and positive corrective action.</u>

17.0 Intercepting a Profile Path from Above

Radar and FDR data showed that UPS1354 flew across the final approach fix of BASKN on the KBHM LOC 18 approach localizer at 2,500 feet, 200 feet above the minimum crossing altitude (2,300 feet) as depicted on the KBHM LOC18 approach chart and above the 3.28 degree vertical path for the approach, and began a vertical speed descent just before passing the BASKN waypoint.

The UPS A300 AOM provided guidance for intercepting a Profile (VNAV) path from above in one instance. The UPS A300 AOM, Section 04.22.12 stated, in part:

On ILS G/S OTS approaches or LOC approaches, where the VNAV path crosses the FAF below the FAF minimum altitude, start a 1000 FPM descent at the FAF and immediately select PROFILE to capture path from above.

The procedure to use in this case was as follows:[177]

- When at the FAF altitude ("ALT"), do not select Profile inbound to the FAF.
- Instead, 1 NM prior to the FAF, open the V/S Window (O/O).
- 0.2 NM prior to FAF, set V/S to a 1000 feet/minute descent and immediately select Profile mode on the MCP.
- Monitor VDI on ND and verify the aircraft captures the VNAV path. Ensure P.SPD and P.DES engaged on the FMA and airspeed stabilized at V_{APP}.

The Profile path depicted on the Jeppesen KBHM LOC18 approach showed a 3.28 degree glidepath from the touchdown crossing height to the BASKN intersection at 2,300 feet. For the KBHM LOC 18 approach, the Profile path did not cross the final approach fix below the minimum crossing altitude. The UPS A300 Training Standards Manager told NTSB Staff that in a case similar to KBHM where the vertical path intersected the final approach fix, pilots were not taught to use vertical speed to capture the flight path and then select profile.

[176] Instrument meteorological conditions (IFR) generally refers to a ceiling of less than 1,000 feet and/or visibility less than 3 miles.
[177] According to the UPS A300 CQ Workshop 1 presentation for 2013, this maneuver was covered in CQ recurrent training in 2012 as a "first look" maneuver.

The UPS A300 Pilot Training Manual included a reference for intercepting a precision approach (ILS) glideslope from above. UPS A300 PTG, Section 02.01.07.03, "Intercepting the Glideslope From Above" stated:

> *With LAND mode selected, the A300 AFDS will not intercept the glideslope from above or prior to localizer interception. If the aircraft is well above the glideslope or outside the localizer, use the V/S pitch mode to descend until on the glide path or localizer interception. Provided LAND mode is armed, GS capture will occur as soon as the aircraft intercepts the glideslope.*

18.0 No-Fault Go-Around Policy

UPS had a "no-fault go-around policy." The UPS FOM Vulume 2, Section 02.10.02.02 "No Fault Go-around " stated, in part:

> *Go-Around Guidance:*
>
> • *The PF (Capt or F/O) may initiate a go-around at any time during an approach.*
> • *Any operating crewmember (Capt, F/O, IRO) shall make a "go-around" callout if an unsafe condition exists or as required by procedure.*
> • *The PF response to a go-around callout shall be an immediate go-around/missed approach procedure.*
>
> *NOTE: The Captain retains ultimate responsibility and authority for the safe operation of the flight (14 CFRs 121.533, 121.535). Therefore, if the Captain determines that the execution of a go-around/missed approach presents a greater risk than continuing the approach, the approach may be continued at the Captain's discretion.*
> • *If either pilot initiates a go-around/missed approach, it must be flown to its conclusion.*

According to the UPS A300 Chief Pilot, there was no mandatory event report required from the pilots for a no-fault go-around.

19.0 Advanced Qualification Program (AQP) Training

19.1 General[178]

UPS was authorized to conduct operations per the aircraft fleets and AQP curricula listed in OpSpec A034 paragraph C. The Advanced Qualification Program Manual (AQPM) contained the required UPS FAA approved Advanced Qualification Program (AQP) information and was developed in accordance with 14 CFR Part 121, Subpart Y and Advisory Circular 120-54, as revised. The A300 trained under AQP at UPS, and entered CQ phase 5 in January 2009.

