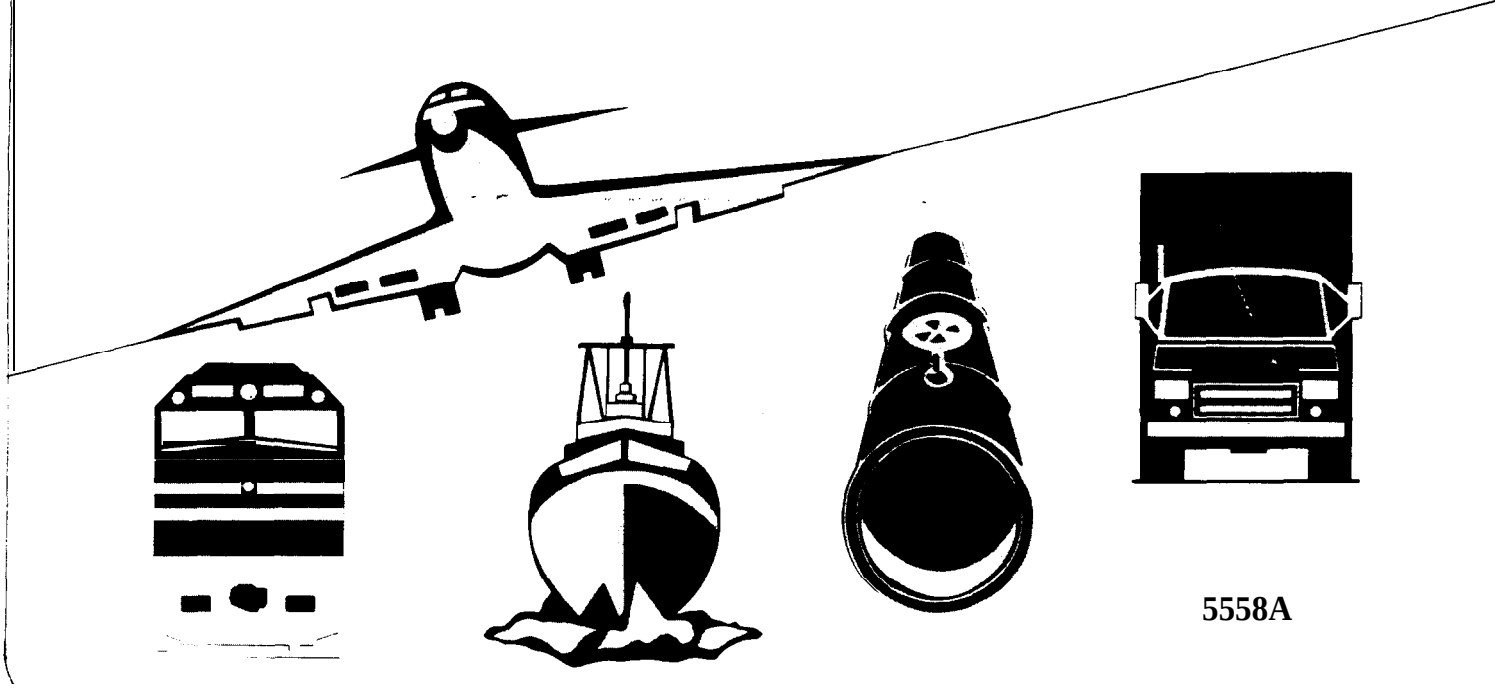
PB92-910401
NTSB/AAR-92/01

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

L'EXPRESS AIRLINES, INC., FLIGHT 508
BEECH C99, N7217L
WEATHER ENCOUNTER AND CRASH
NEAR BIRMINGHAM, ALABAMA
JULY 10, 1991



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Adopted: March 3, 1992
Notation 5558A

Abstract: This report explains the weather encounter and crash of L'Express Flight 508 while the airplane was conducting an instrument landing system approach to runway 5 at the Birmingham Airport, Birmingham, Alabama. The safety issues discussed in this report include pilot training in recognizing thunderstorm hazards and recovering from unusual attitudes, radar interpretation, and the relaying of complete weather information to pilots by air traffic controllers. Recommendations concerning these issues were made to the Federal Aviation Administration.

CONTENTS

EXECUTIVE SUMMARY

On July 10, 1991, at approximately 1812 CDT, L'Express Flight 508 crashed while conducting an instrument landing system approach to runway 5 at the Birmingham Airport, Birmingham, Alabama. Flight 508 was a Beech C99 on an instrument flight rules flight plan. The captain of the flight and one passenger survived the crash in Ensley, a residential area in southwest Birmingham. The first officer and the remaining 12 passengers aboard the flight were fatally injured. The airplane was destroyed by the impact and postcrash fire. Two homes and two automobiles were also destroyed.

The National Transportation Safety Board determines that the probable cause of this accident was the decision of the captain to initiate and continue an instrument approach into clearly identified thunderstorm activity, resulting in a loss of control of the airplane from which the flightcrew was unable to recover and subsequent collision with obstacles and the terrain.

The safety issues raised in this report include:

1. Pilot training in recognizing thunderstorm hazards and recovering from unusual attitudes, and radar interpretation.

2. The relaying of complete weather information to pilots by air traffic controllers.

Recommendations concerning these issues were addressed to the Federal Aviation Administration.

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1. FACTUAL INFORMATION

1.1 History of the Flight

1.1.1 General

On July 10, 1991, at approximately 18 12 CDT,[1] L'Express flight 508 (LEX508) crashed while conducting an instrument landing system (ILS) approach to runway 5 at the Birmingham Airport (BHM), Birmingham, Alabama. LEX508 was a Beech C99 on an instrument flight rules (IFR) flight plan. The captain of the flight and one passenger survived the crash which occurred in Ensley, a residential area in southwest Birmingham. The first officer and the remaining 12 passengers aboard the flight were fatally injured. The airplane was destroyed by the impact and postcrash fire. Two homes and two automobiles were also destroyed.

Around the time of the accident, flightcrews of four other aircraft (three small general aviation airplanes and a Learjet) elected to delay their approaches into BHM or to divert to alternate landing sites. Another airplane (a Piper Aerostar) landed successfully several minutes prior to the accident.

LEX508 originated at the New Orleans International Airport (MSY) in Kenner, Louisiana. The intended destination of the flight was BHM with an intermediate stop at the Mobile Bates Field Airport (MOB) in Mobile, Alabama. This scheduled commuter flight was conducted under the regulatory requirements of 14 Code of Federal Regulation (CFR) Part 135. The flightcrew involved in the accident assumed responsibility for the flight in MSY. LEX508 departed MSY on

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[1] All times in this report are Central Daylight Time (CDT). CDT plus 5 hours equals Coordinated Universal Time (UTC).

schedule at 1605, and the flight from MSY to MOB was routine. The flight arrived at MOB on schedule at 1650.

The captain and station personnel employed by the airline at MOB stated that LEX508 was provided with meteorological data for the MOB/BHM route segment. However, copies of the weather data provided to the flightcrew were not recovered from the accident scene. The airline did not retain a copy of the weather information provided to the flightcrew, and there was no requirement for the airline to do so. The captain, while not recalling the specific weather data provided to him, stated that the information alerted him to the possibility of thunderstorms in the Birmingham area. The information normally provided by the airline would have included the significant weather portion of the area forecast and the terminal forecast for BHM, both of which predicted the possibility of thunderstorm activity at the time LEX508 arrived in the Birmingham area.

1.1.2 Activity En Route to BHM

LEX508 departed MOB on schedule at 1705 and was due to arrive at BHM at 18 15. According to the captain, the flight to the Birmingham area was smooth and uneventful, although visibility was reduced because of haze.

Around 1745, the first officer listened to the BHM Automatic Terminal Information Service (ATIS) information Victor. The approximate 30-minute cockpit voice recorder (CVR) tape recording indicates that the flightcrew requested and was authorized to deviate around a cloud buildup at 175 1. The flight was subsequently cleared by the Atlanta center controller to fly direct to VULCAN, a navigation aid used as a feeder fix west-northwest of BHM. The flightcrew began their descent checklist activity about 1754 and listened to ATIS information Whiskey about 2 minutes later.

At 1755:14, about 17 minutes prior to the accident, the BHM South Radar controller made a blanket broadcast advising, "Attention all aircraft, information Whiskey is now current (unintelligible) altimeter is two niner niner eight, wind three five zero at one zero, rain on the field, low level wind shear advisories." LEX508 was neither assigned to nor monitoring this controller's frequency at the time and did not hear the transmission. In response to an airborne inquiry about the weather at BHM from another airplane at 1756:16, the south

radar controller advised, "Skylane one five romeo, we got level threes2 right over the airport, rain on the field with, wind shear advisories in effect right now." The pilot of this airplane advised the controller, ". ..I'm going to fly to the south around and wait awhile on it." The radar controller responded, "...that sounds like a real good idea."

As LEX508 approached BHM, several airplanes were also in the vicinity and attempting to land at the airport.[3] Three of these airplanes diverted to other locations because of thunderstorms around the airport. Two of them landed successfully at BHM (one prior to the accident and one after). The airplane that landed before the accident was a Piper Aerostar with the radio call sign of CONAERO 209. N45ZP, which was a Learjet, landed safely after the accident. Refer to Appendix I, Radar Study, for depictions of the ground tracks of LEX508, CONAERO 209, and N45ZP. This study is derived from recorded FAA radar airplane position plots and doppler weather radar information from local Birmingham television station WBRC, Channel 6. At 1759:19, the south radar controller transmitted, "OK, attention all aircraft, the field is now IFR, visibility two." Twelve seconds later, the controller, who had been providing vectors to the Learjet (N45ZP) to intercept the final approach course for the ILS approach to runway 5, instructed the pilot, "Lear five zulu papa turn right heading zero two zero, you're five miles from MCDEN, maintain two thousand six hundred til established on the localizer, cleared ILS five approach." LEX508 began monitoring the south radar controller's frequency during this transmission. The pilot of the Learjet then advised the controller, "And zulu papa, I think we better make a left turn here and go out and hold for a while, it looks pretty bad on the radar." The

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[2]According to the Federal Aviation Administration (FAA) Controller's Handbook, 7110.65, the definition for radar weather echo intensity levels is as follows: The National Weather Service has categorized six levels of radar weather echo intensity. The levels are sometimes expressed as "VIP LEVEL" 1 through 6 (derived from the component of the weather radar that produces the information - Video Integrator and Processor). The following list gives the weather features likely to be associated with these levels during thunderstorm weather situations: Level 1 (WEAK) and Level 2 (MODERATE), light to moderate turbulence is possible with lightning; Level 3 (STRONG), severe turbulence possible, lightning; Level 4 (VERY STRONG), severe turbulence likely, lightning; Level 5 (INTENSE), severe turbulence, lightning, organized wind gusts, hail likely; Level 6 (EXTREME), severe turbulence, large hail, lightning, extensive wind gusts, and turbulence.

[3]N2905M diverted to another airport prior to the accident. N669SP and N2015R diverted to another airport after the accident, unaware that the accident had occurred. N45ZP landed at BHM after the accident, unaware that the accident had occurred. CONAERO 209 landed prior to the accident at BHM.

radar controller responded, "OK, Lear five zulu papa, I need you to maintain three thousand five hundred before you turn left." The pilot responded, "OK we're at three thousand and holding, zulu pop." The radar controller repeated, "...that's three thousand five hundred; there's traffic four miles southwest of you, an Aerostar [CONAERO 209] at twenty five hundred, I need you at thirty five." The pilot advised that he would comply with these instructions.

At 1800:23, about 11 minutes prior to the accident, LEX508 made initial contact with the south radar controller, advising, "Birmingham, LEX508 level at six thousand, requesting lower." They were then cleared down to 4,000 feet and acknowledged that clearance.

At 1801:40, the pilot of the Learjet asked the south radar controller, "Birmingham uh five zulu pop, you had anybody on the ILS there last few minutes?" The controller replied, "I've got one on there right now [referring to the Piper Aerostar] well I don't have it, the other controller has one on the approach right now, he's just about where, where you turned out on the approach." The pilot responded, "all right if we could we'd like to get a ride report from him and then turn back and take a better look at it on the radar here in just a few minutes." The controller acknowledged the request. At 1803:04, the pilot of the Learjet inquired, "...had a ride report on that airplane?" The controller replied, "I'm working on that right now." The pilots of LEX508 also began the in-range portion checklist about that time. The captain of LEX508 told the first officer to let the passengers know that their arrival into BHM might be delayed. The south radar controller then made an interphone call to the local controller in the tower cab and asked, "Can I get a ride report from CONAERO 209 [the Aerostar, now in the landing phase of its approach] as soon as you can?" The local controller acknowledged the request.

At 1803:44, the south radar controller instructed the flightcrew of LEX508 to descend and maintain 3,000 feet. The flightcrew acknowledged the clearance. The controller then advised, "OK LEX508, just to let you know what's going on, I had a Lear set up on the base from the southeast for the ILS to five and he got in a little close and saw something on the radar he didn't like so he turned out off the approach and he's holding right now; I do have an Aerostar on the approach and he's on about two mile final right now we're trying to get a ride report out of him." The flightcrew responded, "OK sounds good LEX508."

At 1804:24, the south radar controller broadcast, "attention all aircraft, information X-ray is current at Birmingham, the field is IFR, altimeter is two triple niner." About one minute later, the flightcrew of LEX508 asked, "...any update on

that ride?" The radar controller responded, "I'm waiting for that right now and, LEX508 fly heading zero two zero and intercept the localizer track it inbound, I should have a report here before you get to about twelve, fifteen mile final." The flightcrew replied, "understand zero two zero and track the localizer."

At 1805:42, the north radar controller asked the local controller over the interphone, "What's your visibility right now?" The response was, "Two and half looks good, it looks bad to the south and southwest." Then, the south radar controller heard (on the interphone) the pilot of CONAERO 209 advise the local controller, "CONAERO 209, the ride really wasn't that bad rain showers had the visibility down just about zero til short final there when it cleared up."

At 1805:57, the pilots of LEX508 listened to a portion of ATIS information X-ray: ". ..thousand one hundred overcast, visibility two and one-half miles with thunderstorm and rain shower. Wind three four zero at one two. Altimeter two niner niner eight. Thunderstorm overhead moving southeast...."

At 1806:08, the south radar controller advised the flightcrew of LEX508, "the Aerostar said the ride wasn't all that bad but the rain had the visibility down to just about zero til he got to three quarter mile final4 and when he did pick up the airport but he said the ride wasn't that bad if you want to try it." The flightcrew of LEX508 responded, "Understand five oh eight we'll try it." The controller also asked the pilot of the Learjet, "...did you copy that?" The pilot of the Learjet responded, "Yeah we copied that and will give it a try if you're ready to go." The south radar controller then advised the pilot of the Learjet to reduce his airspeed by 20 knots and then to descend and maintain 3,000 feet.

1.1.3 Activity During the Instrument Approach

At 1806:59, the controller transmitted, "And LEX508 is one one miles from MCDEN maintain two thousand six hundred til established on the localizer cleared ILS five approach." The flightcrew responded, "Two thousand six hundred til established uh cleared for the ILS five approach, LEX508." Approach flaps were lowered shortly thereafter. At 1808:18, the south radar controller advised, "LEX508, I'm just gonna go ahead and hold on to you til you get to the marker and

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[4]As part of a postaccident interview, the south radar controller stated that when he overheard CONAERO 209 say that the visibility was "just about zero til uh, uh, eh, short final...." over the land line interphone to the tower, he noted that the airplane was 3/4 mile from the runway. He then advised LEX508, "the visibility down to zero til he got to uh, three quarter mile final...."

that way if you have to break out for something you see, something you don't like, that way you'll be ready to do it." At 1808:27, the flightcrew responded, "OK sounds good five oh eight." About this time, the captain alerted the first officer, who was flying the airplane at that point, "Okay watch out for windshear okay." About 10 seconds later, the flightcrew of LEX508 asked, "What's your visibility now five oh eight." The controller replied, "Visibility is two and one half thunderstorm, rain showers."

About 1809, the captain stated to the first officer, "If you don't feel comfortable about this let me know." The first officer responded, "Okay, so far it's all right." Also at this time, the sound of rain hitting the airplane was recorded for 18 seconds. Thirty seconds later, about 90 seconds prior to the accident, the radar controller asked, "LEX508, how's the ride so far." The flight responded, "So far it's good, little bit of rain and pretty light." By the time this radio transmission was made, at 1810:02, the airplane was into IFR conditions. See Appendix I, Radar Study.

At 1810:52, the radar controller instructed LEX508 to contact the BHM tower. At 1810:56, the flightcrew acknowledged. This was the last transmission recorded from LEX508.

The Learjet was provided vectors to follow LEX508 on the ILS approach to runway 5. At 1810:59, the south radar controller instructed the pilot, "Lear 45ZP is one zero miles from MCDEN, maintain two thousand six hundred til established on the localizer, present heading to join cleared for the ILS five approach." The pilot acknowledged the clearance. According to air traffic control (ATC) and CVR recordings, LEX508 impacted the ground at 18 11:27.

The CVR indicated that the captain ordered climb power at 18 11:05, and the sound of increasing engine speed was recorded 5 seconds later. Four seconds later, the captain exclaimed in a loud voice, "What are you doin'?" Then, the sound of the trim-in-motion warning was recorded on the CVR. Two seconds later, the captain ordered full power, followed immediately by a 5-second sounding of the landing gear warning horn. Approximately 2/12 seconds prior to the end of the CVR recording, a sound similar to that produced by engine igniters was heard. The arming of the igniters is a final item on the before takeoff checklist used by the airline. The igniters will fire when engine torques of 400 pounds or less are experienced. According to the captain he had retarded the engine power levers before the impact.

The aircraft crash site was determined by Loran-C and topographical maps to be at 33° 30' 10" north latitude and 86° 52' 28" west longitude.

1.1.4 Observations of Witnesses

1.1.4.1 LEX508 Captain

The captain was interviewed on three occasions. During a postaccident interview, the captain stated that he recalled receiving BHM ATIS information during the en route portion of the flight but that he did not remember whether the ATIS mentioned thunderstorms. He said that there might have been some rain during the approach but not enough to affect visibility. The captain also said that he never saw the runway but that he could see the City of Birmingham during the approach. In addition, he stated that the weather encounter and loss of control completely surprised him and that he did not see any storm cell either on radar or by observation.

The captain said that shortly before the loss of control he momentarily transferred control of the airplane to the first officer so that he could review the ILS approach chart. The approach chart manual is stored in a compartment between the cockpit seats. During instrument approach operations, the manual is placed on the console between the pilot seats for reference by each crewmember. He stated that he was in the process of either picking up or returning the chart to the console when the upset occurred.

He described the onset of the accident as a turn and roll to the left of 45° or more, possibly including a slight nose-down attitude. He was unsure of the rate of descent or of the pitch attitude of the airplane at that time, and he initially thought that the roll was the result of wake turbulence.

At the moment of the initial upset, the captain said he called out to the first officer, "What are you doing?" because he thought the first officer might have mishandled the flight controls. However, he then observed the first officer using the flight controls appropriately for the situation. He and the first officer subsequently manipulated the flight controls in a "coordinated manner" in an attempt to return the airplane to level flight. The captain then believed that the airplane began to respond to their efforts. He stated that as the airplane approached level flight with approximately 30° of left bank, it pitched up abruptly, which he compared to an elevator ride. He said that the sensation was such that if the pitchup had continued, the airplane would have become inverted. The captain

stated that the pitchup was not as rapid as the previous roll maneuver and that he did not recall the maximum nose-up attitude of the airplane. During the second interview, the captain stated that he believed the ascent was the result of being in the updraft portion of a thunderstorm cell.

During the abrupt ascent maneuver, he reported that he lost sight of the horizon. He said that after he and the first officer pushed the elevator/pitch control forward to arrest the ascent that there was no initial response. He stated that he could still see the ground throughout the loss of control sequence.

During the third interview, the captain stated he felt that the upset was due to windshear, but that it was not the "type of windshear" for which he was trained because there was no gain or loss of airspeed. He also said that he would expect minimal pitch and roll excursions during actual windshear conditions. The captain described the performance of the attitude indicator as "ok" because its indication coincided with the outside visual picture. He believed he had good rudder control but that there was some difficulty with roll control. He said that he called for climb power and then maximum power as the airplane experienced a loss of airspeed and altitude. During this period, he stated that he used almost full nose-up deflection on the elevator control and that the vertical speed indicator (VSI) was erratic with deflections in both ascent and descent indications. The captain later stated that he was unsure whether the airplane entered a stall or prestall buffet but that he could not arrest the descent. He said that he then retarded the engine power levers and that the airplane was in a near-wings-level attitude at the time of impact. He did not mention and did not recall experiencing any problems with either engine.

1.1.4.2 Piper Aerostar CONAERO 209 Flightcrew

The pilot-in-command of the Aerostar, CONAERO 209 (an all-cargo 14 CFR Part 135 flight), stated that his airplane was equipped with a Ryan Storm Scope.5 It was not equipped with a weather radar. The pilot stated that he did not experience adverse weather during the vectoring of his airplane to the ILS final approach course to runway 5. The initial encounter with adverse weather during the approach occurred about 1 1/2 miles outside MCDEN (the ILS final approach fix to runway 5). See figure 1. At this point, the flight experienced light to

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[5]The Ryan Stormscope is a weather avoidance system that displays occurrences of electrical discharge, such as lightning, as points of light on a video screen in the cockpit. It does not show areas of precipitation as would a radar system.

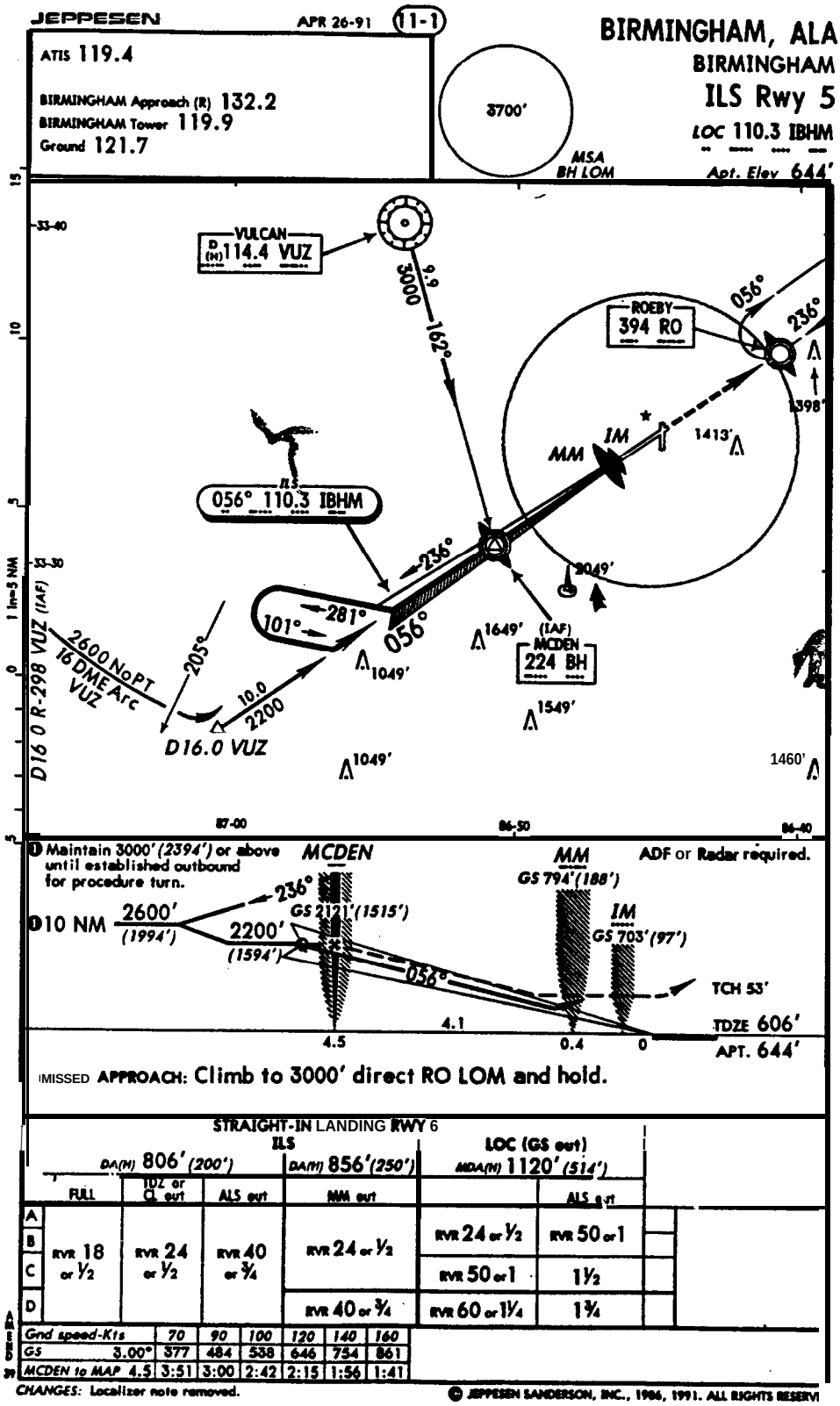

Figure 1.--BHM ILS Rwy 5 Jeppesen Approach Chart.

moderate turbulence but little rain. After passing over MCDEN, the visibility was clear until the short final approach. Downtown Birmingham was clearly visible at the 1 to 2 o'clock position. He observed lightning about 2 miles northwest and 2 miles south-southwest of BHM but did not see any on the final approach course.

The pilot stated that the second area of bad weather started about 1 1/2 miles southwest of the runway 5 threshold and ended at the threshold. It was clear from the threshold to the east of the airport. In this area, there was mostly light turbulence with moderate to heavy rain. Although the forward visibility was zero during the rain encounter, the ground was visible through the side windows. He said that he did not experience any momentary loss of flight control at any time.

1.1.4.3 Learjet N45ZP Flightcrew

This airplane was equipped with an RCA Primus 400 radar system.[6] The flightcrew stated that while they were being vectored for an ILS approach to BHM's runway 5 at approximately 1800, the radar system indicated a cluster of level three or greater thunderstorm cells just north of the airport, extending through the final approach path to runway 5. After lining up to within about 30° of the localizer course heading to runway 5, the first officer, who was flying the airplane at the time, elected to discontinue the approach because of the location and intensity of the cells. The captain concurred with the first officer's decision. They said that after holding south of the airport for about 15 minutes, they heard information over the ATC frequency that indicated an aircraft [the Aerostar, CONAERO 209] had landed. They then asked the air traffic controller for ride reports from that aircraft. They stated that they then heard LEX508 report and inquire about the weather at the airport. The approach controller advised that the Aerostar aircraft had landed and had reported zero visibility due to rain until 3/4 of a mile from the runway. The captain and first officer also reported hearing the controller inform LEX508 of the pilot report they had personally made a few minutes prior to the Aerostar's approach. That report was that the Learjet had aborted the approach because the pilots were concerned about what they had observed on their radar. They then heard the radar controller ask the flightcrew of LEX508 if they wanted to make an approach and heard LEX508 respond in the affirmative. The pilots of the Learjet then turned back toward the airport to look at their radar again and asked the controller to have LEX508 provide a ride report on its final approach. They then heard LEX508 give a ride report on the approach

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[6]The RCA Primus 400 radar system displayed areas of precipitation in three levels of magnitude.

control frequency. LEX508 reported light to moderate rain but that the ride was not too bad. The Learjet crew then opted to make the approach after LEX508.

On that approach, at 5 to 6 miles outside the outer marker, they observed thunderstorm cells and cloud-to-ground lightning along the final approach path. The captain observed cells on the radar at their 10 o'clock and 2 o'clock positions, 5 to 10 miles ahead. The copilot said that he observed a cluster of 3 to 5 cells on the radar along the final approach course positioned between the final approach fix and the airport. He also observed cloud-to-ground lightning at the 11:30 and 2 o'clock positions. At this point, the captain and copilot abandoned their second approach attempt and reported, "OK well we just picked up some lightning out here right in front of us we're gonna go ahead and make a right turn and go out and hold, wherever, whatever altitude or heading you want us on." The captain stated that the thunderstorm cells appeared to be moving to the southwest. Approximately 10 minutes later, the weather situation had improved, and N45ZP was vectored north of the airport for a visual approach to runway 5. During that approach and landing, they did not encounter turbulence or rain.

1.1.4.4 Surviving Passenger

The surviving passenger had been a frequent passenger on L'Express and had flown the accident flight/route several times previously. He was not a pilot. On LEX508, he sat in the right window seat across from the boarding door.

He stated that the flight was very smooth and uneventful until arriving in the Birmingham area. The cockpit door was open, and he could see out the windscreen. He stated that just before the accident he saw an "incredibly black cloud" directly ahead that reminded him of thunderstorms he had observed on previous occasions from his office window overlooking Birmingham. The passenger stated that he and other passengers discussed whether the crew actually intended to fly through the black cloud in their approach to the airport. He saw blue sky to the right of the cloud, and the edge of the cloud could be seen clearly. The airplane then seemed to bounce upward twice. After they entered the cloud, he said that there was torrential rain.

He then looked out his window and could not see the ground. He saw a "muffled white light" ahead like "a light bulb seen through cellophane" but did not hear the sound of thunder or observe lightning either before or after the airplane's entry into the cloud.

He said the airplane then lifted up suddenly to the right, “as if the pilot was steering it out of the cloud.” He said that the airplane then entered a series of violent motions, including a severe left bank during which he believed that the airplane’s wings might have become vertical to the ground. He said that the airplane then “came about” and seemed to be spinning like a corkscrew. He thought the airplane might have been upside down during these maneuvers. At some point, he was pressed against the window next to his seat. He believed that the flightcrew did not have control of the airplane at this point. Until the airplane came out of the cloud, he was unaware that they were descending. As the airplane suddenly exited from the cloud, he observed houses 150 feet to 200 feet below, but he looked away from the ground prior to impact. He did not remember the impact.

1.1.4.5 Individuals on the Ground

Sixteen witnesses, who were on the ground in the vicinity at the time of the accident, were interviewed. Their location relative to the crash site varied from approximately 3 miles to less than 1 city block. Most of the witnesses reported observing lightning and heavy rain about the same time and in the same area as the accident. Because of rain, several witnesses reported a visibility of 2 city blocks or less. Two witnesses reported wind velocities of at least 40 miles per hour and that trees were bowed over due to the wind. No hail was reported.

One witness observed the airplane from her back yard near the crash site. She said she saw the airplane as it was struck by lightning and shortly thereafter a “large ball of fire.” This witness was unable to specify the location of the lightning strike or the origin of the fire. There were no additional reports of fire, smoke, or debris coming from the airplane.

Several witnesses reported hearing normal sounds from the engines of the airplane just prior to the accident. One witness described the engine sounds as initially "fine" then “funny.” Another witness near the crash site reported hearing “surging” sounds from the engines of an airplane about 1808. This witness characterized the sounds as “like moving a fan back and forth through the air.” One witness heard the engines of an airplane “cut off’ at approximately 1800. Two witnesses reported hearing an airplane’s engines increase in pitch at approximately 1805.

One witness reported observing what he initially believed was a helicopter descending out of a thunderstorm at approximately 18 10. He said that the airplane was “turning like a rotor blade and descending at a steep angle just like

When he assumed his duties at the position, the circular polarization (CP) feature of the radar system was activated.8 He said that there was "very little grass," meaning that he believed he was getting minimal ground reflectivity on his radarscope at the time. He described both the primary and secondary targets on the radarscope as "good." He said that areas of precipitation were shown on the radar that were northwest of the airport moving southeast. He described the weather as broken "cells," mostly as a line northwest of the airport extending northeast.

The south controller said that precipitation was depicted on the radar along the final approach course for runway 5 at the time of the accident. He said that it appeared to be broken, with portions on the final approach course being "lighter" than the area west (left) of the final approach course. The weather was moving slowly southeasterly. It was his opinion that this weather area was approximately 4 miles in diameter. His last observation of LEX508 was just outside the approach gate (6.5 miles from the runway) at an altitude of about 2,300 feet. About this time, LEX508 entered a broken portion of the radar-depicted precipitation and was instructed to contact the tower. He subsequently observed the data block for LEX508 in COAST9 mode.

During a postaccident interview, he was asked how he learned that level 3 thunderstorms were in the area. He replied that he was in the radar room when another controller advised everyone that he (the satellite controller) had been advised by the Central Weather Service Unit (CWSU) that level 3 activity was in the area. He added, however, that he was unable to determine the intensity level of any precipitation that was depicted on the radar screen. When asked why he would allow an aircraft to enter an area of precipitation if he were unable to determine the intensity level, even though he knew that level 3 activity was in the area, he responded that he did not have the authority to prevent a pilot from doing so. He also stated that he did not advise any aircraft of reported level 3 activity while he was at the south radar position.

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[8]Circular polarization is a feature of the radar system that automatically suppresses radar reflection of certain levels of moisture. This allows the primary and secondary airplane radar returns to be more visible on the radarscope.

[9]COAST - when the secondary target (beacon) is not being received by the radar antenna, the data block will display "CST" to advise the controller that the aircraft is not being actively tracked. The ARTS system will continue to move the data block forward on the last known track in an attempt to reidentify the target. The length of time a target will remain in COAST before it is "dropped" from the radar screen into a coast/suspend tab list is determined by the facility computer program.

a helicopter." As the witness observed the aircraft, it became obvious to him that it was an airplane because of its size. The witness observed the airplane until it disappeared into a housing development.

Three witness reported seeing the airplane heading in a northeast direction, in a straight and level attitude. It was raining moderately at the time, and the airplane was below the cloud bases. They reported frequent thunder and lightning and said that the wind was of moderate intensity. The engines of the airplane sounded normal to them. They then saw a bright flash of light that momentarily obscured their view of the airplane. They were of the opinion that the flash was lightning, but they were not sure if the lightning struck the airplane. Immediately following the bright flash, the engines began to sound abnormal, as if they were "sputtering." The airplane then reportedly entered a steep 45° to 90° left descending turn. It rolled back to wings level but continued to descend heading directly toward them. They said that the right [No. 2] engine was not running or that it was turning very little, as indicated by the motion of the propeller blade. When the airplane was approximately 200 feet south of their position they heard an increase in engine power and observed the nose of the airplane pitch up dramatically. Using an airplane model, they described an approximate 40° nose-up attitude. One of the witnesses observed the tail of the airplane brush the top of a tree. As the airplane disappeared from view, "engine sputtering" was heard followed by the sound of impact.7

1.1.5 Relay of Weather Information by the South Radar Controller

The south radar controller relieved his predecessor at 1756. He received a position relief briefing in which the controller advised him that runways 5 and 36 were active and that visual approaches were being flown. He was aware that level 3 thunderstorms were northwest of the airport moving southeasterly and that rain had not yet begun at the airport. He stated that both the traffic and his workload were light. However, it was his opinion that the poor weather increased his workload but that the traffic remained light throughout the period that he was on the south radar position.

7"Sputtering" is a frequent observation of witnesses who are describing the sound of reciprocating engines at low power settings, or malfunctioning reciprocating engines. LEX508 was equipped with turboprop engines.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others	Total
Fatal	1	12	0	13
Serious	1	1	0	2
Minor/None	4	0	0	0
Total	2	13	0	15

1.3 Damage to Aircraft

The aircraft was destroyed during the impact sequence and subsequent fire. The value of the airplane was about $1,339,000, according to Beech Aircraft Corporation.

1.4 Other Damage

Two houses and most of their contents, two automobiles, one 15-foot section of street curbing, and numerous trees and shrubs were damaged or destroyed during the impact sequence and subsequent fire. The amount of damage to these objects was about $95,000.

1.5 Personnel Information

1.5.1 The Captain

The captain, age 54, was hired by L'Express Airlines on August 23, 1989. He was originally issued Airline Transport Pilot (ATP) certificate No. 86286368, on December 3, 1987. The latest issue date of his ATP certificate was June 18, 1990, with the ratings and limitations of airplane multiengine land, BE-300, BE-1900, with a second-in-command required, and private pilot privileges airplane single-engine land. A certificate endorsement for the C99 was not required. His first class airman medical certificate, issued May 14, 1991, contained the limitation, "must wear glasses." There were no waivers associated with his medical certification.

The captain's professional aeronautical experience prior to his employment with L'Express began with Air New Orleans, Inc., on January 20, 1987. He left that company on June 15, 1988. At Air New Orleans he was a first officer on C99 airplanes and later a captain on Nomad N22 and N24 airplanes. He

flew for Comair Airlines, Inc., between January 15, 1989, and May 15, 1989, as a first officer on Embraer EMB-110 airplanes.

He completed initial C99 ground and flight training with L'Express on August 3 1, 1989, and October 10, 1989, respectively. His initial operating experience (IOE) in the C99 totaled 11.4 hours and covered the period from October 29, 1989, through October 31, 1989. During this period, his use of airborne radar was recorded as satisfactory. Upon completion of the IOE, the captain was assigned as a pilot-in-command of L'Express C99 aircraft.

The flight training and flight check maneuvers given to the captain by L'Express instructor and check airmen personnel included stalls and steep turns under simulated instrument conditions. Instrument flight conditions were simulated with the use of a view-restricting device attached to the glare shield. No flight training or flight checking on unusual attitude recognition and recovery were given to the captain or first officer.

August 13, and 14, 1990. The subject matter addressed hazardous materials, crewmember security training, basic indoctrination, and general training. Specific items covered under general training included meteorology and severe weather avoidance. One hour of instruction/discussion focused on meteorology and 30 minutes were on severe weather avoidance.

From September 15, 1990, to May 15, 1991, the captain was on a military leave of absence from L'Express. During this period, he was on active duty with the U.S. Air Force in the Middle East, serving as a maintenance officer on C-5A Galaxy aircraft as part of Operation Desert Storm.

Prior to resuming his flying duties with L'Express, the captain again completed C99 initial ground training, recurrent flight training, and a check ride. He completed 16 hours of initial system ground training on May 16, 1991, and flight training totaling 7.8 hours on June 15, 1991. On June 17, 1991, the captain failed an instrument proficiency check ride. The captains performance was deemed unsatisfactory on landings from circling approaches, holding, localizer back course approaches, circling approaches, and judgment. The remarks section of the Airman Competency/Proficiency Check Form (FAA Form 8410-3) stated, "improper entry into holding pattern exceeded bank on circle." On June 18, 1991, he received additional training on the areas in which he was found deficient. He was given another check ride on June 19, 1991, and was found unsatisfactory in very high frequency omnidirectional receiver (VOR) approaches. The captain was

given additional training on the area of deficiency, and a check ride administered to him on June 25, 199 1, was completed satisfactorily. All the check rides given to the captain were administered by the chief pilot of the airline who was also an FAA-designated check airman, and also onboard as an observer was the FAA principal operations inspector (POI) assigned to the airline.

The chief pilot said that his recollection of the deficiencies noted on the June 17 check ride concerned either holding on the wrong radial or using the incorrect type of entry into the holding pattern. The deficiency with the circling maneuver pertained to the captain exceeding the allowable 30° of bank. During the circling maneuver, the captain elected to keep the approach in close to the airfield. Because he did not compensate for the wind factor correctly, he overbanked the airplane in order to keep from overshooting the final approach course. It was this event that caused the chief pilot to believe that the captain did not demonstrate good judgment. Neither the chief pilot nor the FAA POI believed that the captain demonstrated any dangerous propensities or faulty decision-making characteristics. The chief pilot attributed the captain's performance on the two check rides to being somewhat "rusty" on these maneuvers as a result of his extended military leave of absence and to the natural tendency to be nervous because an FAA representative was monitoring the check ride.

L'Express required its pilots to complete a monthly report of their daily flight time in specific types of aircraft, actual instrument time, night landings, approaches, and rest and duty time. This information is used by the airline for oversight of the flight and duty time limitations and currency requirements for each pilot. These reports completed by the captain indicated that as of July 7, 1991, he had accrued a total flight time of 4,141 hours, of which 553 were as pilot-in-command of a C99. During July 1991, he flew 30.8 hours, of which 1.3 were recorded as having been flown under actual instrument conditions.

His combined flight and duty times prior to the accident were as follows: previous 24 hours: 7 hours; previous 72 hours: 19.7 hours; previous 30 days: 90.3 hours. His flight and duty time accrued during the previous 60 day period totaled 98.3 hours.

The captain had no FAA violations or prior FAA-recorded aviation accident history. Records of the Department of Highway Safety and Motor Vehicles of the State of Florida indicated that he had a valid driver's license with no history of accidents or violations. Records of the National Crime Information Center (NCIC) indicated no criminal history.

L'Express records indicated that he flew a trip sequence on July 7 and 8. The first officer on that trip was the same first officer on the accident trip. This trip sequence was their only one recorded together prior to the accident trip. On July 7, they departed MSY at 1732 and terminated at 1950 at Houston Hobby Airport, where they remained overnight. On July 8, they departed Houston at 0615, overflew the first scheduled stop at Lake Charles, Louisiana (LCH), due to fog, and ended the sequence with an arrival at MSY at 1327. The crewmembers logged 6.4 hours of flight time, of which 0.3 hours were instrument time. There were nine landings, including one following an instrument approach flown by the first officer.

The captain also flew a trip sequence on July 9 and 10. The first officer on this trip described the captain as happy, very energetic, and instructive during the trip. On July 9, they departed MSY at 1435 and terminated at 1945 at Monroe, Louisiana (MIU), where they remained overnight. A line pilot for the airline stated that the captain carried tuna fish and crackers as a snack to eat during the overnight stay in Monroe. The captain stated that he ate a bowl of soup for dinner, went to bed between 2100 and 2130, awoke about 0520 on the morning of July 10, and ate breakfast, consisting of an egg and muffin. He reported for duty at 0600 for the 0630 flight. The first officer said that the captain offered cinnamon rolls to other pilots before their departure from MIU. Company records indicate that the flight departed MIU on schedule and ovefflew the first destination at Alexandria, Louisiana, The first officer said that the two attempts to land at Alexandria were discontinued due to heavy fog. The morning sequence on July 10 ended at 1327 with a landing at MSY. The captain was then off duty from approximately 1330 to 1500. He returned to duty at 1505 for the scheduled 1605 departure of LEX508 to MOB.

The accident flight was to be the next to the last flight of the day for both pilots. Their last flight of the day, LEX509, (BHM/MOB) was scheduled to depart at 1840. They were scheduled to remain overnight in Mobile.

Three line captains of the airline reported seeing the captain on the afternoon of July 10 in New Orleans and said that he looked normal and appeared to be in good spirits. One of them said that the captain was perspiring like anyone else at that time of the day and had removed his clip-on tie.

The chief flight instructor for the airline said that she spoke with the captain briefly on July 10 before he departed from the pilot lounge for the

afternoon flight sequence. He seemed to be upbeat and told her he was glad to be flying commercial airplanes again after Desert Storm. She described his appearance as good, although he was perspiring and looked rumpled like a typical pilot who had been flying in the summer heat. She characterized the captain as a pilot with great overall knowledge and understanding, but she noted that he had a tendency to get nervous on check rides. Another fellow line captain stated that the captain had a "tremendous amount of experience and war stories" and that he always had insight and opinions. The chief pilot for the airline characterized the captain as "very dedicated to absorbing more knowledge." A former FAA Principal Operations Inspector (POI) for the airline, who had experience flying with the captain, characterized him as a pilot who was "stable, not too easily excitable, and pretty much minds the store."

A first officer employed by the company reported seeing the pilots of LEX508 at MSY in the airplane designated for LEX508 before their taxi. He stated that they looked like a "normal crew." He said that he spoke briefly to the captain in a radio transmission after the captain's departure from MSY and that the captain sounded "full of energy."

Two pilots provided information related to airborne radar usage by the captain. One of them said that he personally had received detailed training from L'Express Airlines on the radar used in the Beech 1900 airplane but received no detailed training on the radar used in the Beech C99 other than trial and error experience and information from other pilots. During the sequence he flew with the captain on the morning of July 10, he reported that they encountered scattered buildups and that the captain "definitely avoided buildups." They used the 40- and 60-mile scale on the radar, and the nonflying pilot worked the radar on commands from the flying pilot.

The chief pilot for the airline described a ferry flight he completed with the captain shortly after the captain returned from the Middle East. The captain flew in the left seat while he operated the radar from the right seat. They encountered heavy thunderstorm activity. The chief pilot reported that the captain's understanding of the radar seemed "real good." The captain showed good cockpit resource management (CRM) skills by involving him in determining the best way to go around cells by changing the tilt and scale of the radar to attempt to see "behind" the weather. The chief pilot reported that they had a smooth flight through difficult weather while other airplanes were going around it.

1.5.2 The First Officer

The first officer of flight 508, age 30, was hired by L'Express Airlines on December 4, 1990. He possessed Commercial Pilot Certificate No. 530428782, issued on June 3, 1989, with the ratings and limitations of airplane single-and multiengine land instrument airplane. He also possessed a flight instructor certificate dated March 17, 1990, for airplane single-engine land instrument. His most recent first class airman medical certificate, issued on August 21, 1990, contained no restrictions or waivers.

A resume provided to L'Express by the first officer indicated that his initial air carrier flight experience was with Eastern Metro Express from April 1990, to November 1990, as a first officer on British Aerospace 3100 airplanes. Between May 1988, and April 1990, he flew for Miller Wills Aviation, Gulfport, Mississippi, as a general aviation flight instructor.

The first officer was furloughed by L'Express on January 8, 1991. This action was precipitated by the airline reorganizing under Chapter 11 bankruptcy proceedings. He was recalled by the airline on April 8, 1991.

Prior to being furloughed from the airline, the first officer completed initial (company) indoctrination and ground training on the C99. The indoctrination training consisted of 24.5 hours and was completed on December 4, 1990. The C99 ground training consisted of 19 hours and was completed on December 10, 1990. He received C99 initial first officer flight training after his return to the airline from a furloughed status. The flight training consisted of 4.8 hours and was completed on May 7, 1991.

The first officer received a flight check on May 18, 1991. The check ride lasted 1.8 hours. The check, which was conducted by an FAA-designated check airman employed by the airline, indicated that the first officer's performance in maneuvers such as steep turns and approaches to stalls, as well as in the general topical area of "judgment," were satisfactory. However, the check flight disclosed deficiencies and a need for additional training in the areas of in-flight power-plant failures, landings with simulated powerplant failure, and single-engine ILS approach procedures. The check was discontinued at that point in the flight due to the unsatisfactory performance. The first officer was then given additional training by the check airman in the areas of deficiency. Afterwards, the check flight was resumed and was completed in a satisfactory manner. The combined training and

"second check" lasted 2.8 hours. On May 18, 1991, the first officer was assigned second-in-command duties on L'Express C99 airplanes.

The personal resume provided to the airline by the first officer and pilot monthly reports completed by him indicated that his total flight time was 1,545.8 hours. His total multiengine time was reported as 650.7 hours, of which 170.8 hours were in the C99. His total flight time logged in calendar year 1991 was 170.8 hours. His actual instrument time logged during June 1991 was 7.6 hours. Company records indicated that he had flown 27.5 hours in July 199 1.

The first officer's flight times prior to the accident were as follows: previous 24 hours: 1.9 hours; previous 72 hours: 6.3 hours; previous 30 days: 96.7 hours; previous 60 days: 165.8 hours; previous 90 days: 170.8 hours.

He had no record of FAA violations or previous aviation accidents. Records of the Highway Patrol of Mississippi indicated that he had a valid driver's license with no history of accidents or violations. Records of the NCIC indicated no criminal history.

His mother stated that following the completion of the trip sequence with the accident captain on July 8 at 1327 at MSY, the first officer returned to his parents' home in Mississippi, where he went fishing with his father in the evening and returned about 2300. On Wednesday morning, July 10, he telephoned his girlfriend to make plans for the weekend and sounded jovial (as characterized by his mother). A line captain for the airline reported seeing the first officer about noon on Wednesday when the first officer arrived at work. He described the first officer as being his "same good natured self, happy to be in the commuters, happy to have a job, very polite, very straight posture, with a smile on his face." The chief flight instructor for the airline reported seeing him in the pilot lounge before he departed to fuel the airplane. She described the first officer as having a smile on his face, wearing a clean uniform, and being in his usually polite and friendly mood.

According to his mother, the first officer was in good health with no major changes in the 12 months before the accident. His financial situation was unchanged as "he never had much money" as a beginning pilot. He received a divorce in May 1991, at the end of a 1 -year marriage and several months of separation.

1.5.3 L'Express Flightcrew Training

1.5.3.1 General

The L'Express flightcrew training program as outlined in the airline's Aircrew Training Manual had been approved by the FAA Flight Standards District Office (FSDO) No. 62 in Baton Rouge, Louisiana. Approval was given by the POI assigned to the airline.

The flight and ground training programs consist of initial, recurrent, transition, and upgrade training. A set number of program hours was established for each of the various segments of training. Notwithstanding the programmed hours, pilots are required to receive sufficient training to bring them up to the level of proficiency stipulated in the Federal Aviation Regulations (FARs). Flight training programmed hours may be reduced in the event of proficiency in a particular aircraft. However, the instructor who recommends the applicant for the flight check cannot execute the applicant's flight check in that aircraft.

1.5.3.2 Weather Training Aids and Materials

The Aircrew Training Manual indicates that training aids and materials include the use of a slide and overhead projector, video and instructor's manuals for each required subject. The video library includes a 90-minute presentation, "Aviation Weather," a 26-minute presentation, "Windshear," and a presentation, "Keeping Up With Airborne Weather Radar." The radar video is primarily for individuals having no previous airborne radar background or experience and is not specific to one type of radar system. The video did not address the operation and use of the Bendix RDR-160 radar, which is employed in L'Express C99 aircraft. The training library did not contain a copy of the Bendix RDR-160 Weathervision System Pilot's Manual. A C99 first officer informed Safety Board investigators that his training on the RDR-160 radar consisted of "trial and error experience and information from other pilots."

1.5.3.3 Conduct of Training and Documentation

A pilot must be present for the entire course to receive a certificate of completion. Attendance is verified by a student class roster. At the end of a course, a test is administered by the airline to determine satisfactory knowledge and proficiency. Written examinations are supplemented by oral examinations given by flight instructors at various times during ground operational training,

flight training, proficiency checks, and line checks. Flight training is documented on the appropriate L'Express training form. Check rides are documented on FAA Form 8410.

1.5.3.4 Initial General Ground Training

Initial ground training consists of 47 programmed hours and is required for crewmembers who have not qualified or served in any L'Express aircraft. All new-hire crewmembers must receive initial training before they are assigned to serve as crewmembers. A closed-book written exam is required for each training section with a minimum passing grade of 80 percent. Initial ground training is divided into various core subject areas. One such section is called General Training and is 6 hours long, The course content of this section is the same for captains and first officers. The training includes instruction in meteorology and procedures for severe weather avoidance, recognition and escape. The training manual stipulates that instruction in meteorology is given to ensure knowledge of frontal systems, icing, fog, thunderstorms, windshear and high altitude weather systems, if applicable. Procedures for severe weather avoidance, recognition and escape include discussions on low altitude windshear, thunderstorms, turbulent air (clear air turbulence) and ice and hail.

The training outline on thunderstorms addresses atmospheric stability factors, conditions necessary for thunderstorm development, types of thunderstorms, stages of thunderstorms, and operational considerations. The discussion about the various stages of thunderstorms included the following:

A. Cumulus Stage

1. Primarily updrafts

2. Updrafts as high as 3,000 feet per minute

3. Entrainment - horizontal mixing of air to the cumulus cloud. The greatest number of droplets form near the freezing level and grow by collision with other droplets.

B. Mature Stage

1. Cell is usually 25,000 feet by this stage

2. Characterized by rain and hail

3. Contains both updrafts and downdrafts, and turbulence is most severe during this stage

C. Dissipating Stage

1. Characterized by less rain and eventual cessation of rain

Comments contained under operational considerations include the following:

a. Don't take off or land in the face of an approaching thunderstorm.

b. Don't attempt to fly under a thunderstorm. Turbulence under the storm could be disastrous.

c. Circumnavigate severe or intense storms by 20 miles. Do not fly between two intense echoes unless they are separated by at least 40 miles.

d. Do not fly under the anvil.

e. If you must penetrate a thunderstorm:

1. Penetrate the lower third of the storm, or at an altitude below the freezing level or above -15 C.

2. Establish power setting for turbulence penetration speed.

Maintain a constant attitude, and accept variations in airspeed and altitude.

3. Turn cockpit lights to highest intensity.

4. Don't turn back once you're in it. A straight course will get you through the storm most quickly.

Of the 10 questions on the written examination on weather and air traffic control procedures, two dealt with thunderstorms: (1) the stages of a thunderstorm and (2) the conditions necessary for the development of a thunderstorm. There were no questions on the use and operation of airborne radar.

L'Express Form T-202 (Aircraft Ground Training Record) is used by the airline to document and record the specific areas of training given to each pilot. Radios and Radar is listed under the section entitled Aircraft General. Instruction on weather radar operation is provided during initial ground training. A major portion of the instruction focuses on the radar system in the airline's Beech 1900 aircraft. The previously mentioned radar video supplements the comments of the instructor.