The number of planned training and checking events required determined staffing requirements for check airmen and instructors. That process analysis was conducted by Flight Operations Industrial Engineering (IE). As of January 11, 2013 there were 39 ground instructors and 83

[178] Sources include interviews, the UPS AQPM Vol. 1, the UPS RCPM Volume 6, and the Department of Defense (DoD) Flight Operations Master Survey, 2013.

Simulator instructors. The UPS A300 had 27 Aircraft Check Airmen and 16 Simulator Check Airmen.

Ground training was conducted by UPS employees at the UPS Flight Training Center in Louisville and at the Anchorage Flight Training Facility (B747/MD11). Most simulator training was accomplished at the UPS Flight Training Center in Louisville or at the Anchorage Flight Training Facility (B747/MD11). Additional facilities for A300 simulator training could be used at the Federal Express A300 training facility in Memphis, TN. Both accident pilots received their A300 training in Louisville.

All ground and flight training was accomplished under the responsibility and authority of the Flight Standards and Training Division Manager. Simulator Check Airman reported directly to the Fleet Standards and Training Manager. Chief Pilots and Assistant Chief Pilots (ACPs), when accomplishing training, checking or supervision of Operating Experience (OE), did so under the authority of the appropriate Fleet Standards and Training Manager. For other activities, such as managing the crewmember workforce and overseeing execution of strategic and tactical UPS flight operations, ACPs reported to the appropriate Chief Pilot. Line crewmembers who conducted OE reported to their respective Fleet Standards and Training Manager for all activities related to supervision of OE.

Monthly business planning meetings (BPM) were held, and AQP had a CQ developer's meetings for Line Oriented Simulation (LOS) and an Annual review. Quarterly AQP data review focused on the AQP High Risk Report. These meetings included key airline staff and the FAA. AQP data was provided to the Fleet Standards and Training Managers quarterly and annually.

According to the UPS A300 Training Standards Manager, Qualification (Qual) training was 29 days and was provided to pilots initially coming into their program. Training was divided into systems training, followed by knowledge validation of 100 questions; procedures which included workshops done in the Virtual Procedures Trainers (VPT), followed by procedures validation; then maneuvers which taught everything about flying the airplane in the simulator to include all procedures, all abnormals, and different approaches, followed by maneuvers validation. After that, pilots completed a series of LOS; he thought there were 4-5 of those. After LOS was completed successfully, pilots completed Line Oriented Evaluation (LOE) which include a check ride where captains would also get a type rating. Upgrade training mirrored Qual training but was a shorter training footprint, about 17 days.

CQ was an annual recurrent training event, and occurred over a 3 day period. Day 1 covered general subjects, followed by a systems evaluation for the fleet in the afternoon, followed by a knowledge validation. Day 2 included LOS 1, or "first look" maneuvers, where a pilot would come in "cold" and fly the footprint in the simulator for 2 hours, followed by a facilitated debrief.[179]

According to the A300 Training Standards Manager, in 2013 UPS focused on non-precision approaches and performance issues like no slat/no flap approaches during CQ. LOS simulator

[179] For additional information, see Section 19.3 "Non-precision Approach Training" of this Factual Report.

sessions were 2 hours long. They mostly did SPOT[180] training where they performed things that were done in the workshop the previous day, and the simulator session ended with a facilitated debrief. Day 3 was maneuvers validation for 1.5 hours. Pilots performed V1 cuts, CAT II approaches, and then SPOT training, such as stalls. They would then do a facilitated debrief and then another workshop where they would reviewed memory items and limitations. They had also been emphasizing smoke procedures since the UPS 6 accident.

Pilots who experienced training difficulties could be placed in a program called "special tracking." Criteria for special tracking was defined in the UPS AQPM, and could include operational difficulties during a line check, or voluntary entry into special tracking for a pilot wishing for more training time. According to UPS, neither pilot on UPS1354 was in special tracking at the time of the accident.