1.5.3.5 Recurrent Ground Training

The training manual stipulates that recurrent training is required for crewmembers to remain adequately trained and currently proficient for each aircraft, crew position, and type of operation in which the crewmember serves. All crewmembers must receive training within the preceding 12 months to serve as an air crewmember. A closed-book written examination is required for each area of training with a minimum grade of 80 percent. The areas of training include a review of all subjects required in the Initial C99 Ground Training Outline. Three hours are allocated to the General Section of recurrent ground training.

1.5.3.6 Crew Coordination

Procedural policies addressing crew coordination are contained in section 5 of the Training Manual. One policy addresses positive transfer of aircraft control. "The pilot flying must state conditions of flight such as maintain altitude, heading and other pertinent directives."

1.5.3.7 Initial C99 Flight Training

The minimum number of programmed hours for captains and first officers is 5 hours and 2 hours, respectively. A flight crewmember who progresses successfully through flight training is recommended by his instructor or a check airman. If he successfully completes the appropriate flight check administered by a

check airman or the FAA, he need not complete the programmed hours of flight training for the particular airplane. Flight training is documented on L'Express training Form T-301.

1.5.3.8 Recurrent C99 Flight Training

There are no set number of programmed hours for recurrent flight training. Captains and first officers are given the amount of training necessary to satisfactorily pass the required proficiency check. Captains are required to complete an instrument proficiency check every 6 months in accordance with the requirements stipulated in 14 CFR Part 135.297. First officers are required to complete a competency check every 12 months in accordance with the requirements stipulated in 14 CFR Part 135.293.

1.5.3.9 Required Flight Training Maneuvers

The required flight training maneuvers include steep turns, approach to stall(s), and windshear recognition and recovery. Steep turns are conducted with 45° of bank. The performance tolerances for this maneuver are as follows:

- altitude: captains and first officers +/- 100 feet;
- bank: +/- 5° for captains, +/- 10° for first officers;
- heading: +/- 10° for captains and first officers;
- speed: +/- 10 knots for captains and first officers.

Stalls are performed straight ahead or in a left or right bank using prescribed engine and airframe configurations. As buffet indications occur, the recovery procedure includes the following: a call for advancing power to the maximum allowable, lowering the nose and leveling the wings, arresting the descent, maintaining altitude and retracting flaps, if so configured, until airspeed increases to Vl airspeed, then initiating a climb. With a positive rate of climb established, retract the landing gear, if applicable.

The L'Express Aircrew Training Manual does not contain literature on training and acceptable performance guidelines for windshear recognition and recovery. A flight instructor for the airline told investigators that such training was given and that it was simulated in the following manner. The airplane is

1.6.1 Previous Flightcrew Comments/Maintenance Activity

The captain who flew the airplane during the morning and early afternoon hours of July 10, 1991, reported that on a return flight from Shreveport (SHV) to MSY his attitude indicator was slow to respond when the aircraft was maneuvered. At one point when the aircraft was in straight and level flight, the attitude indicator showed a descent of 4° to 6° nose down, wings level. During the same route segment, it was discovered that the first officer's horizontal situation indicator (HSI) and radio magnetic indicator (RMI) were precessing off the indicated heading of the captains HSI. Upon landing in MSY, the captain's attitude indicator was replaced and adjustments were made to the first officer's HSI system. No discrepancies were noted on subsequent flights flown by this captain. The captain stated that the entire series of flights flown by him were in visual flight rule (VFR) conditions with no precipitation and that the radar was on or in the standby mode during this time. The captain stated that he would not be a good judge in determining the working condition of the radar.

1.6.2 Pre- and Postaccident Weight and Balance Calculations

Load manifest and weight and balance records for the flight were retained by the operator in Mobile. Those records showed that the airplane was operated within the prescribed weight and center of gravity limitations on takeoff and during the accident flight. It was calculated that on landing at BHM, the landing weight and center of gravity would have been 10,526 pounds, and 190.46 inches, respectively.

1.6.3 Cockpit Flight Instrumentation

The company chief pilot stated that the L'Express fleet of C99 airplanes was not equipped with standby flight instruments. The following information was provided by representatives of Beech Aircraft Corporation. The captains attitude indicator was manufactured by Edo Air. The attitude indicator is electrically powered and is reliable through 360° of roll and 85° of pitch. The first officer's attitude indicator was manufactured by Sigma Tec, Inc. That attitude indicator is vacuum powered and is reliable through 360° of roll and 90° of pitch.

1.6.4 Bendix RDR-160 Weathervision System

N7217L was equipped with a Bendix RDR-160 X-band Weathervision Airborne Radar System. The initial date of manufacture of this model of the radar was 1976. The RDR-160 does not have antenna stabilization. The radar screen/indicator is offset to the right of center of the main cockpit instrument panel. The Weathervision Pilot's Manual states that the purpose of the RDR-160 Weathervision System is to "detect significant en route weather formations within a range of 160 nautical miles (nmi) and to display this information to the pilot in a form which can be easily interpreted. Thus, any avoidance maneuvers that may be required can be instituted early enough to preclude undesirable penetration of heavy weather and its usually associated turbulence." The information is displayed in much the same manner as a television presentation.

Representatives of the Bendix Corporation reported that the RDR-160 operated like other monochromatic radars in the industry. Bendix does not have a formal training program for the RDR-160. The company believes that the radar is simple to operate, and if the pilot reads the RDR-160 Pilot's Manual, no difficulty should be encountered in the operation of the radar and the interpretation of its presentation. A pilot's manual is included in the sale of every RDR-160 array. Comments received from Bendix on the potential human factors aspect of RDR-160 operation centered, as with other airborne radars, on the mismanagement of the tilt setting and the forgetting and/or mistaking the range of the object being depicted on the indicator. See Appendix G for excerpted pilot's manual information for the RDR-160 system.

The captain stated that prior to departing MSY, he performed a predeparture check of the airborne radar. This check was accomplished by putting the mode selector in the "test" mode. He said that the test mode displayed a test pattern and that he was satisfied with its operation. While en route from MSY, the captain checked the radar for airborne and ground returns. The radar appeared to be functioning properly. He commented that he was knowledgeable about the operation of the radar system and that it was similar to equipment he had used on other aircraft with previous employers.

While en route to BHM, he believed that the radar would most likely have been in the weather mode per normal procedure, but he could not remember precisely. He stated that he directed the first officer on the operation of the radar during the flight. Closer in to BHM, he directed the first officer to place the radar

configured for an ILS approach/landing with landing gear down, approach flaps, and 130 knots indicated airspeed. A preselected altitude is held while the airspeed is reduced to prestall buffet. At this point, the instructor calls out a specific loss of airspeed. The flying pilot calls for props forward, maximum power, and increases the pitch attitude (angle of attack) until the stall warning begins to cycle on and off. Calls for the retraction of the flaps and landing gear are also made during this period. The desired pitch attitude will result in the stall warning indicator cycling on and off.

Recovery from unusual attitudes is addressed in the Aircrew Training Manual. However, two of the airline's flight instructors, as well as the captain of the accident flight, reported that such training was not given. 14 CFR Part 135 does not specifically require training in unusual attitudes.

1.5.4 The South Radar Controller

The south radar controller, age 36, had attended the FAA Academy in Oklahoma City, Oklahoma. He had prior military ATC experience gained while serving with the U.S. Navy for 5 1/2 years. His last FAA duty station was Norfolk, Virginia. The south controller was not a pilot. He was medically certified as a controller without waivers or limitations, and his last physical examination was in September 1990. At the time of the accident, he was a developmental controller and was certified on the south radar position on March 30, 1991. He said that on July 10, 1991, he was working a 1300 to 2100 shift, which was the second day of a 5-day week of duty.

1.6 Aircraft Information

The C99 is manufactured by the Beech Aircraft Corporation. This model is the successor of the B99 and was certificated on July 27, 198 1. The airplane was certificated for operation with one pilot; however, the applicable rules in 14 CFR Part 135 require two pilots in commuter air carrier operations. The number of C99's in operation in the United States is 23, and the number in operation outside the United States is about 52.[10]

N7217L held manufacturer's serial number U226, and was issued a standard (normal category) airworthiness certificate on December 11, 1984.

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[10]Data from the June 1991, FAA Air Carrier Aircraft Utilization and Propulsion Reliability Report and the Beech Aircraft Corporation.

N7217L had recently been at the Beech Aircraft Corporation for a detailed inspection, refurbishment, and overhaul of its structure and interior. It was maintained under an FAA-approved Continuous Aircraft Inspection Program. The Beech maintenance logs revealed that the Bendix radar antenna/receiver transmitter was tested according to manufacturer specifications on March 6, 1991. Also, the test and inspections prescribed by FARs were performed and completed on the altimeter and static pressure system on March 20, 1991.

According to the logs maintained at Beech, the 100-hour inspection of the aircraft was completed on March 24, 1991, with total airframe time of 9,127.8 hours and Hobbs reading as 73.4 hours. Later in the Beech records, following maintenance activity as part of the refurbishment, it was annotated that the aircraft was inspected on June 20, 1991, with a total time on the airframe as 9,13 1.0 hours and Hobbs reading as 76.6 hours. A later logbook entry for maintenance activity stated that on July 1, 1991, the airframe had a total time of 9,054.4 hours and Hobbs meter reading of 83.5 hours. The total time annotation of 9,054.4 hours was inconsistent with other airframe records, because it reflected fewer operating hours than the times recorded on earlier dates.

N7217L was bought by L'Express Airlines on July 1, 199 1. L'Express maintenance logs revealed that the glideslope receiver was replaced on July 2, 1991; and the captain's gyro attitude indicator was replaced on the morning of the accident, July 10, 1991.

The airplane was equipped with two Pratt & Whitney of Canada PT6A-36 engines. Engine serial number PCE 38176 was removed from the right-hand position on September 8, 1989, with total time of 8,218.57 hours for major overhaul. The major overhaul was not completed until November 1, 1990. Afterward, the engine was installed in the left-hand position on the airplane. The engines are interchangeable and can be operated normally on either wing.

Engine serial number PCE 38175 was removed from the left-hand position for major overhaul on September 8, 1989, with a total time of 8,218.57 hours. Following the overhaul, the records indicate that on November 8, 1990, the engine was installed on the right-hand position on the airplane.

The last 100-hour airworthiness inspections of the engines were completed on March 24, 1991, with total time of 9,127.57 hours on both the engines. The time since major overhaul on both the engines was 909 hours. Total time on the right and left engines was 9,18 1.3 hours on July 9, 1991.

in the weather alert mode. During level portions of the approach, the tilt setting of the radar was 4º to 5º nose up. At this setting, some ground returns were picked up by the radar.

1.7 Meteorological Information

1.7.1 General

Based upon climatological history, Birmingham, Alabama, is subject to thunderstorms every month of the year, with a maximum frequency of 17 days in July (55 percent of the days in July), and a minimum of 2 days in October (6.45 percent of the days in October). Annually, there are on average 83 thunderstorm days (23 percent of all days).

1.7.2 Synoptic Information

Throughout the afternoon and evening of July 10, Alabama was under the influence of the moist, conditionally unstable southwesterly flow of a tropical air-mass. Thunderstorms developed over the southern portion of the State by early afternoon and over the northern portion by mid-afternoon.

Between 1740 and 2140, an area of thunderstorms with heavy to very heavy (level 3 to 4) rain showers moved over the Birmingham area. A group of heavy to very heavy cells passed over the airport and the approach to runway 5 at the approximate time of the accident. Visual meteorological conditions prevailed outside the thunderstorm activity.

1.7.3 Weather Forecasts and Advisories

The Area Forecast for Mississippi and Alabama, issued by the National Aviation Weather Advisory Unit at Kansas City, Missouri, at 1345 and valid after 1400 for the period that included the time of the accident, was as follows:

> Above ground level, clouds 4,000 feet scattered occasionally broken. Widely scattered thunderstorms with light rain showers. Cumulonimbus tops to 40,000 feet.

The following is the Terminal Forecast for BHM issued by the NWS Forecast Office, Birmingham, Alabama, valid from July 10, 1200 to July 11, 1200:

> Clouds 4,000 feet scattered, wind 290 degrees 9 knots. Occasionally ceiling 3,000 feet broken, chance of visibility 2 miles in thunderstorms with moderate rain showers. After 1700: clouds 5,000 feet scattered, ceiling 25,000 feet broken. Occasional thunderstorms. Chance of ceiling 700 feet obscured, visibility 1/2 mile in thunderstorms with heavy rain showers and wind gusts to 40 knots. After 2200: clouds 12,000 feet scattered, ceiling 25,000 feet broken. After 0600: VFR.

At 1745, a meteorologist from the Center Weather Advisory Unit at the Atlanta Air Route Traffic Control Center (ARTCC) contacted the BHM TRACON by telephone and advised of an area of weather between the VULCAN VOR and the BHM extending to the vicinity of Gadsden. He noted that there were thunderstorms of level 3 to 4 intensity moving southeast at 15 knots.

There were no Convective SIGMETs, SIGMETs, AIRMETs, or ARTCC Center weather advisories issued by the NWS for Alabama prior to the accident. The weather conditions over Alabama as observed by radar did not meet the NWS requirements for such issuances.

1.7.4 Surface Observations

The following are the surface observations at BHM at the approximate time of the accident:

> Time--1650; type--surface aviation; clouds--5,000 feet scattered; visibility--l0 miles; temperature--920 F.; dew point -- 72º F.; wind--280 degrees 8 knots; altimeter--29.94 inches.

> Time--1740; type--special; ceiling--measured 5,000 feet broken; visibility--l0 miles; weather--thunderstorm; wind--360 degrees 20 knots; altimeter--29.94 inches; remarks--thunderstorm began 1740 northwest moving southeast, thunderstorm northeast moving southeast.

> Time--1750; type--surface aviation; ceiling--measured 4,200 feet broken; visibility--7 miles; weather--840 F.; dew point--680 F.;

wind--360 degrees 16 knots; altimeter -- 29.96 inches; remarks--thunderstorm northwest moving southeast, thunderstorm east moving southeast, thunderstorm began 1740.

Time--1801; type--special; ceiling--measured 4,100 feet overcast; visibility--2 1/2 miles; weather--thunderstorm with moderate rain showers; wind 340 degrees 12 knots; altimeter 29.98 inches; remarks--thunderstorm overhead moving southeast, lightning cloud to ground.

Time-- 18 10; type--special; ceiling--measured 4,800 feet broken, 8,500 feet overcast; visibility--3 miles; weather--thunderstorm with light rain showers; wind--350 degrees 8 knots; altimeter--29.97 inches; remarks--thunderstorm southeast moving southeast thunderstorm southwest moving southeast lightning in cloud and cloud to ground visibility southwest 2 miles aircraft accident.

The wind gust recorder at the airport indicated wind speeds primarily between 6 and 10 knots from 1600 to 1740 with peaks of 18 knots at 1607, 14 knots at 1638, and 16 knots at 1724. The wind speed increased to 16 knots at 1740, then had peaks of 24 knots at 1742 and 1745, 20 knots at 1749 and 18 knots at 1750 and 1802, after which the wind speed decreased to less than 8 knots at 1810 and remained less than 8 knots for the remainder of the hour.

The low level wind shear alert system (LLWAS) at BHM consists of a center field anemometer and five boundary anemometers labeled by the five sectors that they serve (northeast, south, southwest, center, and north). The northeast sector was in an alarm status from 1739:27 until 1740:47. During this period, the maximum wind recorded was from 3400 at 21 knots at 1739:27 by the northeast anemometer. The maximum center field wind during the period was from 3300 at 14 knots at 1740:47. The southwest sector was in alarm status intermittently from 1742:38 until 1800:37. During this period the maximum wind recorded by the southwest anemometer was from 2000 magnetic at 15 knots. The maximum center field wind during the period was from 360° at 21 knots at 1743117.

The transmissometer at the approach end of runway, 5 indicated that between 1700 and 1900 the runway visual range (RVR) was greater than 6,000 feet.

1.7.5 Weather Information Provided to LEX508

Based upon information provided by the dispatcher for L'Express, the crew of LEX508 received the weather information for the flight at approximately 1700 at MOB.

The weather information provided by the dispatcher included the following:

Current surface analysis.

Terminal forecasts for the pertinent airports (including the convective outlook for the BHM area).

Convective SIGMETs as applicable.

PIREPs as applicable.

Significant clouds and weather portion of the Area Forecast.

Winds aloft. Synopsis portion of the Area Forecast.

Notices to Airmen (NOTAMs) as applicable.

The meteorological data provided to the flightcrew in MOB was obtained through data link from the AMR Services SASS computer system. AMR Services is a subsidiary of American Airlines. The SASS system receives weather data electronically as it becomes available from the NWS. SASS contractual users activate a key-coded identifier which provides them with meteorological data in a standardized format. L'Express station personnel in MOB stated that the 1600 weather issued by the NWS was taken from the SASS between approximately 1630 and 1645.

1.7.6 Radar-derived Weather Information

At 1625, the radar report from the NWS radar at the Centerville-Brent Weather Service Meteorological Observatory put BHM within an area of 1/10 coverage of thunderstorms with rain shower intensities up to very heavy (level 4). The cells were moving from 3400 at 12 knots and the maximum top of the precipitation was 45,000 feet approximately 65 miles northwest of BHM.

The radar overlay from the 1625 observation showed 3 heavy to very heavy (level 3 to 4) cells oriented east-northeast--west-southwest approximately 40 miles northwest of Birmingham. The digitized data from the 1625 radar observation, which reports the highest level of activity in grid squares approximately 22 miles on a side, reported no rain shower activity in the grid square containing BHM.

At 1725, BHM was still within an area of 1/10 coverage of thunderstorms with intensities up to very heavy (level 4). The cells were moving from 3400 at 16 knots and the maximum top was 45,000 feet at approximately 20 miles northwest of Birmingham. The radar overlay from the 1725 observation showed heavy to very heavy cells (level 3 to 4) oriented east-northeast--west-southwest with the nearest approximately 20 miles north of Birmingham. The digitized data from the 1725 radar observation reported no rain shower activity in the grid square containing BHM.

The 1810 photograph of the Centerville-Brent radar showed a small area of thunderstorms directly over the accident site. There was insufficient detail in the photograph to identify the level of rain shower activity.

The 1825 report continued to put BHM in an area of 1/10 coverage of thunderstorms with intensities up to very heavy (level 4). The cells continued to move from 3400 at 16 knots and the maximum top was 45,000 feet approximately 12 miles south of BHM. The overlay from the observation showed very heavy (level 4) cells approximately 12 miles southwest, 10 miles south-southeast and 11 miles east-southeast of BHM. The digitized data from the 1825 radar observation reported rain shower activity up to very heavy (level 4) in the grid square containing BHM.

A videotaped copy of doppler weather radar imagery was also obtained from WBRC-TV, Channel 6, a commercial television station in Birmingham, Alabama. Prior to the accident, the station was recording radar "snapshots" at 2-minute intervals for use in its 1800 news and weather broadcast. The station stopped recording around 1808, about 3 1/2 minutes prior to the accident. The weather depicted in Appendix I, Radar Study, was derived from this radar imagery.

1.7.7 Satellite Information

At 1801, a Geostationary Operational Environmental Satellite (GOES) infrared photograph showed an area of apparent thunderstorms over BHM with tops to about 37,000 feet. At 1831, a visual light photograph showed a small area of thunderstorms directly over BHM with a clear space surrounding them.

1.7.8 Astronomical Information

At 1810, near Birmingham, the sun was at an altitude of 21° above the horizon with an azimuth from true north of 284°. This is a relative bearing of 2290 from the flightpath of LEX508 as it approached runway 5.

1.7.9 Automatic Terminal Information Service (ATIS) Information

There were three ATIS messages that were broadcast in the 30 minutes prior to the accident. A review of the CVR tape revealed that an observation taken about 1650 was received by LEX508 at 1744 from the BHM ATC tower. This ATIS message contained the following information:

> Birmingham information Victor, two one five zero zulu, five thousand scattered visibility ten, temperature niner two, dew point seven two, wind two eight zero at eight, altimeter two niner niner six, simultaneous approaches in use localizer runway two three, visual runway three six, advisory all Atlanta high altitude IFR traffic has been ground stopped due to an equipment outage in Atlanta center, departing aircraft contact clearance delivery one two zero point niner or three niner zero point eight prior to taxi, advise you have Victor.

An observation taken about 1750 was broadcast by the BHM ATC tower beginning at approximately 1753, and first received by LEX508 about 1756. This ATIS message contained the following information:

> This is BHM Airport information Whiskey, Birmingham two two five zero weather, measured ceiling four thousand two hundred broken, visibility seven miles, thunderstorm, temperature, eight four, dew point, six eight, wind three five zero at eight, altimeter, two nine nine seven, remarks, thunderstorm northwest of the airport moving southeast, east moving southeast, thunderstorm

began at four zero past the hour, low level wind shear advisories in effect, ILS runway five approaches in use, landing and departing runway five and runway three six, contact clearance delivery on one two zero point niner or three niner zero point eight prior to taxi, advise approach or ground on initial contact you have Whiskey.

The next observation was taken about 1801 and was broadcast at approximately 1803. Note that only the portion of the message between the bracketed asterisks ([**]) was heard by LEX508 about 1806. This ATIS message contained the following information:

Birmingham Airport information X-ray, BHM special two three zero one weather, measured ceiling four [**] thousand one hundred overcast, visibility two and a half miles with thunderstorm and rain shower, wind three four zero at one two, altimeter, two niner niner eight, thunderstorm overhead moving southeast [**], I-L-S runways five and three six, all departing aircraft contact clearance delivery one two zero point niner or three niner zero point eight prior to taxi, advise you have information X-ray.

1.8 Aids to Navigation

Following the accident, FAA technicians performed evaluations of the runway 5 localizer and glideslope, the D-bright radar indicator tower equipment display, multichannel-recorders, airport surveillance radar-g, the automated radar terminal system, and the air traffic control radar beacon system. No discrepancies were noted. All equipment was recertified by these technicians and returned to service. No flight crewmembers associated with this accident noted anything unusual about the navigational signals that they were receiving.

1.9 Communications

A review of FAA Form 6030-l) Facility Maintenance Log, indicated that after facility technicians were notified of the accident, the radio receivers and transmitters for frequencies 121.5, 132.2 (BHM approach control) and 119.9 (BHM tower) were evaluated and found to be working within prescribed guidelines and tolerances and were subsequently recertified and returned to service. No flight

crewmembers or air traffic controllers associated with this accident noted any communications difficulties.

1.10 Aerodrome Information

Birmingham Airport, elevation 644 feet above mean sea level (msl), is 5 miles northeast of the City of Birmingham, Alabama. The airport is situated in a valley between heavily wooded ridges and is tower controlled 24 hours a day. The airport has two runways: 5/23 and 18/36. Both runways are constructed of asphalt with grooved surfacing. Runway 5/23 is 10,000 feet long and 150 feet wide. Runway 18/36 is 4,856 feet long and 150 feet wide. The ATIS frequency is 119.4 MHz. A flight service station (FSS) is at the airport. The FSS frequency is 123.65 MHz. The glideslope intercept altitude for the runway 5 ILS at the MCDEN final approach fix (FAF) is 2,121 feet msl (1,515 feet above ground level (agl)). MCDEN is 4.5 miles from the runway. (See figure 1).

1.11 Flight Recorders

The airplane did not contain a flight data recorder but was equipped with a B&D Instruments and Avionics CVR, serial number A01032. At the time of the accident neither recorder was required by regulation to be installed. A verbatim transcript was prepared of the entire 32-minute recording. See appendix D. The exterior of the recorder was dented and scratched but was not fire or heat damaged. There was no damage noted on the interior of the recorder, and the recording tape was dry and undamaged.

The recording consisted of two channels of high quality audio information. The two channels contained identical intercom, radio and hot microphone audio information from both the captain and the first officer. The airplane was delivered to L'Express from Beech without a cockpit area microphone. It was to be installed at a later date. Therefore, the fourth CVR channel and the area microphone channel contained no audio information.

The recording starts at 1738 when the aircraft is established at its cruise altitude of 9,000 feet and the flightcrew is communicating with the Atlanta Center. The recording continues uninterrupted until 1811:27.4 when the aircraft is making its approach to runway 5 at BHM.

The flight progressed normally during most of the recording. There was some discussion about the weather en route to and at BHM during the

recording. The flightcrew monitored the ATIS recordings Victor, Whiskey, and a portion of X-ray before the start of their approach to BHM. At 1809:40, the sound of rain hitting the front of the aircraft could be heard on the CVR. The sound of the rain stopped 18 seconds later at 1809:58. The approach progressed normally until the captain called for climb power at 18 11:06. At 18 11: 14, the captain exclaimed "what are you doin'." He called for full power at 1811:18. At 1811:19, the sound of the landing gear warning horn is recorded on the CVR for about 4 seconds. The sound of the landing gear warning horn came on again at 1811:24 for less than 1 second. During a quiet passage prior to the end of the recording, the faint sounds of the engine(s) igniters could be heard on the intercom/radio channel of the CVR. The recording stopped at 1811:27.4 when electrical power was terminated.

1.12 Wreckage and Impact Information

1.12.1 Wreckage Distribution

The airplane struck a tree and the top of one house, and continued across a residential street into the front of another house. The wreckage scatter pattern was on a magnetic heading of about 3500.

Impact marks on a tree trunk were observed 20 feet above the ground and 125 feet south of the main wreckage. Tree limbs that had fallen from this tree exhibited propeller strike marks. The roof and yard wall of the first residence at 2520 26th Place (7 feet east of the initial tree that was impacted) were collapsed. A "U" shaped area of destruction 14 feet east of the tree was observed in the roof of this house. A chimney on the house, 23-feet northeast of the tree was also damaged, and metallic strike marks were observed on its side.

The street pavement, 80 feet north of the first impacted tree and between the two destroyed houses, showed no evidence of metal or paint transfer. A 15-foot section of concrete curb on the north edge of the street in front of the second house at 2517 29th Place had been crushed by the airplane. Two automobiles parked on the street between the two houses were destroyed. The airplane was found partially imbedded in the front porch and front rooms of the second residence. (See figure 2).

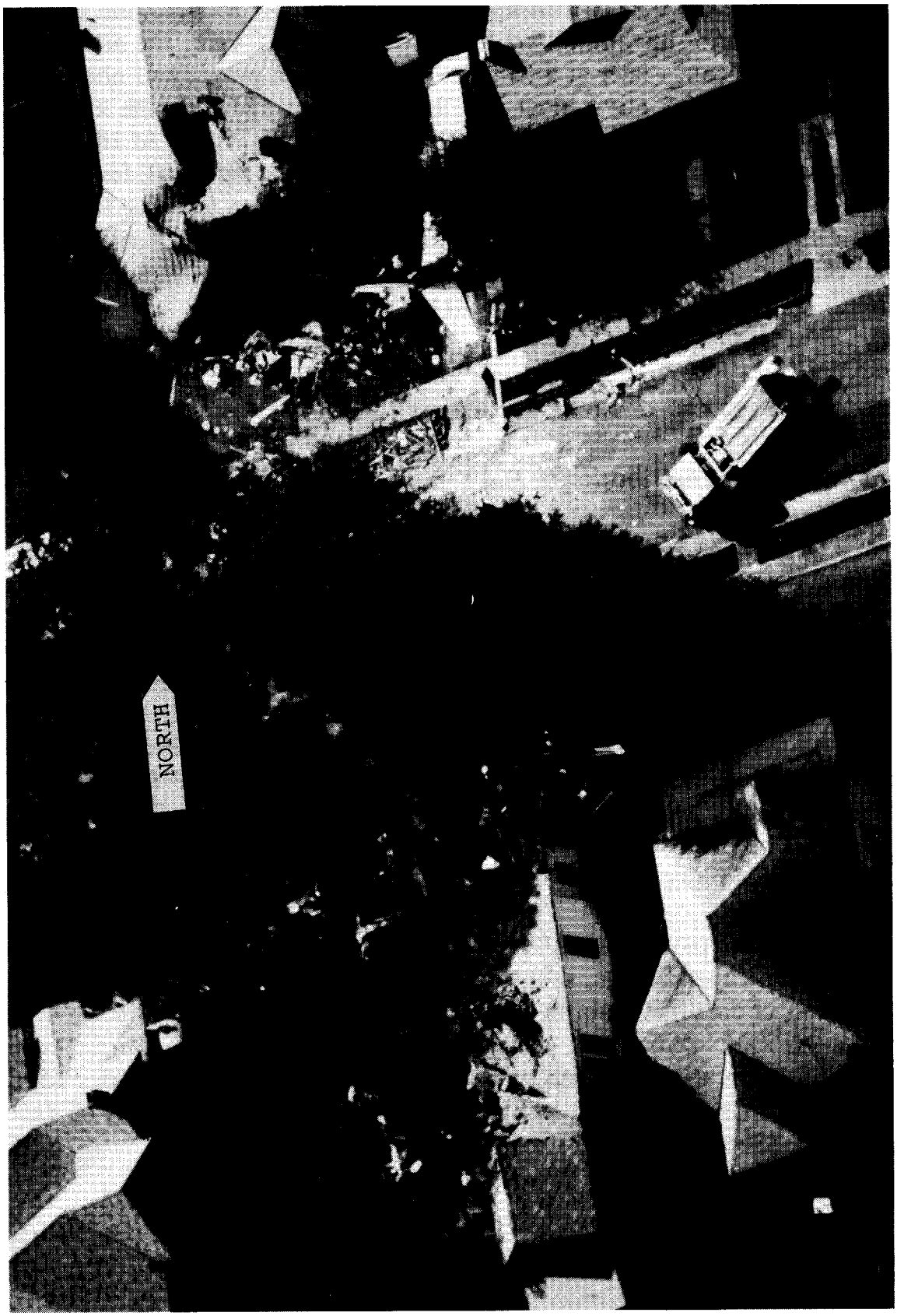

Figure 2.--Aerial photograph of wreckage.

1.12.2 Structural Damage to the Airframe

The interior of the passenger cabin was extensively damaged by impact and fire. The nose section just forward of the cockpit was crushed. The top of the airplane from the cockpit area to just forward of the empennage was destroyed by fire. The fuselage belly skin suffered no fire damage but did show compression buckling. The empennage had broken from the fuselage, but it remained attached by control cables and some fuselage skin. The left and right horizontal stabilizer leading edges had numerous dents similar to tree strikes. The right horizontal stabilizer had partially separated from its attach points and was located about 6 inches from the empennage. Both the right and left elevators were found attached to the stabilizers. The vertical stabilizer was intact with the empennage and had damage to the top, sides, and de-ice boot. The rudder was attached to the lower three hinge points and its control system was intact within the empennage. The top hinge point was severed along with the rotating beacon and top trim cap.

The left and right wing root attach points were severely damaged and had evidence of exposure to extreme heat. All of the wing spar attach bolts and the outer wing attach fittings were examined for preimpact failures. No evidence was found that would indicate preimpact failures, fatigue cracking or necking of any wing attach points. The fuselage baggage pod attached to the belly of the airplane had sheared off upon impact with the first house.

The right wing had sheared from the airplane outboard of the right engine nacelle and showed evidence of having struck the first house. There was no evidence of heat or fire damage to this section of the right wing. The left wing remained attached to the left engine nacelle and exhibited heavy fire damage. This wing had evidence of dents and scratches indicating that it had passed through tree branches.

1.12.3 Systems Damage

All parts of the flight control system were accounted for in the impact area. All propeller blades and hubs were also found at the crash site. The nose of the airplane, including the radar dish mechanism and its transceiver, was crushed and broken from the fuselage. Fiberglass nose cone debris and. electronic parts from the radar system were within 20 feet of the main fuselage, crushed, with no evidence of heat damage or sooting. An automobile, found in the street between the two destroyed houses, had marks that matched the nose cone paint. Fiberglass

and electronic fragments lay nearby. The forward portion of the fuselage containing the nose wheel assembly was attached to the main fuselage and had extreme heat damage. The nose wheel, strut, and actuating cylinder were in the retracted position. The interior and exterior of the nose section showed increasing heat damage from fore to aft. No heat damage similar to an in-flight fire was found.

The cockpit area of the aircraft was crushed and had extreme heat damage. None of the instruments or gauges could be read. The power levers, prop levers, and condition levers were in the full forward position; however, the quadrant had been broken from the airplane structure, and there was no powerplant control system continuity. All of the cables and push-pull rods showed evidence of tension-type failures. An examination of the throttle quadrant revealed severe sooting, heat damage, melting and severe overload-type failures of throttle quadrant components. The aileron trim knob indicated 2 units right. The rudder trim indicated 1 unit right. The stabilizer trim switches were in the "On" position. The flap lever was in the retracted position.

The cockpit switches were crushed and showed evidence of extreme heat damage. The lower right pilot's switch panel was removed for testing. The testing revealed that at impact, the landing gear handle had been in the retracted position, the external light switches were in the "Off' position, and the other switches were destroyed. The avionics were crushed and melted. No dial readings were visible. An examination of the annunciator panel lightbulb filaments under lo-power magnification revealed extreme heat damage to the majority of the lightbulbs and lightbulb sockets. No useful evidence could be obtained from the lightbulb examination.

The flight control push-pull rods, bellcranks and cables were examined for continuity and traced throughout the airframe to their respective failure points. All parts showed evidence similar to overload failures. No evidence of preimpact failure or malfunctions could be found. No cockpit windshield or window material was found that could be identified or categorized. The fire shut-off handles and switches were examined and found in the stowed (normal operations) position.

The center section of the fuselage showed large pools of molten aluminum, ripped and sooted sheet metal, and burned wires.

The landing gear electrical-hydraulic pump showed evidence of heat damage and overload-type failure of the attach fittings. The landing gear hydraulic lines showed evidence of overload failures near fuselage structural attach points and at fittings. No preimpact damage or evidence of malfunctions were noted.

The left and right aileron cables were separated from their respective attach points in the wing and were frayed similar to overload failures. The ailerons and portions of the wings were near the initial impact point. The ailerons were severely damaged but had no evidence of scorching or sooting. The left wing inner and outer flaps and flap actuators remained attached to the left wing. The left wing flaps were partially melted. The flap system inner and outer actuators were examined and measured. The flap actuator extensions were equivalent to the approach flap configuration. The left main landing gear assembly and actuating cylinder were in the retracted position and heat damaged. The right main landing gear assembly was in the extended position with the uplocks broken, and the actuating cylinder was in the retracted position. The right main landing gear and tires were severely heat damaged.

1.12.4 The Engines

The left Pratt & Whitney of Canada PT6A-36 engine was partially attached to the left wing by control rods and left-side attaching bolts. The engine had rotated at around a 45° angle to the left of the centerline. The cowling and propeller were intact with the engine but had extreme damage. The propeller had severe chordwise scratches, and two of the blades had moderate S-type bending. One blade was found bent 90° to the plane of rotation and conformed to the shape of the cowling. The propeller shaft was found to be seized, forced aft, and attached to the reduction gearbox assembly. The exhaust duct was compression buckled, showed slight torsional twisting, and was tom. The fuel control and associated linkage were intact on the engine. The left engine control rods and cables were intact but pulled aft. The gas generator case was intact with light buckling forward of the right side fuel nozzles. The compressor inlet case support struts were intact, and the inlet screen was integral to its attach points. The compressor first stage blades did not show any evidence of damage. The compressor bleed valve was intact in the open (normal engine shutdown) position. The accessory gearbox casing was intact with the igniter box, starter-generator, fuel/oil heater, fuel control, external oil scavenge pump, high pressure fuel pump and the gas tach generator. The left engine and propeller were removed from the crash site and shipped to the engine manufacturer for further examination.

The right Pratt & Whitney of Canada PT6A-36 engine was detached from the airframe and was severely heat damaged. The forward portion of the engine reduction gearbox and propeller had separated. The right propeller, propeller shaft and a portion of the gearbox with the second stage gears attached were found in the burned house about 7 feet from the right engine. The outer portions of two propeller blades were missing from the hub and blade assembly. The two missing propeller chordwise edges showed evidence of extreme heat damage and melting. The propeller inner portions were bent similar to the beginning of the S-shaped curves of the left propeller. The magnesium casing for the reduction gearbox was partially consumed by melting. The first stage reduction gears were found with the engine. The first and second stage gears did not show evidence of operational distress. The exhaust duct was compressed and torsionally deformed. The gas generator case was intact with some compression buckling and heat discoloration. The fuel manifold, transfer tubes and igniters were intact. The compressor inlet case was intact but distorted and heat damaged. The compressor bleed valve was tom from its attach points. The accessory gearbox magnesium casing was heat eroded from approximately the 1 o'clock to 7 o'clock positions. The accessory gearbox-mounted components were intact but severely heat damaged. The right engine and propeller were also removed from the crash site and shipped to the engine manufacturer for further examination.

Detailed examination of the left engine propeller showed that two of the blades were twisted toward the low pitch direction, typical of blades absorbing power during the impact sequence. Impact marks on the interior of the left propeller piston wall were consistent with blade pitch angles of +6 and -11 degrees at impact. The pitch change rod of the right engine propeller had an impact mark consistent with a propeller blade angle of -10°. The evidence indicated that these blade angles were a postimpact condition and were not indicative of any in-flight malfunction.

Disassembly of the left engine revealed axially directed rotational rub marks on the power turbine interstage baffle, the power turbine vane ring, the power turbine and compressor disks, the power turbine shroud, and the first stage axial compressor airfoil blade tips. Similar evidence of axially directed rotational rubbing was found in the right engine.

1.13 Medical and Pathological Information

The 12 deceased passengers and the first officer were recovered from the area of the living room and front yard of the private residence at

2517 29th Place. Autopsies were conducted by the Jefferson County Medical Examiners Office (JCMEO) in Birmingham. On September 11, 1991, the JCMEO issued findings that stated that the first officer and nine of the passengers died of extensive blunt force trauma. Three of the passenger's deaths were attributed to smoke inhalation and thermal bums, and two of them also sustained extensive blunt force trauma.

The captain was found on the front lawn of the residence at 2521 29th Place and had sustained a closed head injury with loss of consciousness, multiple lacerations of the scalp, and abrasions and contusions over his upper torso, arms, and legs. The surviving passenger sustained multiple blunt force traumatic injuries to his head and upper chest and fractures of his right fibula.

Urine and blood samples were obtained from the captain in the hospital about 1 hour after the accident. The blood sample tested negative for ethanol and tricyclics, and the urine sample tested negative on a drug screen that included barbiturates, benzodiazepine, cocaine, cannabinoids, and opiates. An additional urine sample was obtained from the captain about 22 hours after the accident under a company drug testing program. It tested negative for the five drugs specified in the protocol of the National Institute of Drug Abuse (NIDA): marijuana, cocaine, amphetamines, PCP, and opiates. He was tested for drugs before the accident by the airline upon his return from Operation Desert Storm and the results were negative.

Urine and blood samples obtained posthumously from the first officer were toxicologically tested by the FAA Civil Aeromedical Institute (CAMI). The blood sample tested negative for ethanol, carbon monoxide, and cyanide, and the urine sample tested negative for a drug screen which included ethanol, amphetamines, analgesics, antidepressants, antihistamines, barbiturates, benzodiazepines, cannabinoids, cocaine, meprobamate, methaqualone, nicotine, opiates, and phencyclidine.

Shortly after the accident, the Safety Board requested that blood and urine samples be obtained from air traffic controllers who may have been involved in the accident. This request was relayed to the BHM local controller, the south radar controller, and the radar room supervisor by FAA supervisory personnel. On the morning following the accident, these three individuals declined to provide samples. Between 2030 and 2100 on the evening of the accident, FAA supervisory personnel decided not to obtain urine samples from these controllers for testing under FAA postaccident drug testing guidelines.

1.14 Fire

There was no evidence of an in-flight fire. According to witnesses, a ground fire broke out shortly after impact; however, these witnesses could not say where the fire originated. Also, the origin of the fire could not be determined from examining the remaining physical evidence.

1.15 Survival Aspects

1.15.1 Avenues of Escape

All of the normal and emergency exits were examined for evidence of malfunctions. The main cabin door was open and still attached to the fuselage with the locking bayonets also in the closed position. 'This door exhibited fire damage to its interior surface. The forward and upper portion of the door's frame were completely burned. The aft cargo door was closed, locked, and intact in the frame. The left emergency exit hatch was about 20 feet beyond the fuselage and was buckled and in the locked position. There was no evidence of fire or soot damage to the hatch. The right emergency exit door was bent and lying on the ground 25 feet from the main wreckage. It was not damaged by fire or heat. The hinges were still attached to the door, and the locking bayonets were in the closed position. The right emergency exit hatch frame on the fuselage had been almost entirely consumed by fire damage. The pilot's escape hatch was under the left wing root area. It displayed evidence of heat but no extreme heat damage was found.

1.15.2 Occupant Survival

The Beech C99 is equipped with captain and first officer seats in the cockpit, five rows of two seats each separated by an aisle in the passenger cabin, one single seat opposite the left side passenger boarding door, and a double seat unit in the extreme aft cabin. All seats on the airplane were occupied at the time of the crash. All passenger seat-to-floor fastenings failed during the impact sequence. Some passengers were found safety belted into these seats. There is one emergency window exit on the left side of the fuselage near seat row 1.

The captain of LEX508, who was sitting in the left cockpit seat, could not remember how he exited the airplane or other postcrash activity. He was found unconscious in the front yard of the residence at 2521 29th Place shortly after the accident. The surviving passenger, who had been in the only seat in row 6 directly

opposite the passenger entry door, remembered that he was safety belted into his seat when the seat came to rest in the living room of 2517 29th Place. He unbuckled his seat belt and stood up, and an elderly resident of the house told him that his hair was on fire. The passenger, with the help of the resident, extinguished the fire on his hair. The three occupants of the house and the passenger then exited via a rear window of the house. They were helped away from the impact area by a passerby.

1.15.3 Crash/Fire/Rescue Response

The initial notification of the accident to the Birmingham Police Department and the Birmingham Fire Department Communications Centers was made by several residents in the impact area about 18 15. Two police officers were on scene about 3 minutes later. About that time, a squad truck and pumper from the Birmingham Fire Department arrived. Rescue personnel found the surviving passenger and the captain and placed them into two of the five private ambulances that had responded. They were taken to two different hospitals, each about 5 miles from the accident scene.

1.16 Tests and Research

None.

1.17 Additional Information

1.17.1 Airline Operations Information

L'Express Airlines, Inc., is a regional airline headquartered in New Orleans, Louisiana. The airline was formed in March 1989, and began scheduled flight operations on August 9, 1989. The airline is the holder of Air Carrier Certificate No. LXIA-985B, issued on July 24, 1990, by the FAA Southwest Region Flight Standards District Office (FSDO) in Birmingham, Alabama. The airline is authorized to operate in the 48 contiguous United States. Service is provided by 4 Beech C99s, and 4 pressurized Beech 1900Cs, to 11 cities daily. The airline employed approximately 180 people, including 44 pilots, at the time of the accident. L'Express is a subsidiary of Reed Industries, Inc., headquartered in New Orleans, Louisiana.

In January 1991, L'Express filed for bankruptcy protection under Chapter 11. This action resulted from insufficient funds to pay a promissory note

that was due to Beech Aircraft. The chief pilot for L'Express said that the FAA was notified of the airline's intent to file for bankruptcy protection, and that resulted in an increase in surveillance activity by the FAA. He stated that there appeared to be more maintenance and en route inspections, and ramp checks at outlying stations where such checks had not been routinely conducted previously. The filing for protection resulted in a temporary halt in expansion by the airline but did not diminish the amount of service provided at the time of the accident, according to the chief pilot.

1.17.2 FAA Oversight of L'Express

The FSDO in Baton Rouge, Louisiana, holds the air carrier certificate of L'Express and has the primary surveillance and oversight responsibility for the commuter airline. As of July 15, 199 1, the FSDO's current and authorized personnel levels was 30 and 32, respectively. At the time of the accident, the FSDO had 18 aviation safety inspectors with qualifications ranging from trainee to full journeyman.

The POI for L'Express was assigned to the airline approximately 6 weeks prior to the accident. The POI is qualified to fly the Beech 99 aircraft. The POI's primary function is certificate management, which consists of conducting ramp checks and en route checks, reviewing training manuals, and observing check rides. The POI's previous responsibility and work experience consisted of oversight of Part 141 schools, Part 135 on-demand operations, and Part 137 agriculture operations. The POI has also worked as a navaids flight check pilot.

The FSDO personnel reported that in January 1991, they were notified by the management of L'Express of the airline's intention to file for bankruptcy protection. This notice led to additional inspections that were in addition to the scheduled surveillance program. The scheduled surveillance was accelerated, and 1 year of planned surveillance was completed during the first quarter of the year.

From January 10, 1990, to July 12, 1991, there were 94 work program operations surveillance inspections completed on L'Express.

1.17.2.1 Noncompliance Reports

During October and November 1990, L'Express scheduled flight crewmembers for flight time in excess of the time allowed by regulations in a

7-day period. Crewmembers of L'Express reported the occurrences to the airline's Director of Operations, who immediately relayed the information to FSDO 62, in keeping with the FAA Administrator's policy on compliance and enforcement, as outlined in his message to industry on July 12, 1990. The Director of Operations took corrective action by suspending a flight crewmember, discharging a crew scheduler, issuing memorandums concerning the instances, and modifying the airline's general operations manual to include revised procedures for enhanced communications between the crew scheduler, flight controllers, and management personnel. Based upon the positive actions taken by the airline, the FSDO concluded that the matter did not warrant legal enforcement action.

In May 1991, routine surveillance by FSDO 62 personnel of an initial qualification class for flight crewmembers scheduled to serve on the Beech C99 determined that the time devoted to systems familiarization on the C99 was inconsistent with the provisions of the FAA-approved training program and was therefore contrary to Federal aviation regulations. The course instructor was teaching the class as if it were recurrent training because several of the students were former Beech 1900 pilots and had been with the airline for an extended period of time. The FAA reporting official stated that his only complaint was that the training time allotted to each subject did not meet the period of time approved by the FAA. L'Express provided additional instruction to the individuals in the class and amended its training program to comply with the requirements of FAA Order 8400.10. The FAA concluded that this matter also did not warrant legal enforcement action.

1.17.2.2 Excerpts From Aviation Safety Inspectors Handbook 8400.10, Change 4, August 31, 1990

Page 3-302 outlines the flight maneuvers to be accomplished in airplanes during the VFR competency check under 14 CFR 135.293 (initial and recurrent pilot testing requirements). Under the heading "Abnormal and Emergency Procedures" is the recommendation that both pilots-in-command and seconds-in-command are to demonstrate their ability to recover from unusual attitudes by reference to basic flight instruments (needle, ball, and airspeed) if the airplane they are assigned to fly is not equipped with standby flight instruments.

Page 3-303 outlines the flight maneuvers to be accomplished in airplanes during the IFR Competency Check under 14 CFR 135.293 and 135.297 (pilot-in-command: instrument proficiency check requirement). Under the heading "Inflight Maneuvers" is the stipulation that both pilots-in-command and seconds-

in-command are to demonstrate their ability to recover from unusual attitudes if the aircraft they are assigned to fly is not equipped with standby instruments.

Aviation Safety Inspectors from FSDO 62 said that the language in FAA Order 8400.10 is not mandatory unless it is linked to a regulation. In instances where such linkage does not exist, the FSDO encourages air carriers to adopt the flight maneuvers, policies, and procedures contained in the Order that have proven to enhance aviation safety.

The POI for L'Express said that at the time of the accident, he was aware that unusual attitude training was not part of the airline's formal flight training program. He believed that neither Federal aviation regulations nor the FAA Order 8400.10 were applicable because he mistakenly thought L'Express C99 aircraft were equipped with standby flight instruments. Subsequent to the accident, he has been successful in ensuring that the airlines assigned to him incorporate unusual attitude training in their flight training and testing programs.

1.17.2.3 Regulations On Unusual Attitude Training

The initial and recurrent pilot testing requirements contained in 14 CFR Part 135.293 and the pilot-in-command/instrument proficiency check requirements contained in Part 135.297 do not specifically address pilot proficiency in the recognition and recovery from unusual attitudes. The language contained in Part 135.293 stipulates that "the competency check may include any of the maneuvers and procedures currently required for the original issuance of the particular pilot certificate required for the operations authorized and appropriate to the category, class and type of aircraft involved." 14 CFR Part 135.297 requires the flight check to include "recovery from simulated emergencies."

Specific language that addresses the need for competency in recovering from unusual attitudes is found in 14 CFR Part 61.65 (Certification: Pilots And Flight Instructors - Instrument rating requirements). Section C, Item No. 5, requires applicants for the flight test for an instrument rating (airplane) to present a logbook record certified by an authorized flight instructor showing that they have received instrument flight instruction in an airplane and have been found competent in coping with simulated emergencies, including the recovery from unusual attitudes.

1.17.2.4 Air Traffic Control Weather Dissemination Procedures

Air traffic control weather dissemination procedures are contained in FAA Handbook 7110.65F. The following portions are applicable to this accident and the numbers preceding the subject headings are paragraph numbers from the Handbook:

2-102 Pilot Report (PIREP) Information

Significant PIREP information includes reports of strong frontal activity, squall lines, thunderstorms, light to severe icing, windshear and turbulence (including clear air turbulence) of moderate or greater intensity, or other conditions pertinent to flight safety.

a. Solicit PIREPs when requested or when one of the following conditions exist or are forecast for your area of jurisdiction:

These are: (1) ceiling at or below 5,000 feet (2) visibility (surface or aloft) at or less than 5 miles (3) Thunderstorms and related phenomena (4) Turbulence of moderate degree or greater (5) Icing of light degree or greater (6) Windshear.

The Handbook instructs the controller that PIREPs should be obtained directly from the pilot and that terminal controllers should relay this information to appropriate intrafacility positions and to the flight service station (FSS) serving the area in which the report was obtained.

2-103 Weather and Chaff Services

This paragraph directs that a controller, "issue pertinent information on observed/reported weather. Provide radar navigational guidance and/or approve deviations around weather areas when requested by the pilot." Further, (1) "issue weather information by defining the area of coverage in terms of azimuth and distance from the aircraft or by indicating the general width of the area and the area of coverage in terms of fixes or distance and direction from fixes," and, (2) "when a deviation cannot be approved as requested and the situation permits, suggest an alternative course of action." Further, the controller is directed, "in areas of significant weather, plan ahead and be prepared to suggest, upon pilot request, the use of alternative routes/altitudes." It is noted that weather significant to the safety

of aircraft includes such conditions as tornadoes, lines of thunderstorms, embedded thunderstorms, large hail, windshear, moderate to extreme turbulence (including CAT) and light to severe icing. The paragraph also states, "inform any tower for which you provide approach control services if you observe any weather echoes on radar which might affect their operations." The paragraph then provides examples of phraseology that the controller may use to conform to the content of the paragraph. The controller is also cautioned, "phraseology using level number and intensity adjective is only applicable when the radar weather or echo intensity information is determined by NWS radar equipment."

Section 9, "Automatic Terminal Information Service - Procedures," is covered in paragraphs, 2-l 25, "Application," 2- 126, "Operating Procedures," and 2-127, "Content." Specifically, 2-126 advises the controller, "Broadcast on all appropriate frequencies to advise aircraft of a change in the ATIS code/message." In addition it states, "Controllers shall ensure pilots receive all pertinent information contained in the ATIS broadcast. If a pilot does not state receipt of the current ATIS, ask the pilot to confirm receipt of the appropriate ATIS information." The controller is then directed, "controllers shall issue current ATIS information unless the pilot volunteers to obtain it."

2. ANALYSIS

2.1 General

The airplane crashed when control was lost during an ILS approach into an area of thunderstorm activity. An examination of the wreckage and impact marks on trees and structures revealed that the left wing initially struck a tree while the airplane was in a descent of greater than 20°. At impact, the attitude of the airplane was nose down, in a slight left roll. Impact marks on the bottom of the baggage pod showed that the underside of the fuselage struck the roof of the first house and that the right wing simultaneously struck the chimney of that house. As the airplane traveled forward and downward, the entire front of the house was destroyed. It then struck the automobiles parked in front of the second house. There were no impact marks on the street surface, indicating that the airplane had struck the tops of both automobiles and descended into the front yard of the second house. The airplane came to rest with the right side of the fuselage imbedded in the front of the second house.

The examination of the airframe showed that all structural components were intact immediately prior to the accident sequence. The evidence indicated that all doors and exits were locked and secured until the airframe began to break apart. The continuity of the aircraft control system was confirmed by matching failure points and tracing individual cables throughout their respective routings. The measured positions of the four flap control actuators confirmed that the flaps were in the approach position. The damage to the gear uplocks combined with the gear retraction cylinders in the retracted position showed that the landing gear were in the retracted position. The fire patterns on the airframe and numerous nonburned parts near the main wreckage confirmed a fuel-fed, postcrash fire. There was no evidence of an in-flight fire.

Many propeller slash marks along the wreckage path showed that both engines were operating during the crash sequence. The "S" bending of the propeller blades and rotational damage within both engines confirmed that some power was being applied to the propellers during the crash.