19.2 AQP Grade Scales

The UPS AQPM, Volume 1, Appendix G (page 1) provided the following AQP grade scales and reason codes:

GRADE SCALE AND REASON CODES

4 – THREATS MANAGED **Threat:** Factor that must be managed which increases the operational complexity of flight and poses a safety risk. • Crew recognizes, traps, and mitigates threats • Margin of safety clear and never in doubt • Policies / Procedures accomplished avoiding error Performance – in accordance with Qualification Standards. Debrief: Exemplary behaviors are noted and encouraged. *Comments and Reason Codes Desired*	**3 - ERROR(S) MANAGED** **Error:** Action or inaction that could lead to a deviation or incorrect configuration. • Crew recognizes, traps, and mitigates errors • Margin of safety is maintained • Policies / Procedures accomplished avoiding undesired states Performance - limited to minor variations within Qualification Standards. Debrief: How the crew handled the situation, what went well, what could be improved, and how to improve it. *Comments and Reason Codes Desired*
2 – UNDESIRED STATES MANAGED (Debrief Required) **Undesired State:** A deviation or incorrect configuration associated with a reduction in safety margins. • Crew recognizes, traps, and mitigates undesired states • Margin of safety reduced • Policies / Procedures accomplished mitigating consequences Performance - **momentarily deviates from Qualification Standards.** **Debrief:** Crew acknowledges deviations and formulates methods for avoiding, trapping and mitigating similar occurrences. **Debrief is required** to validate Qualification Standard proficiency. *Comments and Reason Codes **Mandatory***	**1 – CONSEQUENCES NOT MITIGATED (Repeat Required)** **Consequence:** The result of incorrectly performing or omitting an action. • Crew fails to recognize, trap, and/or mitigate threats, errors, and/or undesired states • Margin of safety exceeded, in doubt, lost, or unacceptable • Policy / Procedural errors lead to un-mitigated consequences Performance – **does not meet Qualification Standards** **Debrief:** Includes reasons and strategies to assist in the recognition, trapping, and mitigating threats, errors, undesired states, and consequences. **Repeat is required** to demonstrate Qualification Standard proficiency *Comments and Reason Codes **Mandatory***

[180] Special Purpose Operational Training (SPOT) was a simulator training session designed to address specific training objectives.

REASON CODES

Non – Technical Defenses	
Workload Management / Crew Coordination **W**	• Preparation and planning • Work distribution • Prioritizing • Time management • Team building and maintaining • Leadership / followership • Conflict management
Decision Making/ Problem Solving **D**	• Diagnosis of problems • Option generation • Risk assessment • Option Selection • Outcome review
Communication **C**	• Inputs and feedback (closes loop) • Briefings • Standard terminology • Verbal / Non-verbal • Inquiry / Advocacy / Assertiveness
Automation Management **A**	• Optimum use • Integration and coordination • Selection of the appropriate level • Programming and reprogramming • Intervention • Monitoring and supervision
Situational Awareness **S**	• Systems awareness (Monitoring) • Environmental awareness • Time awareness / Anticipation • Orientation graphically and vertically • Distraction / Interruption management

Technical Defenses	
Maneuvering Tolerances **M**	• Tolerances compared to the Qualification Standards • Aircraft within limitations • Positive aircraft control
Knowledge **K**	• Standard Operating Procedures • Aircraft limitations • Systems • AOM, FOM, FAR, OPS SPECS
Procedures **P**	• Compliance with Standard Operating Procedures • Compliance with AOM, FOM, FAR and OPS SPEC policies * Note: When using a reason code of P, at least one additional reason code should be selected. * Note: Record intentional non-compliance in the comments.

Figure 18: AQP Grade Scales and Reasons Codes.[181]

19.3 Non-precision Approach Training

19.3.1 Initial Qualification

Students in AQP A300 Initial or Transition training were first introduced to non-precision approaches on day two of Procedures training (day 11 of initial/transition training) through Workshop 3[182] and were shown a PowerPoint presentation discussing Profile and Vertical Speed non-precision approaches. Students then practiced both types of non-precision approaches in the VPT (virtual procedures trainer) and the simulator during LOS.[183] Profile non-precision approaches were conducted during Procedures Validation (PV)[184] periods 1 and 2, and a Vertical Speed non-precision approaches conducted during Maneuvers Validation and supplemental SPOT training.

19.3.2 Operating Experience (OE)

The UPS Captain/First Officer OE Instructor Guide, Section 11.01.01.12 11.12 "Non-Precision Approaches" provided the following guidance to UPS OE instructors:

> *Discuss the proper briefing and navigation setup to conduct a non-precision approach. Proper INS, GPS, or FMC loading should be emphasized. Visual Descent Point (VDP)*

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[181] Source: UPS AQPM, Volume 1, Appendix G (page 1).

[182] Workshops normally precede or follow an FSTD event which covers the related material. Source: UPS Advanced Qualification Program Manual (AQPM), Volume 1.

[183] Line Oriented Simulation (LOS) training was designed to integrate systems, procedures, and maneuvers in line oriented scenarios. This training focused on technical and CRM skills. Source: UPS Advanced Qualification Program Manual (AQPM), Volume 1.

[184] The purpose of the PV is to ensure that normal procedures and flows, as well as selected Abnormal or Emergency procedures, are conducted with sufficient accuracy for the trainee to continue with FFS training through MV. Source: UPS Advanced Qualification Program Manual (AQPM), Volume 1.

computation should be explained. Time and situations permitting, the student should conduct at least one non-precision approach during IOE.

19.3.3 Continuing Qualification

A300 pilots attending CQ training also received training on non-precision approaches. On day two, pilots conducted the KPHL (Philadelphia International Airport) RNAV GPS Y 9R (Profile approach with a 473' DA) non-precision approach in the simulator. This was a first look maneuver (a "First Look Maneuver" is accomplished without pre-briefing). Pilots then reviewed non-precision approaches during a Workshop PowerPoint presentation.[185]

During the simulator LOE (Line Oriented Evaluation) on day 3, the pilots conducted a non-precision RNAV (GPS) Y 4R approach at KEWR (Newark Liberty International Airport), the KPHL (Philadelphia International Airport) RNAV GPS Y 9R or the RNAV GPS Y Rwy 4L at KJFK (New York Kennedy International Airport).

A300 pilots were also provided a "2013 A300 Recurrent Homestudy" prior to class. The homestudy material included a written discussion on "Final Approach Mode Activation" and use of the Profile mode. The homestudy included the following note:

NOTE: Profile mode will arm, but will not engage, unless NAV, LOC or LOC is the active lateral mode. With Profile mode armed, a subsequent LVL CHG descent or engagement of ALT* will disarm Profile mode. A V/S descent DOES NOT disarm Profile so long as ALT* or ALT HLD is not activated.*

19.4 Flight Crew's AQP Training[186]

19.4.1 Captain A300 Upgrade Training

The captain attended A300 Upgrade training from May 4, 2009 through June 2, 2009. According to the UPS Aviation Training Management System (ATMS) that retained training records for pilots, the following AQP remarks were included in the captain's upgrade training record:[187]

Date	Maneuver	Score	Reason	Comments
5/19/2009	Perform Visual Approach	2	P,D	Decided to go around because he was unstable, but he had 2-300 more feet before reaching 1000'. He was looking at the RA instead of the Baro for HAA.
5/19/2009	Perform LOC Approach (V/S)	2	M,D	Got a little behind on the approach.
5/27/2009	Perform GPS Approach (V/S)	1	M, D	

[185] See Attachment 6 – 2013 CQ Workshop Presentation.
[186] For additional information, see Attachment 4 – Crew Records.
[187] All items were listed as trained to proficiency.