Although a transient, untraceable radar malfunction could have occurred as the flight was approaching BHM, the evidence indicated that such a malfunction was highly unlikely. The surviving captain stated that he self-tested the radar on the ground prior to takeoff at MSY and that the radar was operating normally during the en route portion of the flight. He also stated that it was not malfunctioning during the instrument approach.

Given the fact that the captain's attitude indicator had been replaced at MSY on the day of the accident, and in the absence of physical evidence to the contrary, the Safety Board believes that the attitude indicators in the airplane were working as designed at the time of the accident. Following the accident, the captain stated that his attitude indicator was working "OK" because its indication coincided with his outside view of the horizon. Also, the flightcrew who flew the airplane on the flight segment leg after the attitude indicator replacement did not note attitude indicator problems.

The Safety Board believes that the discrepancy in operating hours (9,054.4 hours instead of a higher number) in the July 1, 1991, maintenance logbook entry was a clerical error on the part of Beech maintenance personnel. All other operating hour and Hobbs meter hour entries in the extensive repair and refurbishment documentation concerning N7217L were in proper ascending order and appeared to reflect proper maintenance.

The captain of LEX508 had indications that the continuation of the instrument approach would necessitate penetration of a thunderstorm. His decision making and the factors associated with his performance during the accident sequence of events are analyzed herein. The south radar controller had responsibilities concerning weather warnings that are also analyzed.

The Safety Board believes that the pilots of LEX508 were properly certificated and qualified for the flight in accordance with Federal regulations in effect at the time of the accident. There was no evidence that medical or physiological factors adversely affected the performance of the flightcrew. Neither pilot had received formal, standardized training on the use and operation of the Bendix RDR-160 radar, or training in recognizing and recovering from unusual attitudes from L'Express Airlines. In several previous accidents,[11] the Safety

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[11] "Eastern Air Lines, Inc., Boeing 727-225, John F. Kennedy Airport, Jamaica, New York, June 24, 1975" (NTSB/AAR-76/8); "Continental Air Lines, Inc., Boeing 727-224, Stapleton International Airport, Denver, Colorado, August 7, 1975" (NTSB/AAR-76/-14); "Southern Airways, Inc., DC-9-31, New Hope, Georgia, April 4, 1977" (NTSB/AAR-78/3); "Continental Air Lines, Inc., Boeing 727-224, Tucson, Arizona, June 3, 1977" (NTSB/AAR-78/9); (Incident) "Eastern Airlines, Inc., Boeing 727-25, Atlanta Hartsfield International Airport, Atlanta, Georgia, August 22, 1979" (NTSB/AAR-80/6); "Air Wisconsin, Inc., Swearingen SA-226 Metro, Valley, Nebraska, June 12, 1980" (NTSB/AAR-80/15); "United Airlines Inc., Boeing 727-222, Denver, Colorado, May 31, 1984" (NTSB/AAR-85/05); "Delta Airlines Inc., Lockheed L-101 1-385-1, Dallas/Fort Worth International Airport, Texas, August 2, 1985" (NTSB/AAR-86/05)

Board found similar shortcomings in training in these areas, and it believes that these shortcomings need to be addressed by the FAA.

2.2 Flightcrew Experience and Training

The Safety Board examined closely the experience level of the flightcrew and the training provided by L'Express to determine how they might have affected the flightcrew's performance on the evening of the accident.

Both flight crewmembers possessed extensive experience in conducting flight operations in the Gulf Coast States of Florida, Alabama, Mississippi, and Texas. This area of the United States experiences a high rate of convective activity throughout the year. In the summer, the atmospheric convection and the attendant thunderstorms are frequently the result of the moist air from the Gulf of Mexico heated at the surface by the subtropical sun. During the winter, the convection and thunderstorms result from the interaction of the Gulf air and the cooler air of the central United States and the plains states.

ATC personnel and several pilots, including the captain of LEX508, characterized the thunderstorms in the BHM area as a typical afternoon phenomenon. The Safety Board is concerned that the frequency with which both pilots and ATC personnel are subjected to thunderstorms may lead to a complacent attitude and diminished level of respect for their potential destructiveness. Pilots who have experience flying in areas of thunderstorm activity learn that the possibility exists of encountering a hazard due to a thunderstorm. Most of the time, however, a pilot will encounter nothing more intimidating than heavy rain and lightning as was experienced by the pilot of the Aerostar. In fact, according to the National Severe Storms Laboratory, Norman, Oklahoma, the statistical odds of encountering severe turbulence is about 8 percent in a thunderstorm having a radar echo reflectivity of 41 dB (VIP level 3). As a result, over a period of time some pilots may lose their respect for thunderstorms by flying close to, or even directly into, areas that display such reflectivity. The problem is exacerbated by the belief that an existing storm situation is identical or similar to previous encounters in which flight was uneventful. The fact is, while thunderstorms may appear to be the same, they may present vastly different levels of hazard.

The Safety Board believes that the captains decision to continue the instrument approach, while other pilots elected to do otherwise, was based upon his previous experience with thunderstorm situations in the terminal environment that were uneventful. This process, over a period of time, diminished his respect for the hazards inherent in all mature thunderstorms.

The investigation revealed that the captain had recently returned to the airline following an 8-month leave of absence as an aircraft maintenance officer in the U.S. Air Force stationed in Saudi Arabia. Following his return to the airline in May 1991, he attempted unsuccessfully on two occasions to complete an instrument proficiency flight check. These unsuccessful attempts suggest a deficiency in his planning ability, instrument flying abilities, and judgment. However, there was insufficient evidence for the Safety Board to draw a direct correlation between his previous deficiencies and his performance on the day of the accident. The Safety Board questioned other crewmembers who had flown with the captain about his piloting abilities and decision making. They described him as an experienced and good pilot, but his performance during the accident flight is not consistent with this assessment.

2.2.1 Meteorological Training

The pilot training program was required to comply with 14 CFR, Part 135.345, "Pilots: Initial, Transition, and Upgrade Training." This regulation required the training program, in part, to include "enough meteorology to ensure a practical knowledge of weather phenomena, including the principles of thunderstorms and windshear." It also included procedures for recognizing and avoiding severe weather situations and escaping from severe weather situations, and procedures for operating in or near thunderstorms, including best penetrating altitudes.

The Safety Board found that the flight hours provided by L'Express to their pilots for training and the methods and content of the ground and flight instruction programs complied with the applicable FAA requirements. Sufficient coverage was provided on the subject of meteorology and thunderstorms, in particular. The training provided the flightcrew with the capability to correctly analyze the flight conditions they were confronted with and effect a rational course of action.

2.2.2 Radar Training

The radar training provided by L'Express did not adequately address the specific operating characteristics and procedures of the Bendix RDR-160. The ground school reference library did not include a copy of the RDR- 160 Weathervision Pilot's Manual. Moreover, the check airman/ground instructor for the airline, who taught the radar portion of the ground school, did not possess an operations manual for the RDR-160. The Safety Board provided the airline with a

copy of the RDR-160 Pilot's Manual during the field phase of the accident investigation. The Safety Board believes that in order for any training program on a system or component to be truly effective, it should incorporate the limitations, operating guidelines, and thoughts and viewpoints published by the manufacturer of that device. A C99 first officer told Safety Board investigators that his training on the RDR-160 radar consisted of "trial and error experience and information from other pilots." The Safety Board believes that such "learn as you go" training can easily foster improper operating procedures and techniques and a false sense of system capability. The Safety Board believes that the FAA should require that radar training programs include information on the specific radar that the flightcrew will be using and reference the information provided by the manufacturer concerning its limitations and recommended operating procedures.

2.2.3 Training in Recognizing and Recovering from Unusual Attitudes

The Safety Board is also concerned that the flightcrew had not received unusual attitude recognition and recovery training and that current Federal regulations do not specifically require flightcrews to receive recurrent training in these subjects. The captain described the initial upsetting event as a steep roll to the left followed by an abrupt pitch up. He indicated that he lost sight of the horizon and that at certain points during the event he was unaware of the attitude of the airplane. Additionally, he could not ascertain whether the airplane entered a stall or experienced a prestall buffet. The Safety Board was unable to determine, with any precision, the exact magnitude of the vertical and horizontal winds encountered by LEX508 or to objectively assess the actions of the flightcrew following the upset. Given the difficulty the captain experienced in controlling the airplane, the Safety Board believes that the flight encountered severe turbulence and that it is likely that the airplane was in a level 3 or 4 thunderstorm.

The Safety Board believes that the thunderstorms in the BHM area on the evening of the accident, and the turbulent winds encountered by the flight, were extremely localized and relatively short lived. If the flightcrew had been trained and proficient in the recognition and recovery techniques for an unusual attitude situation, they would most likely have been better able to cope with the attitudes that were experienced. The true nature of the problem--the training of flightcrews in the recognition of and recovery from unusual attitudes using basic flight instrumentation--has, heretofore, not been addressed. Consequently, the Safety Board believes that the FAA should require the initial and recurrent training of general aviation and air carrier pilots in the recognition of and recovery procedures for unusual attitude situations.

The Safety Board has twice before addressed the issue of pilot training for recovery from unusual attitude situations. As a result of its investigation of a November 16, 1968, upset incident involving a Boeing 727 departing Detroit, the Safety Board issued Safety Recommendation A-69-115 to the FAA. This recommendation asked that the FAA:

> Require airlines to provide additional flightcrew training, whereby pilots would be required to demonstrate periodically, proficiency in the area of recovery from unusual attitudes. It is suggested that a simulator be utilized to provide flightcrew familiarization in the following areas: A. the various instrument displays associated with and resulting from encounters with unusual meteorological conditions; B. the proper flightcrew response to the various displays; C. demonstration of and recovery from possible ensuing unusual attitudes.

As a result of its investigation of a March 3 1, 1971 accident involving an out-of-control Boeing 707/720B on a proficiency check flight out of Ontario, California, the Safety Board issued Safety Recommendation A-72-152 asking that the FAA:

> Amend 14 CFR 61, Appendix A, and CFR 121, Appendices E and F to include a requirement for pilots to demonstrate their ability to recover from abnormal regimes of flight and unusual attitudes solely by reference to flight instruments. For maximum safety, these demonstrations should be conducted in an appropriate flight simulator. Should existing or proposed simulators be incapable of realistically duplicating aircraft performance in the regimes of flight beyond normal operation, it is further recommended that the FAA take appropriate measures to require that such existing or proposed simulators be replaced or modified to include such a capability.

The FAA declined to implement these safety recommendations pointing out that out-of-trim upset accidents were very rare and that a requirement for unusual attitude recovery maneuvers was deleted from the pilot proficiency checks in August 1965 because such maneuvers had "...little or no training value....” Further, the FAA stated that since simulators were not required, the agency could not require that specific maneuvers be placed in the programming. Safety Recommendation A-69-l 15 was classified as “Closed--Unacceptable

Action" on August 17, 1972; Safety Recommendation A-72-152 was classified as "Closed--Unacceptable Action" on January 16, 1973.

2.2.4 Aeronautical Decision Making

The Safety Board believes that pilot training should contain a formal decision-making curriculum so that accidents and incidents, in which pilot judgment is called into question, can be analyzed for their educational value. In its investigation of a midair collision involving a Piper Aerostar and a Bell 412 helicopter at Merion, Pennsylvania, on April 4, 1991, the Safety Board addressed the initial development of training projects in the area of aeronautical decision making.12 Because of evidence of poor judgment and poor decision making by pilots in many accidents, the Safety Board made the following recommendation to the Federal Aviation Administration:

> Disseminate more aggressively available information and materials pertaining to Aeronautical Decision Making training and actively promote its implementation among all categories of pilots in the civil aviation community. (Class II, Priority Action) (A-9 l-93)

On December 27, 1991, the FAA responded to this safety recommendation listing a number of actions taken to satisfy the intent. The FAA response included a reference to Advisory Circular 60-22, "Aeronautical Decision Making," which provides a systematic approach to risk assessment and stress management in aviation, and illustrates how personal attitudes can influence decision making and how those attitudes can be modified to enhance safety in the cockpit. Further, the FAA's Accident Prevention Program has been actively disseminating information and materials pertaining to aeronautical decision making, including slide presentations, videotapes, and pamphlets on the subject, to all FSDOs. The FAA pointed out that during practical testing, all airmen are evaluated on sound judgment in decision making at each level of pilot certification. The FAA committed to adding aeronautical decision making publications to the reference list of publications in each edition of the Practical Test Standards.

The Safety Board is evaluating the information supplied by the FAA and will assign a status in the near future. In the meantime, the Safety Board urges

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12"Midair Collision Involving Lycoming Air Services Piper Aerostar PA-60 and Sun Company Aviation Department Bell 412, Merion, Pennsylvania, April 4, 1991" (NTSB/AAR-1/01/SUM)

the FAA to continue efforts to provide information and materials pertaining to aeronautical decision making to pilots.

2.3 Weather at the Time of the Accident

The Safety Board's examination of weather radar data, and the observations from witnesses on the ground and aloft, indicate that several thunderstorm cells having a precipitation intensity of between heavy (level 3) to very heavy (level 4) passed over the airport and across the final approach course of runway 5 about the same time that LEX508 commenced its approach.

A doppler weather radar system, owned and operated by a local television station, recorded the presence of multiple weather cells in the intensity of level 2 in the airport area and the approach environment until 1808, about 3 minutes before the accident.

The majority of witnesses on the ground reported observing lightning and heavy ram in the area of the accident site about the same time the accident occurred. Several witnesses reported a visibility of two blocks or less due to the intensity of the rain. The velocity of the wind during this period was estimated at approximately 40 miles per hour (mph). Trees were observed being bowed over due to the force of the wind. Also, the passenger who survived the crash reported that the flight entered a "dark cloud" and that rain and turbulence were encountered just prior to the upset.

Several pilot reports confirmed the location and intensity of the thunderstorm cells. At approximately 1759:39, the flightcrew of Lear-jet N45ZP detected multiple level 3+ cells on their Primus 400 color weather radar near the approach course to runway 5 and elected to discontinue the approach and hold until the weather situation improved. A second approach attempt at about 18 10 was also terminated when the flightcrew observed cloud-to-ground lightning along the final approach course. A Piper Aerostar (CONAERO 209) preceded the approach of LEX508 by approximately 5 minutes. The pilot of the Aerostar reported that during the approach he observed lightning near the airport and experienced mostly light turbulence with moderate to heavy rain about 1 to 1 1/2 miles southwest of the runway 5 threshold. The forward visibility in the area of the precipitation was zero; however, the ground was visible through the side windows, according to the Aerostar pilot. The weather ended at the threshold where it was clear overhead and to the east of the airport. The successful completion of the Aerostar's approach influenced the LEX508 captain to continue the approach.

Given the rapidly changing and localized weather patterns on the evening of the accident, the Safety Board believes that the weather data provided by the NWS for BHM and surrounding area was accurate. The 1725 and 1825 radar reports from the NWS radar at the Centerville-Brent Weather Service Meteorological Observatory put BHM within an area of 1/10 coverage of thunderstorms with precipitation/echo intensities up to very heavy (level 4). The cells were moving from 3400 at 16 knots, and the maximum top was 45,000 feet at approximately 20 miles and 12 miles, respectively, northwest of BHM. The 1810 special surface weather observation for BHM reported a visibility of 3 miles with thunderstorms, light rainshowers and in-cloud and cloud-to-ground lightning.

2.4 Pilot/Controller Physical and Psychological Factors

The captain and first officer were physically and psychologically prepared to begin their crew duty days. There was no evidence that either pilot was suffering from chronic or acute illnesses, and toxicology test results for both pilots were negative for major drugs of abuse (including alcohol), prescription, and over-the-counter medications. Both pilots had received adequate crew rest and nourishment prior to the accident. In addition, they were not under undue stress because of adverse life events.

It should be noted, however, that the accident occurred toward the end of a long duty day for the captain. The accident day was the captain's fourth day of flying and began when he reported for duty about 0600. Two attempts to land at the first destination were discontinued because of heavy fog. After several flight legs, the morning sequence of flying ended about 1330. There was a break of about 1 1/2 hours in which the captain waited in the unairconditioned pilot's lounge. This environment may have exacerbated any fatigue he may have been experiencing. Two witnesses who saw him there commented that he was perspiring. One of them said that he "looked rumpled, like a typical pilot who had been flying in the summer heat." The captain returned to duty at 1505, and the accident occurred on the second leg about 12 hours after he first reported for duty. The full duty day would have been about 14 hours. Given the captain's age of 54 years, the oppressive heat, which was typical of the region in July, and the extended length of the actual duty day, the Safety Board believes that the captain was fatigued to some degree. In that connection, the Safety board considered the possibility of fatigue as a factor in the captain's poor decision to fly into the storm cell. Regardless of the possible effects of fatigue on judgment, the captain might have felt some pressure to land at BHM so as not to extend the expected 14-hour duty day by delaying his landing. While the Safety Board believes that the circumstances surrounding the flightcrew's activities on July 10 could have led to a

deterioration of his judgment, there is no information available regarding the captain's ability to perform under either long-term or short-term fatigue. Therefore, a finding that his decision to penetrate the thunderstorm was the result of fatigue could not be supported.

Although the physical well-being of the south radar controller did not appear to be a factor in this sequence of events, the fact that no controllers were directed by FAA supervisory personnel to submit urine samples for toxicological testing is of considerable concern to the Safety Board. Should the Safety Board have developed information relating to poor performance on the part of air traffic control, it would have had no method to confirm whether that poor performance was related to impairment from alcohol and/or drugs. The Safety Board continues to believe strongly that, at the time of an accident, the facts at hand are usually insufficient to determine with certainty individual controller or pilot involvement in cause; and that, as with testing of flightcrews, any appearance of involvement in the accident sequence is good cause to obtain toxicological samples from air traffic controllers. The Safety Board, therefore, urges the FAA to undertake a less restrictive approach in its FAA guidelines for deciding whom to test following an accident in the interest of ensuring a thorough investigation of all relevant facts and circumstances.

Decisions made (after more than a 12-hour delay) not to volunteer to provide blood and urine samples to the Safety Board are also of concern. Flight crewmembers routinely submit toxicological samples to prove their innocence concerning drug and alcohol use, and air traffic controllers should be held to that same standard of accountability.

2.5 Actions of the LEX508 Pilots

2.5.1 The Pilot's Behavior Prior to the Weather Encounter

The captain had logged about 4,000 hours of flight time and had no history of accidents or FAA violations. He had just returned to commercial flying 2 months before the accident following a break of 8 months because of military duties. Also, he had failed two check rides in attempting to return to flight status. A former POI for the airline characterized the captain as, "stable, not too easily excitable, and pretty much minds the store." The chief pilot described him as "very dedicated to absorbing more knowledge," and another captain said he had a "tremendous amount of experience and war stories." The chief flight instructor said that he was a pilot with great overall knowledge and understanding who had a

tendency to get nervous on check rides. Overall, the implication is that the captain had areas of weakness despite a relatively high level of experience.

The first officer's failure to object to the decision to enter the storm cell may have been a reflection of some of his hesitation to contradict a captain whom he believed had extensive aeronautical experience. There was no evidence on the CVR transcript of disagreement between the two pilots. To the contrary, their interaction was often cordial.

2.5.2 The Captain's Awareness of the Hazardous Weather

The captain stated, following the accident, that the weather encounter and loss of control caught him completely by surprise and that he did not see any storm cell directly ahead of the airplane either on radar or visually. This explanation, however, is not supported by the available evidence. The cell contained rain, according to the pilot reports from the Aerostar, rain noise on the CVR tape and ground witnesses, and should have provided significant radar returns if the radar was used properly before he entered the cell. The Learjet crew observed significant cell activity on their radar and also reported seeing cells and visible lightning on the approach. As a result, they discontinued two approaches. The surviving passenger on LEX508 stated that a dark thunderstorm cloud was clearly visible directly ahead of the accident airplane and that its edges were clearly defined against the background sky on both sides of the cell. ATIS messages received in the cockpit indicated thunderstorm activity over and near the airport. According to the CVR transcript, the captain's decision to complete the approach was made after he received a ride report from the Aerostar that was preceding him. During the approach, the captain told the first officer to "watch out for windshear" (1808:23) and that "if you don't feel comfortable about this let me know" (1809:12). None of these conditions and statements was consistent with a pilot who anticipated an approach with no weather hazards present. Contrary to the captain's later statements, the available evidence suggests that the flightcrew was aware of the thunderstorm conditions and elected to continue the approach.

2.5.3 Weather Radar Observations in Flight and on the Ground

The statement by the captain of LEX508 concerning the location and intensity of thunderstorm cells is inconsistent with other pilot observations or the ground weather radar photographs. The captain stated that the airborne radar indicated that the thunderstorm cells were well to the north and west of the airport and the intended approach path. The thunderstorm location described by other pilots and the ground radar photo analysis were quite different. Both showed

multiple level 3 and possibly level 4 thunderstorm cells either directly on or very near the final approach course to runway 5.

The Safety Board sought to determine the reason for this disparity in observations. The Safety Board reviewed the comments from flightcrews who had previously used this particular airborne radar equipment, the maintenance history of the radar, the training the flightcrew received on the radar, the differences in the characteristics and capabilities of the radar sets involved, the differences in distance and location of the radar antennas from the observed cells, and the combined effects of any of these factors.

The flightcrew on the airplane the morning of July 10 stated that they were not in a position to comment on the operation of the radar because the flight conditions did not require the assistance of the radar. A review of the maintenance records for the airplane indicated that there were no open or recurring writeups that pertained to the radar system.

The L'Express flightcrew training program did not include formalized classroom training on the use and operation of the Bendix RDR-160 Weather-vision System Radar. The captain indicated that he had not received specific training on the Bendix RDR-160 and that his skill and knowledge in operating the radar was acquired by "learning by doing." A C99 first officer for the airline confirmed the captain's comments. Tests that were required by the FAA during various portions of the ground training program to evaluate the pilot's knowledge and comprehension of various topical areas did not include a comprehensive means to objectively evaluate a pilot's knowledge concerning the operation of the RDR-160. Consequently, there was no objective means available to evaluate the captain's knowledge of the radar prior to July 10, 199 1.

During a postaccident interview of the captain, he demonstrated an understanding of the testing procedure and the in-flight operational use of the radar, including antenna tilt management. The captain stated that he conducted a preflight test of the radar in MSY and that operation of the radar while en route to BHM indicated to him that the radar was operating satisfactorily. The CVR transcript indicates that there was some discussion by the flightcrew concerning their observations of weather. The Safety Board believes that these discussions were based upon their visual observations, as well as indications from the airborne radar. The evidence indicates that while the flight conditions between MOB and BHM were hazy, they were not so restrictive as to prevent the flightcrew from using a combination of visual observations and radar to circumnavigate weather. This is supported by the fact that the decision by other pilots to delay their landing

at BHM or divert to an alternate landing site was based primarily upon their visual observation of thunderstorm cells and not on airborne radar.

The Safety Board believes that if the flightcrew of LEX508 had experienced a disparity between their visual observations and the indications from the radar, there would have been some discussion in the cockpit concerning this issue. None was noted. The comments by the first officer at 1758:40 "pretty big guy" and at 1758:48 "that's the one that's northwest of the field there" were both a confirmation of and a reference to the location of a large thunderstorm northwest of the airport, presumably referenced in ATIS information Whiskey. The Safety Board, therefore, believes that the absence of discussion by the flightcrew indicates that the radar was portraying thunderstorm cell echoes in about the same location as noted by the flightcrew's visual observations.

The Safety Board also believes that if the nearest thunderstorms cells were as far removed from the final approach path as the captain indicated, his comment to the first officer to "watch out for windshear" would have been unwarranted. Moreover, his comment to the first officer at 1809:12, "if you don't feel comfortable about this let me know" strongly suggests that the flight was closer to thunderstorm cells than he indicated during his interviews with investigators.

The Safety Board examined the limitations of the radar, the radar's operating controls, the presentation indicator, and cockpit ergonomics for characteristics that could result in the flightcrew mismanaging the tilt control setting or forgetting or mistaking the range and location of the echo depicted on the indicator. No firm conclusions could be drawn. The radar was not equipped with antenna stabilization. Antenna stabilization consists of an electro-mechanical means of maintaining a selected radar beam scan relative to the Earth's horizon during moderate aircraft maneuvers. The Safety Board believes that the normal maneuvers associated with the descent and approach of LEX508 would not have distorted the relative size or location of the thunderstorm cells on the radar screen long enough to be misleading. Moreover, LEX508's fmal approach prior to penetrating the thunderstorm was about 10 miles long, in nearly wings-level flight.

The captain stated that the first officer operated the radar at his direction. Given the fact that the first officer was a relative new hire, he had limited experience operating the radar. The Safety Board examined the possibility that the first officer unintentionally selected an inappropriate antenna tilt or range setting. The Safety Board determined that the radar position mode selectors were identifiable and accessible to both crewmembers and that no conclusive

determination could be made regarding the first officer's performance. The fact that neither flight crewmember received formal training on the RDR-160 could contribute to a human error. If the error was attributable to the first officer, it may have gone undetected by the captain who had the duties of the flying pilot.

2.5.4 Reasons to Discontinue the Approach

There is no evidence that the financial condition of L'Express at the time contributed to the accident. The increased surveillance that had been placed upon the company by the FAA would tend to lessen the impact of financial difficulties on safe flight operations. Moreover, because the company manual had a provision that "no crew member will be punished or reprimanded for refusal to fly with cause" and the fact that "Inclement weather considered beyond the limits of a safe flight" is listed as a satisfactory cause for refusing to take a flight, it does not appear that undue pressure was placed on the flightcrew to complete the flight.

The morning of the accident, the captain had overflown an airport after rejecting two landings due to low ceilings because of fog. In addition, all passengers were scheduled to disembark at BHM. While the company would have suffered a financial loss if the flight had diverted, the widely scattered thunderstorms were moving rapidly enough that the need to divert was unlikely. Other airplanes were holding, and the Learjet crew was able to land several minutes after the accident without difficulty from weather. The captain reported that he felt no pressure to land on time at BHM. The flightcrew had another leg to fly and would have remained overnight at MOB after their arrival. With the exception of the captains possible concern about extending his crew duty time, there is no evidence that company pressure or time pressure were unduly involved in his decision to enter the storm cell.

Notwithstanding the benefits provided by airborne radar in the detection and avoidance of hazardous weather, the Safety Board believes that visual signs were evident, as well as reports from the ATIS and the approach controller, that warranted further examination by the crew to determine if the approach/landing should be delayed. Given the dynamics of the weather situation, the Safety Board believes that when the flightcrew of LEX508 was advised that the crew of a Lear-jet had aborted their approach because "it looks pretty bad on the radar," they should have inquired about the Learjet crew's observations by asking them about the location and intensity of the radar echoes to ascertain if the observations by the Learjet crew were different from the indications on their radar.