				Descended to incorrect altitude while being vectored
5/31/2009	Perform Descent	2	A,S	Used V/S with speed brakes during part of the descent, when profile or level change would have worked better. Did not recognize the need to get down to FAF altitude immediately after passing lead-in radial.
6/2/2009	Perform GPS Approach (Profile)	1	M.D	Used DA instead of a DDA and flew below mins.
11/23/2009 Supplemental SPOT	Perform V/S Non-precision Approach	2	S,D	PF briefed an inadequate rate of descent that left aircraft high in the visual segment. PM failed to correct.

19.4.2 Captain CQ Training

The captain attended A300 CQ (recurrent) training from July 10-12, 2010, and June 27-29, 2011, and June 29-July 1, 2012, and his most recent CQ June 24-26, 2013 . According to the UPS ATMS, the following AQP remarks were included in the captain's most recent CQ training record for a non-precision approach first look maneuver:

Date	Maneuver	Score	Reason	Comments
6/25/2013	Perform Non-Precision Approach with Nominal Threat Level	2	W,S	capt's mins bug set incorrectly (200' below da) on both gps appr's[188]

A300 pilots attending CQ training in 2013 received ground training on non-precision approaches. The A300 CQ for 2013 included a Workshop presentation in the classroom on day 2 of the 3 day CQ viewed by the pilots that included a discussion of Profile and Vertical Speed Approaches.[189] In addition, the NTSB reviewed downloaded data from the captain's cell phone, and copies of the 2013 CQ and Initial/Transition Student Guides were found on his cell phone.

[188] During an interview with check airman who conducted this CQ, he corrected that the accident captain's bug was actually set 200 feet "above" DA for that approach. The FO was PF, and his bug was set correctly. The FAA A300 APM was also in the simulator observing the CQ.
[189] See Attachment 6 – 2013 CQ Workshop Presentation.

19.4.3 FO A300 Transition Training

The FO attended A300 Initial Qualification training from May 1, 2012 through June 7, 2012. According to the UPS ATMS, the following AQP remarks were included in the FO's Initial Qualification training record:

Date	Maneuver	Score	Reason	Comments
6/25/2012	Perform Non-Precision Approach with Nominal Threat Level	2	K	Showed some confusion on the mechanics of the Profile mode. A repeat was reaccomplished to clarify the operation even though first approach was satisfactory.
6/3/2012	Perform Precision Approach with Nominal Threat	2	C	Did not communicate to FP concern about descending to 3000 while not within 9 DME of ILS approach

19.4.4 FO A300 CQ Training

The FO attended A300 CQ (recurrent) training from June 24, 2013 through June 26, 2013. According to the UPS ATMS, there were no remarks included in the FO's CQ training record.

20.0 FAA Oversight

UPS was a certificated 14 CFR Part 121 airline (FAA Certificate Number IPXA097B) authorized by the FAA to conduct Flag, Domestic and Supplemental operations. The certificate was managed by the FAA Certificate Management Office (CMO) located in Louisville, Kentucky. Primary operational oversight responsibility resided with the "Supervisory" Principal Operations Inspector (POI), who told NTSB Staff his job task was split between the technical side of the oversight and his supervisory role. The CMO's organizational structure included an operations side and a maintenance side, as well as a ground services side that interfaced with the trucking side of the company. According to the POI, there were about 5-6 Aircrew Program Managers (APMs) who provided fleet specific oversight. The A300, B767 and B747 each had one program manager and each had assistants. The B757 had two APMs and the B747 had one APM in ANC. The POI also supervised the technical assistants. On the A300, there was one APM and an Assistant APM. In addition, the POI had an Aviation Safety Inspector (ASI) who assisted with dispatch oversight.

The POI would meet with the UPS training management about every two weeks. They had quarterly meetings with the UPS safety department, and the ASAP and FOQA was reviewed at those meetings. UPS was organized so that safety had control of the ASAP and FOQA data. The pilots and dispatchers at UPS had ASAP MOUs with the FAA, and the mechanics were expected to have ASAP soon.