The captain of LEX508 indicated that the report from the pilot of the Aerostar was a factor in his decision to continue with the approach. In reality, the comments by the Aerostar pilot foretold the presence of a hazardous weather situation. The pilot's comment, as relayed by the approach controller, that the "ah rain had the visibility down to just about zero till they got to ah three quarter mile final" should have alerted the flightcrew to the existence of the mature stage thunderstorm and to the high potential for encountering severe vertical turbulence. Information addressing the indications of a mature thunderstorm and its volatile nature was included in the L'Express training program and reiterated in the Operations Manual. The Safety Board, therefore, believes that the captain's decision to continue the approach was based more on the fact that the Aerostar had successfully negotiated the approach to a safe landing than on the ride report provided by the Aerostar pilot.

The Safety Board also questions the prudence of the approach conducted by the pilot of the Aerostar, given that the dynamics of a mature thunderstorm cell were present during his approach to the airport. The Safety Board believes that the fact that the Aerostar did not encounter the extreme weather situation experienced by LEX508 was a matter of chance.

The Safety Board also notes that the pilots and flightcrews of five other aircraft elected to delay their approaches into BHM or to divert to alternate landing sites, and that their decisions were based solely on their visual observation and subsequent evaluation of the hazards present. The flightcrew of LEX508 was in possession of the same information but made a different determination.

The L'Express Operations Manual stipulated that "flight in turbulence and thunderstorms is extremely hazardous, obviously to be avoided if possible." Additionally, the L'Express pilot training program discussed delaying the takeoff or landing in the face of an approaching thunderstorm. The emphasis given, however, was apparently insufficient to deter this captain from penetrating the thunderstorm.

This accident underscores the rapidly changing nature of thunderstorms, and the importance of clarifying information about the safety of flight near areas of convective activity. For example, only about 10 minutes elapsed from the time that the flightcrew of Learjet N45ZP aborted their second approach to the time that they were able to conduct a safe and successful visual approach to runway 5.

In several accident and incident reports, the Safety Board has cited the failure of pilots to properly assess information concerning convective activity. Specifically, the Safety Board has been critical of the training that flightcrews received on hazardous weather avoidance and windshear recognition and recovery. A large number of these accidents and incidents involved highly experienced, professional pilots who had reportedly received the finest training available. Yet, these accident reports reveal that, in most of these cases, the pilot/flightcrew displayed an absence of prudence concerning thunderstorms and demonstrated a lack of knowledge of basic airborne radar operating techniques and limitations by relying on the radar as the primary navigation tool. In most cases, there was ample information available from visual observations and other resources. The collective use and conservative interpretation of this information would have provided evidence to the flightcrews of the maturation of a hazardous weather situation and the need for avoidance.

Concerted efforts by government and industry have produced comprehensive windshear training programs that are now commonplace in the airline industry. The Safety Board is concerned that, while these programs have produced improvements, the training may not place sufficient emphasis on the purpose of the training: severe weather recognition and avoidance, not mastery of piloting skills to "handle" the weather. The facts of this accident indicate that training, albeit improved, needs to be refocused on recognition and avoidance.

Pilots must exercise conservative judgment when they are confronted with hazardous weather conditions, especially in the terminal environment. They must be able to recognize and accurately interpret the conditions within, under, or near rapidly developing and maturing thunderstorms. In addition, they must understand that the life cycle of a thunderstorm is extremely dynamic and can change significantly within a short distance or within a short time, or both. In particular, they must recognize low-altitude hazards associated with thunderstorms along or near the approach path and avoid them. More emphasis is needed in training to stress that the characteristics and dynamics of thunderstorms require deliberate avoidance techniques rather than the skills to fly through these thunderstorms.

The Safety Board believes that the FAA should continue to emphasize to POIs the importance of requiring pilots to demonstrate their knowledge of the conditions associated with mature thunderstorms and the potential effects mature thunderstorms might have on an aircraft, during initial and recurrent pilot training and testing programs. Such pilot training concerning thunderstorms could be based

upon the windshear training aid developed by the FAA for CFR Part 121 operators and the windshear training aid currently being written for CFR Part 135 operators.

The Safety Board believes that the FAA should take the lead in a joint government/industry effort to develop and institute criteria for use by flightcrews to evaluate or index the extent of thunderstorm hazards present to assist them in the go/no go decision-making process.

2.6 Cockpit Resource Management on LEX508

Comments from representatives of the airline, as well as literature contained in the training program, indicate that the airline supported and attempted to integrate the principles of CRM into its line flying. The Safety Board notes that the captain did ask the first officer whether he felt comfortable with the approach. It is possible that the captain was seeking input from the first officer to reinforce the decision he had made to continue the approach. In a review of the CVR and the ATC tapes, the comment by the first officer “okay so far it’s all right” suggests that he was not totally comfortable with the captain’s decision to continue the approach. The Safety Board was unable to ascertain the extent of the first officer’s comfort with the captains approach decision or, perhaps, if their roles in the cockpit had been reversed, how the decision to continue the approach would have been different.

The Safety Board recognizes the importance of timely and constructive discussion in the cockpit, and of the need for assertiveness and receptivity training for subordinate crewmembers. Since 1979, the Safety Board has made numerous recommendations to the FAA and the airline industry addressing the importance of crew coordination, or cockpit resource management, defined as “effective utilization of flight crewmembers and other resources to enhance crew interaction, communication and decision making in multicrew aircraft operations.”

L'Express Airlines stated that several hours of CRM training were provided to its pilots during initial training. However, this short introduction to the concept of CRM was not sufficient to reap the benefits of this valuable training technique. While it is impossible to know what the crew would have decided if they had engaged in an active discussion about their landing, it is not unreasonable to assume that some discussion might have prompted suggestions of alternatives to the captain. The absence of such a discussion is one of the striking features of the accident. On November 21, 1990, the Safety Board issued a recommendation that the FAA require 14 CFR Part 135 operators to develop and use CRM programs in

their training methodology. In a February 8, 1991, response to this recommendation, the FAA stated that it "is considering amending the training requirements of 14 CFR 121 and 135. This amendment, if adopted, would require all certificate holders operating under Part 135 who elect or who will be required to follow 14 CFR Part 121 training and qualification requirements to include cockpit resource management in their flight crewmembers training programs."

The principal author of the proposed regulations said that the regulations as written in the completed Notice of Proposed Rulemaking (NPRM) would allow any Part 135 operator to adopt any or all of the 121 regulations for training and qualifications, including CRM, Line Oriented Flight Training (LOFT), and the Advanced Qualification Program (AQP). The proposed regulation does include provisions that will require all scheduled commuter operators to include CRM in their training programs. As of March 6, 1992, the NPRM is in the regulatory moratorium for review, with a deadline for review of April 15, 1992.

2.7 The Actions of the South Radar Controller

Prior to assuming the duties at the south radar position, the controller stated that he was aware of a report of level 3 thunderstorm activity in the area, and that weather was northwest of the airport, moving southeasterly. He learned this information after another controller received a telephone call from the Center Weather Unit Specialist at the Atlanta ARTCC. This controller made a general statement, heard by all controllers in the radar room, that there was level 3 thunderstorm activity in the area. The south radar controller did not provide specific information to the flightcrew of LEX508 concerning level 3 activity, but the Safety Board believes that he did provide other information concerning hazardous weather that was timely and essential.

Although the south radar controller did not indicate, in precise ATC terminology, the position of the weather prior to the commencement of the approach of LEX508, he did provide the flightcrew with additional information, such as the pilot reports provided by N45ZP, the Learjet, and CONAERO 209, the Aerostar, regarding flight conditions. The Safety Board believes that these reports provided enough information to meet the criteria and intent of the ATC Handbook that requires controllers to report observed weather. The guiding premise here is that the primary responsibility of the air traffic controller is to: (1) separate airplanes and, (2) to issue safety alerts. During daytime flight, through visual observation and onboard weather radar, pilots are in a better position than air traffic radar controllers to determine whether an instrument approach can be safely

accomplished. The ultimate responsibility for determining the safety of the flight is delegated to the pilots, and more specifically, to the captain.

The Safety Board believes that it would not have been reasonable to expect the south radar controller to observe the thunderstorms on his radarscope and then to report his observations to aircrews using this information alone. Although the BHM ATC radar would display precipitation intensities above certain levels as a milky luminescent area on the radarscope, because of its circular polarization (CP) weather suppression capability, the intensity of the precipitation return on the radarscope would be lessened. Therefore, because CP was selected, the precipitation shown on the display was not indicative of the actual thunderstorm conditions around the airfield. Because the radar room had no windows, the only reliable sources of weather information available to the controller would have been messages from the NWS via the central weather unit specialist in Atlanta, the airport's surface weather observations, PIREPs, and the visual observations of the tower cab controllers.

The south arrival radar controller did properly broadcast to all aircraft that a new ATIS was in effect at 1755:14; however, he failed to determine upon initial contact with the flightcrew of LEX508, at 1800:23, that they had received the current ATIS information. However, at 1804:24, when the south radar controller informed all aircraft that the new information X-ray was in effect, LEX508 was on the frequency. The flightcrew should have obtained the new ATIS information independently or should have asked the controller to provide them with the content of the ATIS broadcast.

Earlier, at 1756, the pilots listened to the entire information Whiskey transmission. Information Whiskey contained the phrase, "thunderstorm northwest of the airport moving southeast, east moving southeast, thunderstorm began at four zero past the hour." The pilots of LEX508 also listened to a portion of information X-ray around 1806. The portion they monitored contained the phrases "visibility two and a half miles with thunderstorm and rain shower," and "thunderstorm overhead moving southeast."

Therefore, the Safety Board concludes that although the performance of the south radar controller was not in total accordance with the Air Traffic Controller's Handbook, his actions did not cause or contribute to the accident. The pilots of LEX508 had been adequately advised of the thunderstorm activity around BHM through two ATIS receptions.

3. CONCLUSIONS

3.1 Findings

1. The flightcrew was properly certificated and qualified for the flight.

2. The airplane was properly certificated and maintained in accordance with existing regulations.

3. There were no airplane system or powerplant anomalies that contributed to the cause of the accident.

4. The weather briefing data that the captain received in MOB was accurate, advising him to expect thunderstorms in the Birmingham area.

5. BHM ATIS information Whiskey and X-ray, mentioning thunderstorms, was accurate, and the LEX508 flightcrew heard them, as well as information from the BHM approach controller that the airport was experiencing thunderstorm activity.

6. The captain had information before he initiated the approach that should have alerted him of the likelihood of penetrating thunderstorms prior to touchdown.

7. The L'Express pilot training program and Operations Manual provided the flightcrew with information about the characteristics, dynamics, and volatile nature of thunderstorms. L'Express flightcrews were advised not to take off or land in the face of an approaching thunderstorm. The captains decision to continue the approach did not fully consider this guidance.

8. Current Federal regulations do not require instrument-rated pilots to maintain proficiency in the ability to recognize and recover from unusual attitudes.

9. The difficulty that the L'Express flightcrew experienced in controlling the airplane may have been exacerbated because they had not received unusual attitude recognition and recovery training from L'Express.

10. The meteorological event that led to the accident was contained within a small geographical area and lasted only minutes.

11. The south radar controller did not determine if the flightcrew of LEX508 had received the ATIS information on initial contact; however, he later advised all aircraft that a new ATIS was in effect. The flightcrew should have heard his broadcast.

12. The south radar controller did not issue weather information in accordance with specific phraseology outlined in the ATC Handbook; however, he did provide PIREPs that provided the most complete and comprehensive information available.

13. LEX508 encountered a thunderstorm cell of at least a VIP 3 level along the final approach course for runway 5, containing very strong vertical air shafts and associated turbulence, as the airplane approached the airport about 1,600 feet above the ground.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the decision of the captain to initiate and continue an instrument approach into clearly identified thunderstorm activity, resulting in a loss of control of the airplane from which the flightcrew was unable to recover and subsequent collision with obstacles and the terrain.

4. RECOMMENDATIONS

As a result of this investigation, the National Transportation Safety Board makes the following recommendations:

--to the Federal Aviation Administration:

Develop and institute criteria through a joint government/industry effort that can be used by flightcrews to evaluate or index the extent of thunderstorm hazards present to assist them in the go/no go decision-making process. (Class II, Priority Action) (A-92-l 8)

Require that airline airborne weather radar training programs include information on the specific types of radar that the flightcrew will be using and require that information on the limitations and recommended operating procedures for the radar be referenced during the training from information provided by the manufacturer of the radar. (Class **II,** Priority Action) (A-92-19)

Require that recurrent training and proficiency programs for instrument-rated pilots include techniques for recognizing and recovering from unusual attitudes. (Class II, Priority Action) (A-92-20)

In addition, the National Transportation Safety Board reiterates the following recommendation to the FAA:

A-91-93

Disseminate more aggressively available information and materials pertaining to Aeronautical Decision Making training and actively promote its implementation among all categories of pilots in the civil aviation community. (Class II, Priority Action)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

Susan Coughlin
Acting Chairman

John K. Lauber
Member

Christopher A. Hart
Member

John Hammerschmidt
Member

James L. Kolstad
Member

March 3, 1992

APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident around 2000 on July 10, 1991. An investigation team from Washington, D.C., was dispatched the next morning and arrived in BHM around 1100. Investigative groups were formed on the scene for operations/human performance, air traffic control, meteorology, structures/maintenance records, systems/powerplants, and survival factors. A team to create the CVR transcript was formed later in Washington, and a radar study was also accomplished. Safety Board Vice Chairman Susan Coughlin accompanied the investigative team. The on-scene portion of this investigation was completed between July 10 and July 15, 1991. The engines and propellers were subsequently disassembled and examined under Safety Board supervision.

Parties to this investigation included L'Express Airlines, Inc., Beech Aircraft Corporation, United Technologies/Pratt & Whitney, Allied Signal Aerospace Company/Bendix King, the National Air Traffic Controllers Association, the National Weather Service, and the Federal Aviation Administration.

2. Public Hearing

No public hearing or depositions were held.

APPENDIX B

PERSONNEL INFORMATION

The Captain

The captain, born on October 4, 1936, was hired by L'Express Airlines on August 23, 1989. He possesses Airline Transport Pilot Certificate No. 86286368, issued on June 18, 1990, with the ratings and limitations of airplane multiengine land, BE-300, BE-1900, private privileges airplane single-engine land, BE-300, BE-1900, second-in-command required. His first class medical certificate, issued May 14, 1991, contains the limitation, "must wear glasses." There are no waivers associated with his medical certification.

As of July 7, 199 1, he had accrued a total flight time of 4,141 hours, of which 553 were as pilot-in-command of a C99. During July, he flew 30.8 hours, of which 1.3 were recorded as having been flown under actual instrument conditions.

The First Officer

The first officer of flight 508, born on March 1, 1961, was hired by L'Express Airlines on December 4, 1990. He possessed Commercial Pilot Certificate No. 530428782, issued on June 3, 1989, with the ratings and limitations of airplane-single and multiengine land instrument airplane. He also possessed a flight instructor certificate dated March 17, 1990, for airplane single-engine land instrument. His most recent first class medical certificate, issued on August 21, 1990, contained no restrictions or waivers.

The personal resume provided to the airline by the first officer and pilot monthly reports completed by him indicated that his total flight time was 1,545.8 hours. His total multiengine time was 650.7 hours, of which 170.8 hours were accrued in the C99. His total flight time accrued thus far in calendar year 1991 was 170.8 hours. His actual instrument time logged during June 1991 was 7.6 hours. The flight hours accrued by him during July 1991 had, as of July 10, 1991, not been recorded by him on a pilot monthly report form. July flight times were tabulated from the records of the captains he flew with which reflected 27.5 hours.

The South Radar Controller

The south radar controller was born on September 27, 1964. He has attended the FAA Academy in Oklahoma City, Oklahoma. He has prior military air traffic control experience gained while serving with the U.S. Navy for 5 1/2 years. His last military duty station was Norfolk, Virginia. The south controller is not a pilot. He was medically certified as a controller without waivers or limitations, and his last physical examination was during September 1990. At the time of the accident, he was a developmental controller and was certified on the south radar position on March 30, 1991.

APPENDIX C

AIRPLANE INFORMATION

N7217L held manufacturer's serial number U226, and was issued a standard (normal category) airworthiness certificate on December 11, 1984. It had recently been at the Beech Aircraft Corporation for a detailed inspection, refurbishment, overhaul of its structure and interior, and was maintained under an FAA-approved Continuous Airworthiness Inspection Program.

According to the logs maintained by Beech, the 100-hour inspection of the aircraft was completed on March 24, 1991, with total airframe time of 9,127.8 hours and Hobbs reading as 73.4 hours. N7217L was bought by L'Express Airlines on July 1, 1991. L'Express maintenance logs revealed that the glideslope receiver was replaced on July 2, 1991; and the gyro attitude indicator was replaced on July 10, 1991. The airplane is equipped with two Pratt & Whitney of Canada PT6A-36 engines.

APPENDIX D

COCKPIT VOICE RECORDER TRANSCRIPT

The surviving captain was invited to review the CVR audio recording and transcript. His suggested corrections and/or additions are as follows:

1. At time 1744:43 during the ATIS reception add note that there was an unintelligible weather advisory broadcast by Atlanta Center to all aircraft on center frequency.

2. At time 1748:17 replace * with "I'm tellin' you."

3. At time 1750:18 add the word "up" between head and to.

4. At time 1752:18 replace word "yeah" with "here."

5. At time 1752:42 replace * with "Tampa."

6. At time 1811:05 delete entire comment.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1738:16 Start of recording			
1738:18 INT-2	what else have you gotten to fly Frank?		
1739:23 INT-1	ah seven twos C-5s, a whole bunch of recips.		
1739:32 INT-1	a couple of other turbo props in that commuter business we're in.		
1739:36 INT-2	right.		
1739:42 INT-1	remember the Nomads we had?		
1739:45 INT-1	you know I had a double flame out right around here.		
1739:47 INT-2	no. is that right?		
1739:48 INT-1	yeah, I was at twelve thousand feet and they both flamed out. I was a glider down to four thousand feet.		
1739:53 INT-2	gee, that's somethin'.		

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1739:54 INT-1	we had a little airport around here someplace picked out and they had a two thousand foot overcast ceiling. I was gunna dead stick the sucker.		
1740:ooo INT-2	wow huh. what you got them lit again?		
1740:03 HOT-l	yeah.		
1740:04 INT-2	what happened?		
1740:07 INT-1	* the outside air temperature gauge was reading six degrees hot - and that engine only had one igniter and one fuel nozzle - and it was susceptible to icing. we were you know we were it was like this - but it it was cold out. but I I'm lookin' up and I said # we're past twelve - I said that's awful hot must ta got a temperature inversion. - we're actually six and they froze up. - we got compressor blade icing and it blew the flame out. no auto ignition. the only way you can catch it if you know it's gunna happen.		
1740:45 INT-1	they had everything up here. you can hit the starter cause that would put the ignition on but. I mean you gotta be good.		
1740:51 HOT-2	yeah.		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1740:52 INT-1	yeah, we lost 'em both.		
1740:56 INT-1	like just like that wah wah.		
1740:58 INT-2	that's amazing.		
1741:oo INT-1	made it back to Birmingham.		
1741:03 INT-2	you were on your way, comin' this way?		
1741:05 HOT-2	uh huh.		
1741:07 INT-1	we had twelve people on the airplane. it was like seven o'clock in the morning and only one guy back there, I looked back there, only one had his head like this going. everybody else was reading. it was quiet.		
1741:21 INT-2	(sound of laugh)		
1741:29 INT-1	and the airplane flew beautifully. I mean it it was so stable. I had a hundred a hundred and eight knots going downhill.		
1741:32 INT-2	that's incredible.		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1741:33 INT-1	the only thing I was glad of was that I had somebody with me. he was our check airman. had a lot of experience. didn't get excited. I didn't get excited, I just said I'll fly the airplane you work the checklist you know notify you know notify them Atlanta we got an emergency and so on. we had to tell Atlanta three times they didn't believe us.		
1741:56 INT-2	(sound of laugh) that's that's funny.		
1741:59 INT-1	so we got, seeing that we shut down so fast we got an N-l rub. in other words the the ah turbine from from rapid cooling rubbed up against the side you know so we had to wait for that to cool down and the book says four minutes and we got one goin' then we got the other one goin'.		
1742:08 INT-2	I see wow.		
1742:21 INT-2	you were down to four thousand feet?		
1742:25 INT-2	boy that's thrilling.		
1742:28 INT-1	we had an airport ah eight miles twelve o'clock. ah I didn't give a # and that thing there use to have STOL which - so ah you could put it on the ground at fifty miles an hour.		

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1742:34 INT-2	okay.		
		1742:53 RDO-1	hay Tom, five oh eight can you hear us?
1743: 29 INT-1	you know it really didn't affect me until I was on the ground about three or four hours then I started thinkin' about the ah whole scenario. I said holy #.		
1743:40 INT-2	(sound of laugh)		
1743: 43 INT-2	you were nervous after that?		
1743:45 INT-1	not during it, cause I was in deep concentration you know -.		
1743:48 INT-2	right.		
1743:49 INT-1	but after it, I said my God you know that is kind of risky.		
1743:52 INT-2	yeah.		
1743:53 INT-1	that's when I started gettin' a little leery about that airplane.		

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1743:56 INT-2	yeah.		
1743:58 INT-1	I wouldn't fly it over ten thousand any more.		
1744:oo INT-2	uh huh.		
1744:02 INT-1	we were in training one night up there, you know Birmingham you know. you pick up ice up here. we picked up ice. I put the prop heat on, it threw the ice off and it the ice came right in the airplane. it broke a window-.		
1744:15 INT-2	no kiddin', wow. again on the Nomad? wow, dangerous airplane isn't it?		
1744:22 INT-1	it was. it really shouldn't have been ah certified for one thirty five pax operation.		
1744:29 INT-2	that's why they grounded them huh?		
1744:30 INT-1	well there was a lotta reasons.		
1744:33 INT-2	a lot of past paperwork problems and everything.		

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1744:43	((start of ATIS reception))		
ATIS	Birmingham information victor, two one five zero zulu, five thousand scattered visibility ten. temperature niner two, dew point seven two. wind two eight zero at eight. altimeter two niner niner six. simultaneous approaches in use localizer runway two three, visual runway three six. advisory all Atlanta high altitude IFR traffic has been ground stopped due to an equipment outage in Atlanta center. departing aircraft contact clearance delivery one two zero point niner or three niner zero point eight prior to taxi. advise you have victor.		
1745:37 INT-2	It'll probably change before we get there so I just I just wanted to get a heads up.		
1745:48	((stop of ATIS victor transmission))		
1746:01 INT-2	wonder if it's, ah the temperature is okay for 'em back here.		
1746:04 HOT-l	what?		
1746:06 INT-1	what's that?		
1746:08 INT-2	I was just wonderin' if the temperature is okay for 'em back there.		

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1746:12 INT-1	after a while we'll call back.		
1746:16 INT-1	there really nothing we can do about it. it's a plus fourteen out there. it's actually ah -.		
1746:24 INT-1	so they wanted to hang my #.		
1746:26 INT-2	oh they did, for the ah two engine out?		
1746:28 INT-1	oh yeah well let me tell ya - ah I was on the ground up there I would say fifteen minutes you know just ah doin' some paper work and gettin' ready for everything in reference to the FO and about how we're we're gunna talk about. this a guy comes out of a ah Delta DC-9 right in front of us comes right to the airplane, NTSB.		
1746:49 INT-2	no kidding, what did he say?		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1746:52 INT-1	well first thing he said was ah you're you're not to talk about this incident you know. you're coming with me, you're goin' with him you know. FAA was there in other words they didn't want us to concoct a story. what was there to concoct. so they sent the gauge out to be tested and it came back readin' six hot at altitude. so that was - but they tried to say that I didn't ah check my weather good enough. I said ah he said to me what's my freezing level? I said well it's ah it's forty seven at Birmingham and I said I got a two degree per thousand lapse rate so I said at ten thousand feet it's you know. I I can I figured it out. I said what's I know what it's freezing at .		
1747:34 INT-1	he says yeah, but then when you called weather did you get the freezing level? I said why should I want to do that there wasn't icing or snow out here. I said I I take the freezing level from that and from a standard lapse rate that's what they were tryin' to say that I should have known that there was somthin' wrong lookin' at that thing you know and at ten thousand feet and I should know better.		
1747:53 HOT-2	oh.		
1747:55 INT-1	but ah then when they got the gauge back they totally - then I got an attaboy.		
1747:59 INT-2	oh okay. (sound of laugh)		

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1748:02 INT-1	in fact I got the article it appeared in Safe - Flight safety magazine or somethin' like that.		
1748:06 INT-2	oh wow.		
1748:07 INT-1	IFR magazine. I don't know but they applauded us for what we did.		
1748:12 INT-2	good deal.		
1748:17 INT-1	I was gunna dead stick that sucker in. * I had it all planned in my head what I was gunna do.		
1748:21 INT-2	uh huh.		
1748:29 INT-1	my biggest concern was runnin' without generators you know I only had a battery. I'm sayin' to myself # man we're gunna run out of instruments we're gunna run out of everything here pretty soon.		
		1748:35 CTR	-one three two point two five.
		1748:43 CTR	Lex five oh eight contact Atlanta center one three two point two five.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1748:48 RDO-2	one three two point two five Lex five oh eight thanks.
		1748:50 CTR	*
		1748:56 RDO-2	Atlanta center Lex five oh eight level nine thousand feet.
		1748:58 CTR	**Lex five oh eight Atlanta center roger, Birmingham altimeter two niner niner four.**
		1749:02 RDO-2	**two niner niner four Lex five oh eight.**
1749:15 INT-2	anything else happen to you while you've been flyin'?		
1749:19 INT-1	well I've had a lot of near misses. I blew an engine on a ninety nine on takeoff out of Eglin one day and ah I'll tell you somethin' we were tree tops comin' in.		
1749:30 INT-2	is that right.		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1749:31 INT-1	this sucker on a hot day ah full load of people I mean you got to be very diligent. you got to be you got to actually say what would I do here what would I do here and that's it. even when I took off out of here, I'm thinkin' we're heavy, its hot ah you know that's why we keep max power on you know. I'm gunna hold it at Vee two before I lift off.		
1749:57 INT-1	and I lost that engine about five hundred feet. sucker did not want to fly.		
1750:07 INT-2	so what did you do circle around?		
1750:18 INT-1	why don't you ask for a deviation. I'd like to ah head to the northeast here a little bit.		
1750:22 INT-2	okay.		
		1750:42 RDO-2	Center, Lex five oh eight request deviation to the north east around ah weather.
		1750:47 CTR	Lex five zero eight ah is that left or right?
		1750:50 RDO-2	that'd be right.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1750:52 CTR	okay deviation right of course approved, when able direct Vulcan.
		1750:56 RDO-2	okay right is approved and then direct, Lex five oh eight.
1751:18 INT-2	I guess if you were ah tree top level it might be *more* important to ah turn in the direction ah ah.		
1751:27 INT-1	more likely to the good engine.		
1751:28 INT-2	good engine yeah otherwise.		
1751:30 INT-1	that's right.		
1751:31 INT-1	you know I hear these briefings. I'm gunna do left traffic back.		
1751:33 INT-2	right.		
1751:34 INT-1	I don't say anything you know because if you're right side you want right traffic.		
1751:40 INT-1	well, I will tell you which way to turn.		

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1751:42 INT-2	right.		
1751:43 INT-1	you know what I'm sayin'.		
1751:45 INT-2	yup.		
1751:48 INT-1	and we didn't put the gear down till ah I would say twenty feet off the ground. - we got three green and we landed.		
1751:52 INT-2	oh.		
1752:07 INT-1	you know I think it looks better over here.		
1752:18 INT-1	let's get on course yeah let me see what we got.		
1752:20 INT-2	okay.		
1752:42 INT-1	I also put one gear up in *.		
1752:46 INT-2	oh.		
1752:48 INT-2	what happened to that one?		

INTRA-COCKE'IT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1752:52 INT-1	couldn't get the mains down. got the nose wheel down and the same week we had one go into Gulf Port with all three up landed on the pods.		
1753:oo INT-2	I remember that one.		
1753:01 INT-1	and a just a little bit to the right.		
1753:03 INT-2	yeah I was there that day watchin' it.		
1753:07 INT-1	yeah well in my plane, we flew it that afternoon with the nose gear and the pods the props didn't touch.		
1753:13 INT-2	oh wow.		
1753:15 INT-1	that's one good thing about this pod.		
1753:17 INT-2	right.		
1753:21 INT-2	that pod doesn't get too damaged?		
1753:23 INT-1	no it's made out of fiberglass but it's strong.		
1753:26 INT-2	huh.		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1753:30 INT-2	how do you wanta' land like that with the gear up?		
1753:35 INT-1	like the way you just landed.		
1753:36 INT-2	okay.		
1753:42 INT-2	do you kill the engines?		
1753:43 INT-1	you're suppose to I guess if you really want ta get technical about it, but if I did it I would be comin' in hot as a you know what.		
		1753:54 CTR	* five oh eight descend and maintain six thousand, pilots discretion,
		1753:58 RDO-2	pilots discretion to six thousand, Lex five oh eight.
1754:02 INT-2	might help us with this weather huh.		
		1754:05 RDO-2	and Lex five oh eight would like to leave nine for six thousand at this time.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1754:07 CTR	five oh eight roger that's approved.
		1754:10 RDO-2	five oh eight.
1754:13 INT-1	let's just do a descent check that's all.		
1754:15 INT-2	okay landing lights are on. altimeters ah two nine nine six.		
1754:23 INT-1	set.		
1754:25 INT-2	set on the right also, ah company let's see I'll call in just a minute.		
1754:30 INT	(sound of trim-in-motion beep))		
1755:55	((start of ATIS reception))		
ATIS	This is Birmingham airport information whiskey. Birmingham two two five zero weather, measured ceiling four thousand two hundred broken, visibility seven miles, thunderstorms. temperature eighty four, dew point six eight, wind three five zero at eight. altimeter two nine nine seven. large thunderstorm northwest of airport moving southeast, east moving southeast. thunderstorm began at four zero past the hour. low level windshear advisory's in effect. ILS runway five approach is in use landing and departing runway five, runway three six. all departing aircraft contact clearance delivery on one two zero point niner or three hundred zero point eight prior to taxi. advise approach or ground on initial contact you have whiskey.		

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1757:00	((end of ATIS reception))		
1757:06 INT-1	what's the localizer up here?		
1757:10 INT-2	that's it.		
1757:15 INT-2	seven for six.		
1757:54 INT-2	localizer runway two three is ah.		
1757:58 INT-1	it might be the same but we're usin' five now.		
1757:59 INT-2	okay we are.		
1758:07 INT-2	one ten point three.		
1758:29 INT-2	I'll be on two real quick.		
1758:40 INT-2	pretty big guy.		
1758:41 HOT-1	yeah.		
1758:48 INT-2	that's the one that's northwest of the field there.		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1758:51 HOT-l	well- .		
1758:52 INT-1	- we're forty six from Vulcan yeah.		
1758:58 INT-1	should be able to get under that I mean go around that.		
		1759:04 RDO-2	Birmingham operations Lex five oh eight.
1759:16 INT-2	(hundred to go).		
		1759:22 CTR	Lex five oh eight contact Birmingham approach one three two point two.
		1759:25 RDO-2	one thirty two point two Lex five oh eight thank you.
		1759:33 APP	zero two zero your five miles from McDen maintain two thousand six hundred until established on the localizer, cleared ILS five approach.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME 6 SOURCE	CONTENT
		1759:39 5ZP	and zulu pop I think we better make a left turn here and go out and hold for a while it looks pretty bad on the radar.
		1759:44 APP	lear five zulu pop I need you to maintain three thousand five hundred before you turn left.
		1759:48 5ZP	okay we're at three thousand and holding zulu pop.
		1759:51 APP	that's three thousand five hundred. there's traffic ah four miles southwest of you an aerostar at twenty five hundred. I need you-at thirty five.
		1759:56 5ZP	okay we're at three thousand five hundred zulu pop.
		1759:59 APP	okay and five zulu pop when you ah get to thirty five hundred you can go ahead and turn left out and ah what are your intentions?

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1800:06 5ZP	ah let's go out here to about a ah two six zero heading for about ah ten miles and we'll give you a call.
		1800:14 APP	okay lear four zulu correction five zulu pop go ahead and climb back up to four thousand for that please.
		1800:20 5ZP	okay zulu pop is out of thirty five for four thousand.
		1800:23 RDO-2	Birmingham Lex five oh eight level six thousand requesting lower.
		1800:28 APP	Lex five zero eight Birmingham approach roger descend and maintain four thousand.
		1800:33 RDO-2	leavin' six for four thousand Lex five oh eight.
		1800:36 APP	Navaho nine sugar papa say that again please.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1800:38 9SP	ah niner sugar papa we're gunna need to deviate away from this cell now. but are we in the vicinity of the race track cause I don't think I can penetrate any closer.
		1800:45 APP	the ah race track is about five miles north of your position. ah you were headin' pretty close towards it and if you can't get any closer than that ah it's probably gunna be a while to you get it cause that field is right over the airport movin' southeast bound. looks like it's probably gunna take at least a half hour forty five minutes before it ah gets out of your way.
		1801:05 9SP	ah niner sugar pop ah let you know in about a minute.
		1801:07 29M	Birmingham approach Warrior two niner zero five mike we like just to proceed to Shelby county.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1801:11 APP	Warrior zero five mike ah go ahead. Shelby county is that's fine sir ah just heading two zero zero eight miles.
		1801:20 29M	five mike roger.
		1801:23 RDO-2	Birmingham operations Lex five oh eight.
1801:29 HOT-l	well?		
1801:30 INT-1	well now what about this?		
		1801:41 5ZP	Birmingham five zulu pop, do you have anybody on the ah ILS there last few minutes?
		1801:45 APP	I've got one on there right now well I don't have it ah the other controller has one on the approach right now. he's ah just about where where you turned out on the approach.

TIME & SOURCE	INTRA-COCKPIT COMMTJNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
		1801:53 5ZP	all right if we could we'd like to get a ride report from him and ah and then turn back and take a better look at it on the radar here in just a few minutes.
		1802:03 APP	**and lear five zulu pop ah roger turn left heading one four zero.**
		1802:06 5ZP	**left to one four zero zulu pop.**
		1802:08 APP	**ah Navaho nine sugar papa** ah what do you want to ah do, due to this weather what are your intentions?
		1802:13 9SP	ah niner sugar papa I think what I'd like to do if it's only gunna be about **say** twenty minutes or a half hour maybe orbit around the Galleria at about four thousand feet and ah just observe the storm.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1802:23 APP	navaho nine zero papa climb and maintain five thousand. you can just go ahead and orbit the Galleria area but I need you at five.
		1802:28 9SP	niner sugar papa leaving four for five.
1802:51 INT-2	one to go.		
		1803:01 APP	and Lear five zulu papa turn left heading zero six zero.
		1803:04 5ZP	okay zero six zero zulu pop had a ride report on that airplane?
		1803:07 APP	I'm workin' on that right' now.
		1803:09 5ZP	zulu papa.
1803:10 INT-1	in-range when you get a chance.		
1803:11 INT-2	okay.		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1803:14 INT-1	tell them we may be delayed.		
1803:15 INT-2	okay.		
1803:18 INT-2	Passenger briefing I'll get just a minute, cabin sign is on altimeters two nine nine seven.		
		1803:22 APP	* zero five mike ah Shelby county airport * five miles.
		1803:29 05M	ah zero five mike we have Shelby county in sight.
1803:25 HOT-l	set left.		
1803:30 INT-2	set right here also. auto-feather is armed. what was ref ah weight?		
		1803:31 APP	zero five mike radar service isterminated at * zero zero. frequency change is approved. good day.
		1803:35 05M	ah we'll see you later zero five mike.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1803:42 INT-1	eleven thousand.		
1803:43 INT-2	eleven thousand.		
and			
		1803:45 APP	Lex five zero eight descend maintain three thousand.
		1803:47 RDO-2	and ah five oh eight down to three thousand.
		1803:51 APP	Lex five zero eight just to let you know what's goin' on. I had a Lear ah set up on the base ah from the south east for the ILS to five and he got in a little close and saw somethin' on the radar he didn't like so he turned out off the approach and he's holding right now. I do have an Aerostar on the approach and he's on about a two mile final right now we're tryin' to get a ride report out of him.
		1804:11 RDO-2	okay it sounds good Lex five oh eight.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1804:24 APP	attention all aircraft information x-ray is current at Birmingham. the field is IFR the altimeter is two triple niner.
1804:30 INT-2	okay ref speed is going to be one oh eight. approach brief?		
		1804:32 APP	lear five zulu papa turn
right			heading two three zero.
1804:35 INT-1	well if we get it ah ILS to five		
		1804:40 APP	* one five romeo say your intentions sir.
1804:41 INT-2	I'm be off ah one for a second.		
		1804:44 15R	ah I'm * north VFR * until you tell me that I can come in.
		1804:46 RDO-2	Birmingham operations Lex five oh eight.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1804:51 APP	okay skylane one five romeo you're under an IFR clearance ah you are in under an IFR flightplan. turn left heading two seven zero. I'll just go ahead and put you in a little holding pattern out there.
		1805:05 15R	* stay where I am until the weather gets good enough for me to come in.
1805:10 PA-2	and ah ladies and gentleman we're starting our descent into the Birmingham area at this time. if you would please recheck your seat belts make sure they're still securely fastened and that your carry-on items are stowed underneath the seat in front of you. we'll be landing in Birmingham in approximately twelve minutes. a little bit of weather in the area so ah if you would please make sure your seat belts are fastened an ah we'll try we'll try to make this as smooth as possible. thank you.		
		1805:12 APP	okay Skylane one five romeo go ahead and establish your own holding pattern out there and ah maneuver as necessary. if I have anything to avoid traffic or vectors for anything I'll let you know.
		1805:21 15R	ah that's affirmative one five romeo.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME! & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1805:26 RDO-1	ah five oh eight any update on that ride.
		1805:28 APP	I'm waitin' for that right now and ah Lex five zero eight fly heading zero two zero and intercept the localizer track it inbound. I should have a report here before you get ah to about twelve fifteen mile final.
		1805:39 RDO-1	understand zero two zero and track the localizer.
1805:42 INT-2	in-range complete except for the company.		
1805:44 HOT-l	okay.		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME 6 SOURCE	CONTENT
		1805:46 C8536	Birmingham approach Commander eight five three six at five thousand.
		1805:48 APP	Commander eight five three six Birmingham at five thousand the altimeter is two triple niner.
1805:57	((start of ATIS reception))		
ATIS	- thousand one hundred overcast, visibility two and one half miles with thunderstorm and rain shower. wind three four zero at one two. altimeter two niner niner eight. thunderstorm overhead moving southeast -		
		1806:07 APP	and Lex five zero eight the Aerostar ah the Aerostar said that the ride wasn't all that bad but the ah rain had the visibility down to just aboutzero till they got to ah three quarter mile final and then he he did pick up the airport but ah he did say the ride wasn't that bad if you want to try it.
1806:11	((end of ATIS reception))		

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
		1806:22 RDO-2	understand five oh eight we'll try it.
1806:25 INT	((sound of trim-in-motion beep))		
		1806:27 UNK	* zero *
1806:28 INT-1	make sure you brief the people in the back.		
1806:31 INT-2	okay I already have.		
1806:32 HOT-l	okay.		
		1806:34 APP	and lear five zulu pop did you copy that sir?
		1806:35 5ZP	yeah we copied that and ah we'll give it a try here *.
1806:38 HOT-l	okay.		
1806:40 INT-1	you got the approach out everything is all up and cookin'.		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1806:42 APP	* proceed to * reduce reduce your speed twenty knots and ah when you get slowed twenty * three thousand.
1806:44 INT-2	yeah let me brief you real quick on it.		
1806:47 INT-1	*.		
		1806:49 5ZP	okay slowin' up. goin' down to three thousand zulu pop.
1806:51 INT-2	zero five six.		
1806:52 INT-1	set left.		
1806:55 INT-2	set on the right. we got the localizer set i◦ ah one ten three -.		
		1806:59 APP	Lex five zero eight is ah one one miles from McDen. maintain two thousand six hundred 'til established on the localizer. cleared ILS five approach.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1807:08 RDO-2	two thousand six hundred 'til established ah cleared for the ILS five approach, Lex five oh eight.
1807:15 INT-1	okay I'm established. what can I go down to?		
1807:17 INT-2	okay two thousand six hundred until established then we can go down to ah twenty two hundred.		
1807:25 INT-1	approach flaps.		
1807:28 INT-2	flaps approach. now.		
1807:33 INT	((sound of three trim-in-motion beeps))		
1807:41 INT-2	decision height is ah decision altitude is eight oh six.		
1807:46 INT	((sound of trim-in-motion beep))		
		1807:50 APP	lear five zulu pop turn right heading three two zero.
		1807:52 5ZP	three two zero zulu pop.

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT	TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1808:02 INT-1	got the time in there and everything.		
1808:05 INT-2	do that right now.		
		1808:18 APP	Lex five oh eight I'm just going to hold on to you until you get to the marker and that way if you ah have to break out for something you see somethin' you don't like that way you'll be ready to ah-.
1808:23 INT-1	okay watch out for windshear okay.		
		1808:27 RDO-2	okay sounds good five oh eight.
1808:25 INT-2	right.		
		1808:37 RDO-1	what's your visibility now five oh eight?
		1808:40 APP	ah visibility is two and one half thunderstorm and rain showers.

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT
1808:58 INT-2	there's twenty two.
1809:12 INT-1	if you don't feel comfortable about this let me know.
1809:15 INT-2	okay so far it's all right.
1809:37 INT	((sound of trim-in-motion beep)
1809:40 HOT	((sound of rain starts))
1809:58 HOT	((sound of rain stops))

T I M E & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1808:42 RDO-?	((sound of two mike clicks))
1809:03 APP	lear four five zulu pop turn right heading zero two zero.
1809:07 5ZP	zero two zero zulu pop.
1810:00 APP	Lex five zero eight how's the ride so far?

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1810:02 RDO-2	so far it's good ah little bit of rain and ah pretty light.
		1810:07 APP	okay.
		1810:13 APP	lear five zulu pop descend and maintain two thousand six hundred.
		1810:16 5ZP	okay down to two point six,' for four five zulu papa. ∞
		1810:28 4297N	Birmingham approach Cherokee four two niner seven november's with you.
		1810:32 APP	four two niner seven november Bi'rmingham approach.
		1810:35 4297N	ah Cherokee niner seven november is thirty eight miles due south just crossed ah Clanton ah be landing at Birmingham or do you think we should ah set down at ah ah Shelby County first.

TIME & SOURCE	INTRA-COCKPIT COMMUNICATIONS CONTENT
1811:05 INT-2	(one to go.)
1811:06 INT-1	climb power.

TIME & SOURCE	AIR-GROUND COMMUNICATIONS CONTENT
1810:47 APP	okay ah Warrior seven November how far south did you say you were?
1810:49 4297N	thirty eight miles south.
1810:52 APP	okay Lex five zero eight contact the tower one one niner point niner. we'll see ya.
1810:56 RDO-2	one one niner point niner Lex five oh eight.
1810:59 APP	lear four five zulu pop is one zero miles from McDen maintain two thousand six hundred until established on the localizer present heading to join. Cleared for the ILS five approach.
1811:07 5ZP	* papa.

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1811:08 APP	Warrior five seven November how far south did you say you were?
1811:10 HOT	((sound of increasing engine speed))		
		1811:11 4297N	thirty seven thirty eight miles.
		1811:13 APP	eight?
1811:14 HOT-l	what are you doin'?		
		1811:15 4297N	three eight.
1811:16 INT	(sound of trim-in-motion beep))		
		1811:17 APP	ah Warrior nine seven november that ah you're breaking up extremely bad ah understand you are goin' to Shelby county first is that correct.
1811:18 HOT-l	full power.		
1811:19 INT	((sound of landing gear warning horn starts))		

INTRA-COCKPIT COMMUNICATIONS		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1811:23 INT	((sound of landing gear warning horn stops))		
		1811:23 4297N	what I'd like to do is * find out how the weather was in Birmingham.
1811:24 INT	((one beep of the landing gear warning horn))		
1811:25 INT	((sound similar to engine(s) igniter sound))		
1811:27.4	End of recording		

APPENDIX E

L'EXPRESS OPERATIONS MANUAL EXCERPTS

General

The L'Express Operations Manual has been accepted by the Federal Aviation Administration. L'Express flightcrew personnel are required to be familiar with the information contained in the manual and to adhere to the policies and procedures described therein. Information contained in the Operations Manual includes a list of the key management personnel, along with their duties and responsibilities, flightcrew qualifications and requirements for employment and upgrade, flight and duty time limitations and rest requirements, and general operating policies. The General Operating Policy section contains a discussion on refusal to fly with and without cause. The Operations Manual also contains discussions on the captain's responsibilities, takeoff and landing policy, and en route weather. En route Weather, Section 3, discusses the necessity and requirement for the captain to keep current on all weather conditions that will affect his route of flight. Specific topics addressed in Section 3 include a description of thunderstorms, flight in turbulence and thunderstorms in general, preparation for turbulence, flying in turbulence, use of weather radar, and low level windshear. The following information contains paraphrased segments of the Operations Manual.

Key Management Personnel

The management structure of the airline is comprised of the positions of president, vice-president/director of operations, operations manager, crew scheduler, chief pilot and chief instructor. The line pilots report directly to the chief pilot. The chief pilot reports directly to the vice-president/director of operations. Quality assurance of company policies and procedures is the primary responsibility of the airline's four flight instructors.

Flightcrew Qualifications

Captains must meet the requirements of FAR 135.243 (Pilot-in-Command Qualifications). The aeronautical experience required by L'Express includes 6 months experience as a first officer with L'Express and sufficient pilot seniority to bid a captains position through the normal bid process as determined by the chief pilot, or at least 500 flight hours on the same or similar make/model

equipment as being upgraded into and at least 2,000 hours total time including at least 1,000 hours airplane multiengine land or approval due to special considerations and requirements as determined by the director of operations.

First officers must meet the requirements of FAR 135.245 (Second-in-Command Qualifications). The aeronautical experience required by L'Express consist of 1,000 hours total time fixed wing, with 250 hours multiengine land flying time. Flight and Duty Time Limitations

L'Express must operate within the requirements of FAR 135.265, "Flight time limitations and rest requirements: Scheduled operations." Flightcrews are normally scheduled to fly between 80 and 90 hours per month. They are paid an hourly salary which is based upon a guaranteed minimum of 85 hours per month. Flight time in excess of 85 hours is paid the straight hourly rate. The tracking and logging of flight time is a dual responsibility of the airline and individual pilot.

Refusal to fly as a crewmember on an assigned schedule as published by the chief pilot or assigned scheduling office is broken down into two categories: with cause and without cause. With cause includes such factors as unsatisfactory equipment, unsatisfactory crewmember, inclement weather considered beyond the limits of a safe flight. Section 3, Item D of the Operations Manual states that "no crewmember will be punished or reprimanded for refusal to fly with cause providing such incident is reported immediately to the Chief Pilot and followed up with a written report. All incidents will be thoroughly and confidentially investigated."

The Captain's Responsibilities

The captain's responsibilities include a review of en route, destination and alternate weather.

Takeoff and Landing Policy

When the first officer is flying the aircraft, the captain is required to keep his feet in a normal position on the rudder pedals and closely monitor all controls during the critical stages of takeoff, climb, approach and landing.

Weather

The Operations Manual advises the captain that it is essential and required that he keep himself current on all weather conditions that will affect his route of flight. This includes NOTAM information which may be obtained from Company Flight Control or through the local Flight Service Station.

Thunderstorms - Description

A description is provided of the characteristics of thunderstorms and how thunderstorm cells normally progress through three stages - cumulus or building, mature or peak stage, and dissipating or anvil stage. Details follow:

A. Building Stage - The cells of a rapidly building towering cumulus cloud composed entirely of updrafts. There is no rain or lightning; there is turbulence; hail, rain and snow are being formed.

B. Mature Stage - Extreme turbulence; strong updrafts and downdrafts in close proximity; cloud-to-ground lightning; heavy precipitation, often including hail; rapidly building icy top, 25,000 feet or higher.

C. Weakening updrafts form an anvil top which in extreme cases may reach 70,000 feet or higher. Widespread areas of light rain, cloud-to-ground lightning, and turbulence becoming less violent.

The manual states that pilots who must decide to fly in thunderstorm areas should try to analyze their progression through them by use of available weather reports and advice.

Flight in Turbulence and Thunderstorms - General

Pilots are reminded that “flight in turbulence and thunderstorms is extremely hazardous; obviously to be avoided if possible.” The information includes flight planning around the area as much as possible and asking ATC for the most favorable routing and for radar monitoring around known thunderstorm cells. The information states that in selecting the best altitude, in general it is good practice to fly through a thunderstorm area where the tops are lowest and that short

range flights may be possible under the main cloud base, provided that a least 2,000 feet of terrain clearance can be maintained. Avoid flight under the overhang of a thunderstorm; this can be a heavy hail area. For clearance around a thunderstorm, allow one mile clearance for every 2,000 feet of vertical development. For example: Detour 20 miles around a cell building to 40,000 feet. Pilots are advised that power setting and pitch attitude are of primary importance in thunderstorm flying and that the two should be established for the desired penetration airspeed before entering turbulent air. A more constant airspeed will result if the two are maintained.

Preparation for Turbulence

This section addresses the checking and positioning of various controls, systems and components in anticipation of an encounter with turbulence. Included within the section is the need to check the gyro instruments and keep the aircraft aerodynamically clean by keeping the landing gear and flaps up.

Flying in Turbulence

Information provided in this section includes (a) the need to fly the airplane, (b) expecting and trying to be mentally prepared for turbulence, precipitation and lightning, (c) holding the power setting and pitch attitude constant, (d) not chasing the airspeed indicator; expecting it to fluctuate wildly, (e) expecting the altimeter to fluctuate wildly, and (f) avoiding excessive movements of the flight controls.

Use of Weather Radar

The information states that no flight can be released in areas where potentially hazardous weather conditions exist which can be detected by airborne radar unless the radar equipment is in satisfactory operating condition (FAR 135.175). If the radar equipment becomes inoperative en route, the aircraft must be operated in accordance with the provisions of the Minimum Equipment List. Weather radar can provide clearance around rain areas by indicating headings to steer. Pilots are instructed to detour by the following rules: (1) clearance of 5 miles when the outside air temperature (OAT) is above freezing, (2) clearance of 10 miles when the OAT is below freezing, (3) clearance of 20 miles at or above 25,000 feet.

Low Level Windshear

Pilots are told that while flying in atmospheric conditions that produce low level windshear they need to be alert to monitor flight instruments and maintain proper pitch attitude and airspeed, especially during the critical phases of approach and landing and takeoff and climbout.

APPENDIX F

OPERATING HANDBOOK AND FLIGHT MANUAL INFORMATION

The following information was derived from the C99 Pilot Operating Handbook and FAA Approved Airplane Flight Manual.

Maximum Certificated Gross Weight:

Taxi: 11,380 lbs.; Takeoff & Landing: 11,300 lbs.

Center of Gravity (CG) Range:

195 inches aft of datum at all weights.

182 inches aft of datum at 11,380 lbs. with straight line variation to 179 inches aft of datum at 10,000 lbs.

179 inches aft of datum at 10,900 lbs. or less.

NOTE: Datum reference is located 85.3 inches forward of the center jack point.

Landing Approach Speeds:

0 flap with luggage pod: 123 knots (kt.) indicated airspeed (IAS).

100% flap with luggage pod: 108 kt. IAS.

Stall Speeds:

Flaps up 0 degree bank @ 10,500 lbs: 90 knots (kt.) indicated airspeed (IAS).

Flaps up 60 degree bank @ 10,500 lbs.: 128 kt. IAS.

Flaps 30 (approach) 0 degree bank @ 10,500 lbs.: 91 kt. IAS.

Flaps 30 60 degree bank @ 10,500 lbs.: 125 kt. IAS.

VA (Maneuvering Speed):

@ 11,300 lbs.: 165 kt. IAS.

Turbulent Air Penetration Cautionary Note:

Do not use controls abruptly above 165 kt. For turbulent air penetration, use an airspeed of 165 kt. Avoid over-reaction on power levers. Keep wings level, maintain attitude, and avoid use of trim. Do not chase airspeed and altitude. Penetration should be at an altitude which provides adequate maneuvering margins when severe turbulence is encountered.

Systems & Equipment:

The C99 is not equipped with an auto-pilot or yaw damper. The flight controls are unassisted mechanical linkage direct feel.

APPENDIX G

RDR-160 PILOTS MANUAL INFORMATION EXCERPTS

Preflight

The Weathervision System should be tested before each flight to verify proper operation of the system. Full operation of the system is possible approximately two minutes after turnon.