UPS had about 40-45 APD's,[190] and about 180-190 total check airman. The POI told NTSB Staff that the CMO had a "budget debacle" going on, and some of the UPS check airmen were not

[190] Aircrew Program Designees. APDs are designated to conduct certification within specifically approved programs

getting their required 2 year check ride with the FAA due to the FAA staffing situation, and the check airmen were becoming de-qualified. About 90% of APDs at UPS were management pilots and about 70% of check airmen were mostly IPA union members, and unique to UPS was the fact that all of the check airman training (except for OE) was done in the simulator.

Oversight was conducted using the elements contained in the Air Transportation Oversight System (ATOS) program. According to the FAA, ATOS implemented FAA policy by providing safety controls (i.e., regulations and their application) of business organizations and individuals that fall under FAA regulations. Three major functions further defined the oversight system: design assessment, performance assessment, and risk management. Design assessment was the ATOS function that ensured an air carrier's operating systems complied with regulations and safety standards. Performance assessments confirmed that an air carrier's operating systems produced intended results, including mitigation or control of hazards and associated risks. Risk management process dealt with hazards and associated risks. The risk management process was used to manage FAA resources according to risk-based priorities.

The POI told NTSB Staff the recent budget cuts were affecting their ability to conduct oversight of UPS. He said their office was operating with 30-40% less funding than what they requested. He further said that ATOS was a program set up to address risk, and high risk items were getting put off because of the lack of funds.

The APM told NTSB Staff that, with only he and one Assistant APM for the A300, they had difficulty accomplishing all their surveillance items, and they had several check airmen on the A300 go unqualified because the FAA could not get their check airman observations within the required 24 months. He said he was able to sit in on specific training events, and conducted line observations on the A300, and he had observed pilots make a mode change and not verify it with the FMA. He further stated that pilots did not see non-precision approaches often, and most of their approaches were ILS's. Pilots maintained proficiency in non-precision approaches in CQ every year.

The dispatch ASI told NTSB Staff he was responsible for the EPIs[191] and SAIs[192] in his area, and would also sit in on training sessions for the dispatchers. He said the initial training course for dispatchers was aligned with the regulations. The most impressive part was the "several hundred hours of on-the-desk training with a qualified and 'super qualified' dispatcher." The number of hours of training for UPS dispatchers was aligned with the CFRs, and UPS dispatchers were part of the ASAP program.

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known as ADE (aircrew designated examiner) programs. APDs are restricted to examining only those applicants employed by their operator and trained in their approved training program. APD candidates must be employed by the operator and qualified as check airmen for the operator before they may be designated as APDs. Principal operations inspectors (POI) are authorized to designate APDs to serve in any ADE program that the POI oversees. The specific functions of an APD are named in the Letter of Authority that supplements the Certificate of Designation and Certificate of Authority. Source: FAA. UPS had 33 management APD's.

[191] Element Performance Inspection.

[192] Safety Attribute Inspection (SAI) Self Audit. The Air Transportation Oversight System (ATOS) SAI tool is used to collect data to determine if the design of a safety critical process can be approved or accepted. Source: FAA.

The dispatch ASI said UPS did not have a "really formalized" remedial training program for dispatchers. A flight standards individual would go over weak areas with a dispatcher following an evaluation. It was tailored to the individual's short-comings, and was not formalized. The FAA (AVP900) just completed a NASIP[193] inspection on UPS, and they looked at training and looked at dispatchers, and according to the FAA there were no findings.

When asked by NTSB Staff if UPS dispatchers had an over reliance on automation, he said they would not dispatch a flight without the Lido system, and they (UPS) would rather shut the operation down. According to the FAA Dispatch ASI , UPS did not have a backup plan to operate without the Lido system, and could not legally conduct a manual dispatch of a flight since their procedures did not allow it, adding that the Lido system was stable and back up programs were too costly.[194]

The dispatch ASI said it would be a surprise to him if the METAR remarks were not being included in the weather issued through the Lido system, but he would not necessarily look for those remarks. He said the remarks section of a METAR could include important information for the pilot, and was not aware if the pilots at UPS were notified that the remarks section of the METARs were not included in the briefing package.

21.0 Previous Recommendations and Guidance

21.1 NTSB Recommendations

Require all 14 *Code of Federal Regulations* Part 121 and 135 operators to incorporate the constant-angle-of-descent technique into their non-precision approach procedures and to emphasize the preference for that technique where practicable. (A-06-08)
Status: Open Acceptable Alternative Response

Revise applicable 14 *Code of Federal Regulations* Part 121 and 135 regulations to prohibit pilots from descending below the minimum descent altitude during non-precision instrument approaches unless conditions allow for clear visual identification of all obstacles and terrain along the approach path or vertical guidance to the runway is available and being used. (A-06-09)
Status: Closed – Reconsidered

Issue guidance to air carriers to ensure that pilots periodically perform non-precision approaches during line operations in daytime visual condition in which such practice would not add a risk factor. (A-00-011)
Status: Closed - Acceptable Alternate Action[195]

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[193] National Aviation Safety Inspection Program.

[194] Note: The UPS FOM Volume 2, Section 01.02.01.08 "Aircraft Movement Authorization" allowed manual dispatch of flights.

[195] According to NTSB correspondence to the FAA (dated January 23, 2002) "The FAA's proposed response, to always use constant angle, constant rate-of-descent flightpaths when conducting nonprecision approaches, eliminates the need for flight crews to periodically perform nonprecision approaches during line operations. With the issuance of AC 120-71 and FSATs 99-08, 00-08, and 00-18, the FAA has addressed this recommendation through alternate actions. Consequently, Safety Recommendation A-00-11 is classified "Closed--Acceptable Alternate Action."

21.2 FAA Guidance

21.2.1 Advisory Circular (AC) 120-108

This advisory circular (AC) provided guidance for all operators using the continuous descent final approach (CDFA) technique while conducting a Non-precision Approach (NPA) procedure. It described the rationale for using the CDFA technique, as well as recommended general procedures and training guidelines for implementing CDFA as a standard operating procedure (SOP).

21.2.2 AC 120-71A

This advisory circular presented background, basic concepts, and philosophy in respect to SOPs. It emphasized that SOPs should be clear, comprehensive, and readily available in the manuals used by flight deck crewmembers.

21.2.3 Safety Alert For Operators (SAFO) 09011

This SAFO incorporated constant-angle-of-descent techniques for all non-precision approach procedures, and addressed NTSB Safety Recommendation A-06-08.

F. LIST OF ATTACHMENTS

Attachment 1 - Birmingham Interview Summaries
Attachment 2 – Louisville Interview Summaries
Attachment 3 – Other Interview Summaries
Attachment 4 – Crew Records
Attachment 5 – A300 Non-precision Approach Training
Attachment 6 – 2013 CQ Workshop Presentation
Attachment 7 – AOM Approach Briefing Guides
Attachment 8 – Approach and Landing Briefing
Attachment 9 - UPS A300 Descent Planning
Attachment 10 - UPS Pilot Training Guide
Attachment 11 – Witness Statements
Attachment 12 – ACARS Data
Attachment 13 – Weight and Balance
Attachment 14 – Dispatch Paperwork
Attachment 15 – BHM Landing Performance Data
Attachment 16 – Flight Dispatcher Information
Attachment 17 - Dispatcher Joint Responsibility and Authority
Attachment 18 – Dispatcher Statement and Interviews
Attachment 19 - UPS Flight Dispatcher - General
Attachment 20 - Lido METAR Remarks Removal
Attachment 21 – BHM Chart Information
Attachment 22 - Lido LOC18 NOTAM Information

Attachment 23 - Non-Precision Approach Procedures
Attachment 24 – Descent Preparation
Attachment 25 – Stable Approach Criteria
Attachment 26 – A300 Flight Management System
Attachment 27 – FMC Study Guide
Attachment 28 – EGPWS Alerts
Attachment 29 – Operations Specification (OpSpecs)
Attachment 30 – Party Forms
Attachment 31 – FAA Responses
Attachment 32 – Advisory Circular 120-108
Attachment 33 – FAA KBHM NOTAM Information

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