Systems Components

The RDR-160 System consists of a remote mounted receiver-transmitter-antenna unit and a panel mounted indicator. The Receiver-Transmitter-Antenna amplifies the echoes received by the antenna and routes them to the indicator for display and threat analysis. The indicator provides a constant nonfading monochrome display of any targets within the selected range and antenna scan angle. Direct viewing is possible under all cockpit ambient lighting conditions.

Operational Controls

The operational controls of the RDR-160 are located on the front panel of the indicator. The operational controls consist of a Function Switch, Mode Selector, and Tilt Adjustment.

The positions of the Function Switch are OFF, Standby (STBY), TEST, and Range selections of 5, 10, 20, 40, 80, and 160 nmi. The TEST function applies drive to the antenna and activates the test circuit and indicator display.

The RDR-160 has three weather mode presentations, Weather (Wx), MAP, and Weather Alert (WxA). Each tune the function mode switch position is changed, the indicator presentation is automatically erased so that information on the newly selected function may be presented without confusion. The Wx mode places the indicator presentation in automatic contour mode. Contoured storm cells will be outlined by lighter shades of green on a dark/black background automatically. The MAP mode activates the manual gain control. All targets will be presented on the indicator in up to 3 different shades of green dependent on the radar echo strength and the particular click-gain setting used. In the WxA mode, the display on the indicator will cycle to verify if a dark hole is a contour or storm

cell. If the dark hole is a contour or storm cell, its presentation will alternate from the darkest shade, ie. black to the brightest shade of green approximately 1 time per second. Cycling is initiated by the reflectivity of an echo above 40 decibels (dB). If a dark hole remains the same intensity while in the WxA mode, then this area of the display does not represent a contour or storm cell but rather a lake or some other terrain feature. The Tilt control adjusts the tilt of the antenna to allow the best indicator presentation.

Contour Presentation and Display Shading

Radar echoes received from storms are divided into three distinct levels depending on the strength of the echo. These three distinct echo levels are presented on the Weathervision indicator as three different levels of (green) brilliance.

A dark hole or brightest shade represents the strongest of the three-different levels of echo being received. This is the hard core of the thunderstorm and represents thunderstorms having an echo reflectivity of 40 decibels (dB) and above. Severe turbulence in this and adjacent areas is capable of destroying an aircraft.

The middle shade represents the intermediate level of echo strength being received. An echo having a reflectivity between 23 dB and 30 dB is represented by this colorization. Turbulence associated with this level of rainfall considered severe and, therefore, avoided.

The lightest shade represents the lowest level of echo strength being received. An echo having a reflectivity between 7 dB and 23 dB is represented by this colorization. The Weather-vision Pilot's Manual states that though lower in rainfall level, severe turbulence would still be expected in this area and, therefore should be avoided.

The Weather-vision Pilot's Manual indicates that even though no echo is being received from the area adjacent to the narrow, lower right edge of the storm, severe turbulence would be expected in this area. Areas adjacent to the narrow edge of a storm should always be avoided for this reason.

Lightning and Static Discharges

Lightning and static discharges could scatter the display momentarily. However, the general presentation is unaffected and should return to normal within 1 scan.

Use of Hold Function

The RDR- 160 incorporates a HOLD function. The Hold feature freezes the display on the indicator until the function switch is changed or until power is removed from the system. When seeking to evaluate storm direction and rate of movement relative to the aircraft, the use of the HOLD function will often provide useful assistance on the longer ranges. On the shorter ranges the situation can change too rapidly to justify use of the HOLD function.

Operation In Flight - Tilt Control

Proper management of the Tilt Control is one of the most important considerations in the operation of any airborne weather radar and that an improper Tilt Control setting can result in valuable information not being properly displayed.

APPENDIX H

FAA HANDBOOK 7110.65F "AIR TRAFFIC CONTROL" EXCERPTS

Paragraph 2- 102, "PIREP Information"

Significant PIREP information includes reports of strong frontal activity, squall lines, thunderstorms, light to severe icing, windshear and turbulence (including clear air turbulence) of moderate or greater intensity, or other conditions pertinent to flight safety.

a. Solicit PIREPs when requested or when one of the following conditions exist or are forecast for your area of jurisdiction:

> These are: (1) ceiling at or below 5,000 feet (2) visibility (surface or aloft) at or less than 5 miles (3) Thunderstorms and related phenomena (4) Turbulence of moderate degree or greater (5) Icing of light degree or greater (6) Windshear

The Handbook instructs the controller to obtain PIREPs directly from the pilot and that terminal controllers should relay this information to appropriate intrafacility positions and to the flight service station (FSS) serving the area in which the report was obtained.

Paragraph 2-103, "Weather and Chaff Services"

This paragraph directs that a controller, "issue pertinent information on observed/reported weather or chaff areas. Provide radar navigational guidance and/or approve deviations around weather or chaff areas when requested by the pilot." It goes on to say (1) "issue weather and chaff information by defining the area of coverage in terms of azimuth and distance from the aircraft or by indicating the general width of the area and the area of coverage in terms of fixes or distance and direction from fixes" and, (2) "when a deviation cannot be approved as requested and the situation permits, suggest an alternative course of action." Further, the controller is directed, "in areas of significant weather, plan ahead and be prepared to suggest, upon pilot request, the use of alternative routes/altitudes." It is noted that weather significant to the safety of aircraft includes such conditions as tornadoes, lines of thunderstorms, embedded thunderstorms, large hail, windshear, moderate to extreme turbulence (including CAT) and light to severe icing. The paragraph goes on to say, "inform any tower for which you provide

affect their operations." The paragraph then provides examples of phraseology which the controller may use to conform to the content of the paragraph. The controller is also cautioned, "phraseology using level number and intensity adjective is only applicable when the radar weather or echo intensity information is determined by NWS radar equipment."

Paragraph 2- 105, "Reporting Weather Conditions"

This paragraph states, "when the prevailing visibility at the usual point of observation, or at the tower level, is less than 4 miles, tower personnel shall take prevailing visibility observations...."

Section 9, "Automatic Terminal Information Service - Procedures"
Paragraph 2- 126, "Operating Procedures"

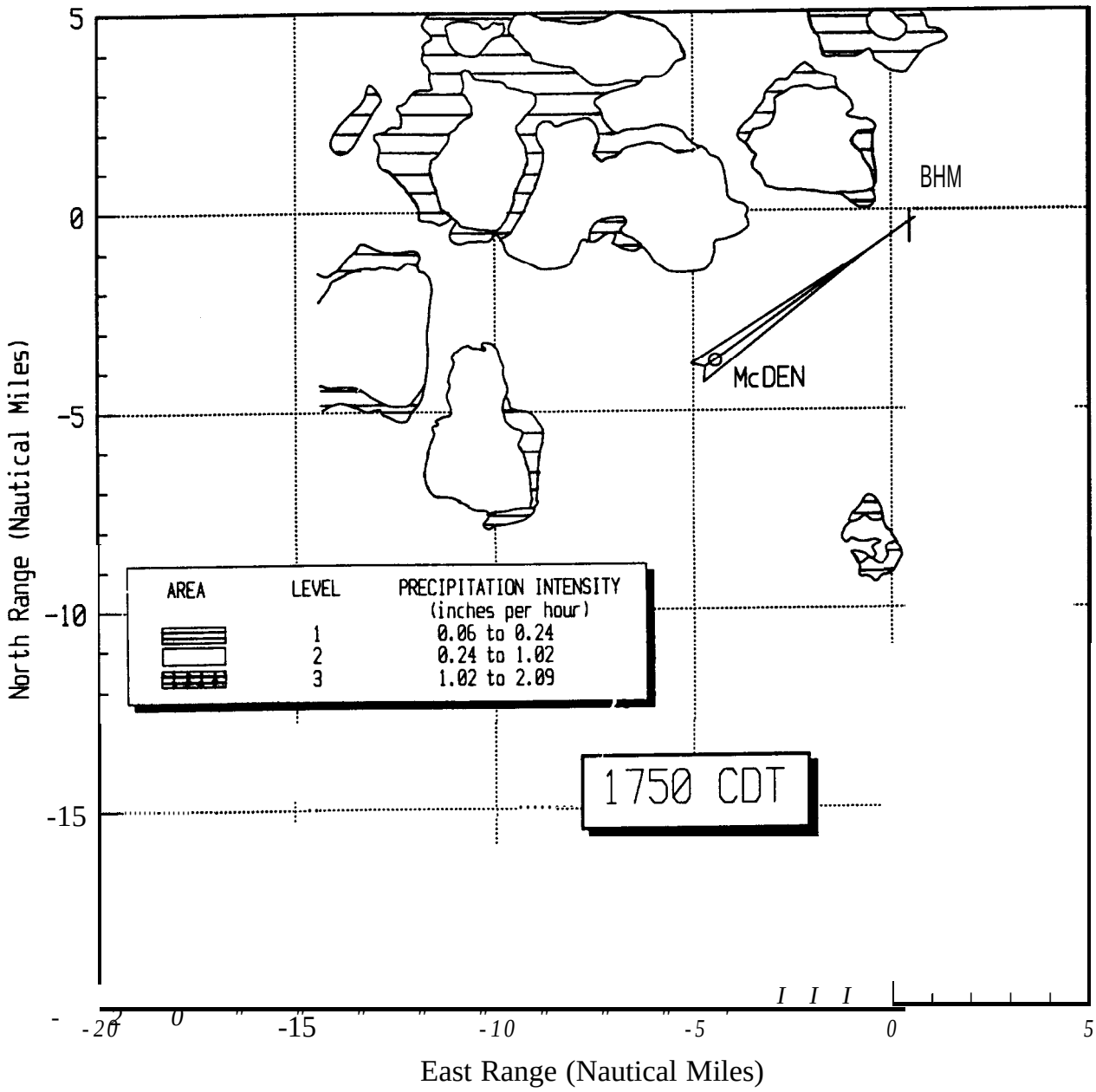
This section advises the controller, "Broadcast on all appropriate frequencies to advise aircraft of a change in the ATIS code/message." In addition it states, "Controllers shall ensure pilots receive all pertinent information contained in the ATIS broadcast. If a pilot does not state receipt of the current ATIS, ask the pilot to confirm receipt of the appropriate ATIS information." The controller is then directed, "controllers shall issue current ATIS information unless the pilot volunteers to obtain it."

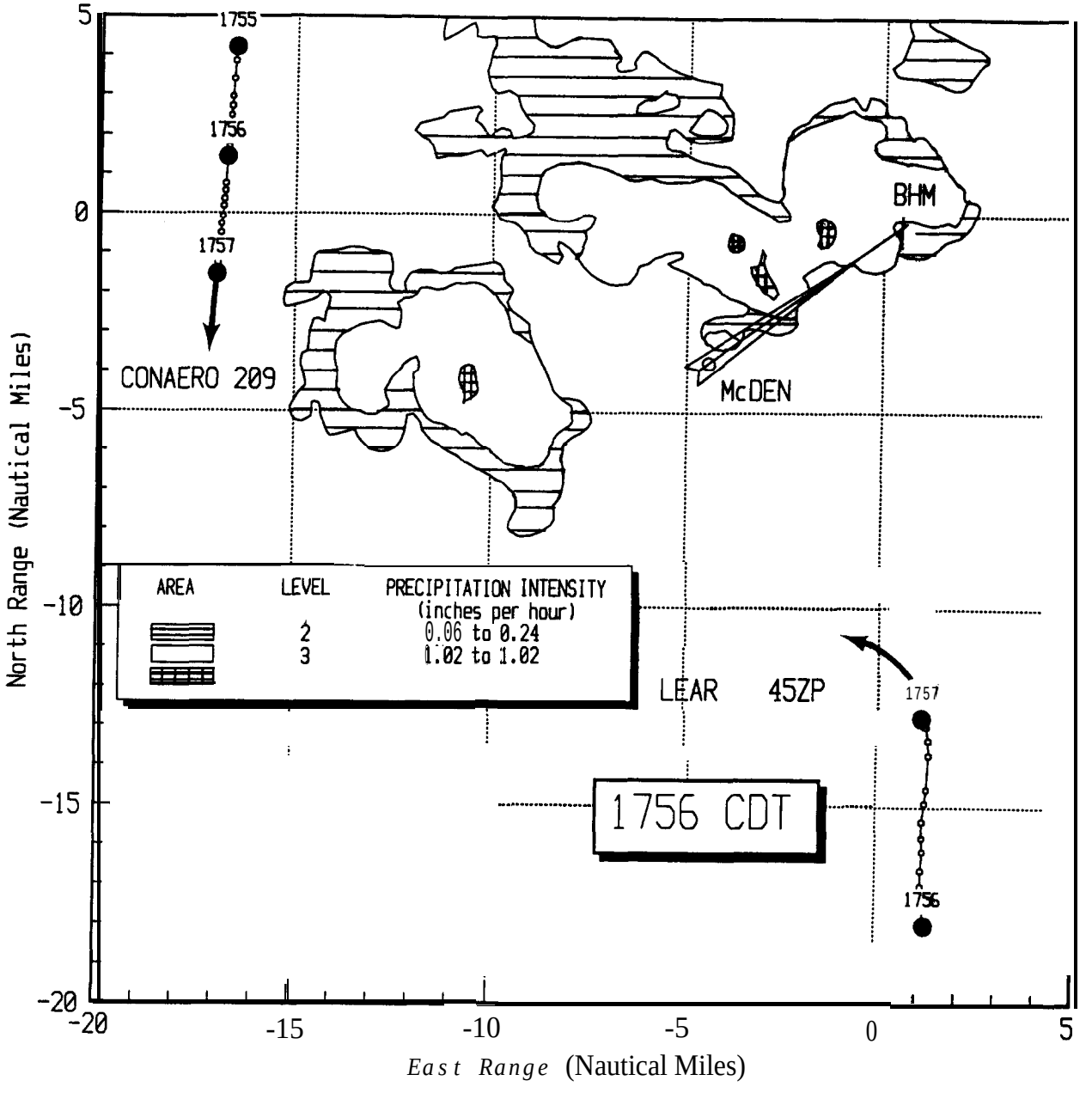
The "Pilot/Controller Glossary, Appendix A," contains definitions for specific terms used in the Handbook. The definition for "Radar Weather Echo Intensity Levels" is provided:

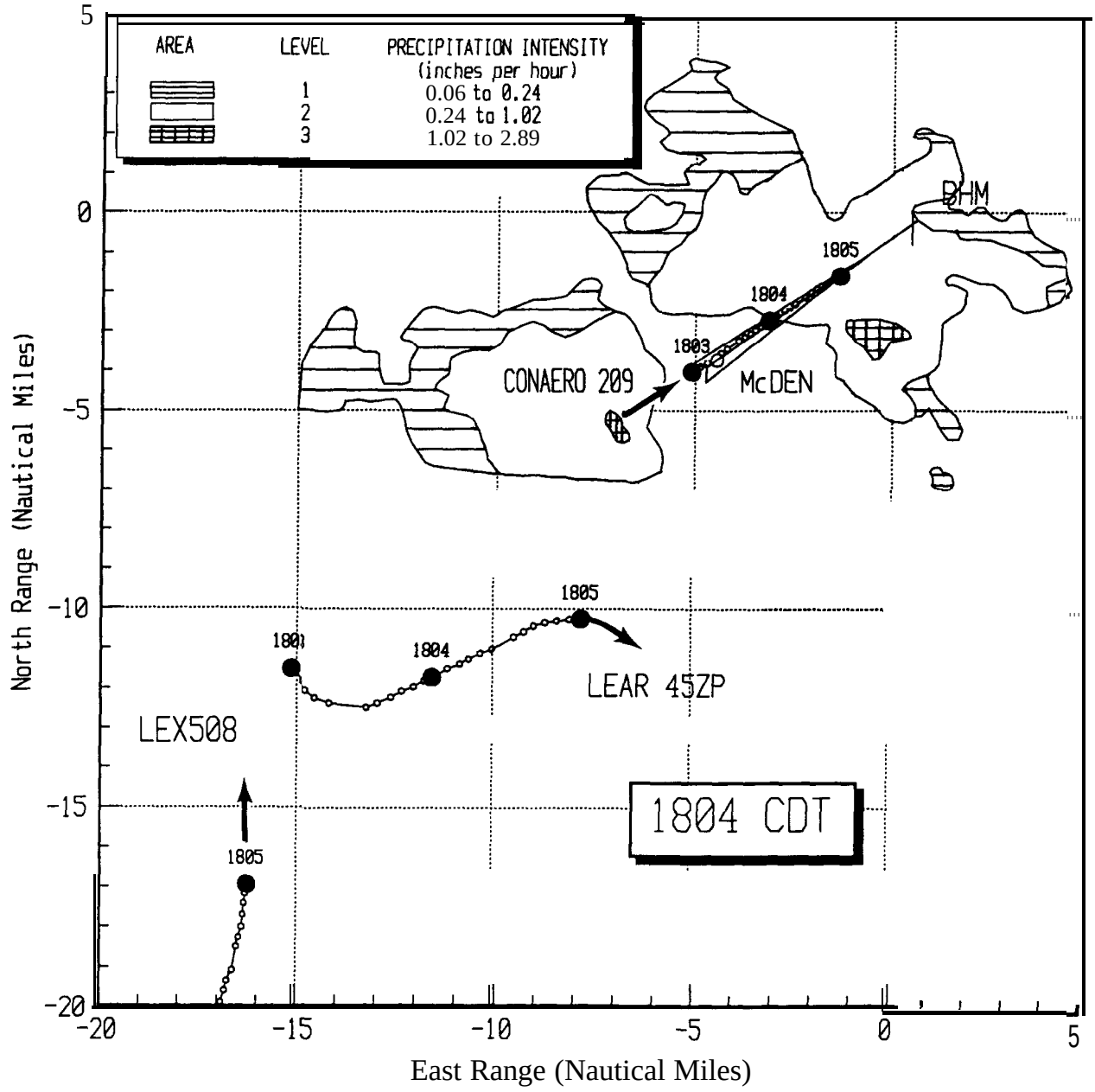
> Existing radar systems cannot detect turbulence. However, there is a direct correlation between the degree of turbulence and other weather features associated with thunderstorms and the radar weather echo intensity. The National Weather Service has categorized radar weather echo intensity for precipitation into six levels. These levels are sometimes expressed during communications as "VIP LEVEL" 1 through 6 (derived from the component of the radar that produces the information-video interrogator and processor). The following list gives the "VIP LEVELS" in relation to the precipitation intensity within a thunderstorm: Level 1. WEAK; Level 2. MODERATE; Level 3. STRONG; Level 4. VERY STRONG; Level 5. INTENSE; Level 6. EXTREME

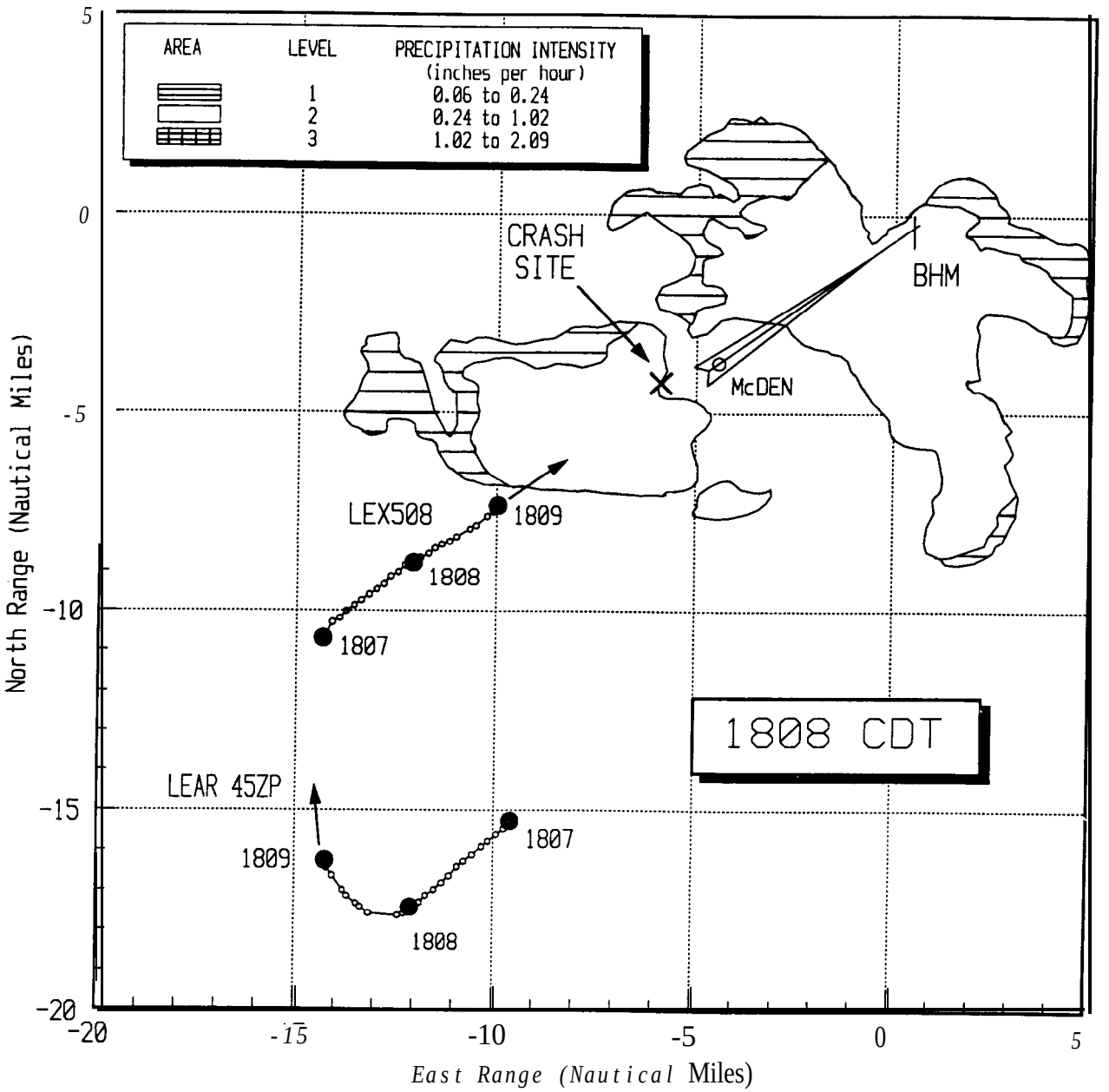
APPENDIX I

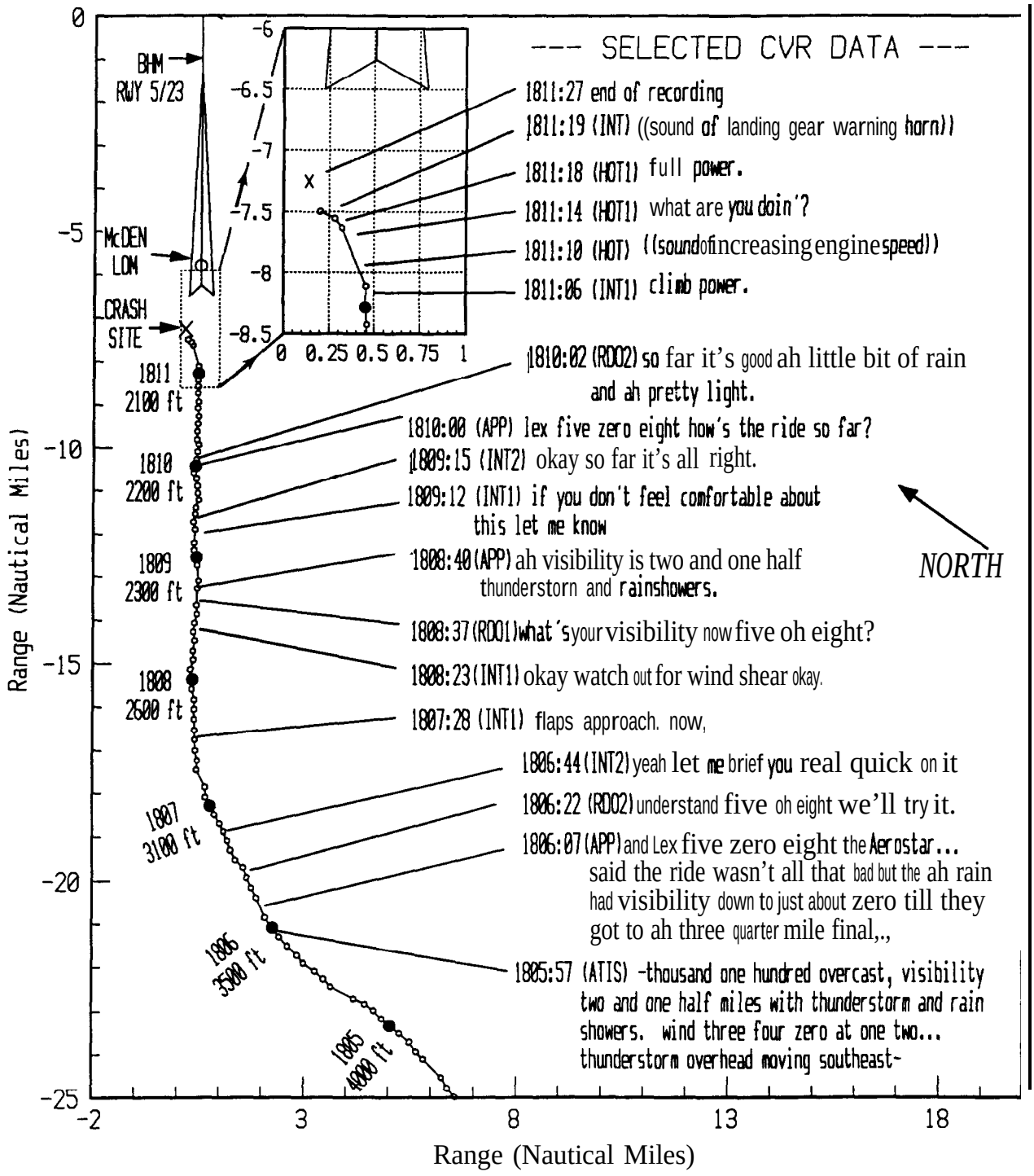
RADAR STUDY




1755
1756
1757
CONAERO 209
BHM
McDEN
AREA
LEVEL
PRECIPITATION INTENSITY
(inches per hour)
2
0.06 to 0.24
3
1.02 to 1.02
LEAR 45ZP
1757
1756 CDT
1756
North Range (Nautical Miles)
East Range (Nautical Miles)
5
0
-5
-10
-15
-20
-20
-15
-10
-5
0
5


AREA
LEVEL
PRECIPITATION INTENSITY
(inches per hour)
1
0.06 to 0.24
2
0.24 to 1.02
3
1.02 to 2.89
BHM
1805
1804
1803
CONAERO 209
McDEN
1805
1804
1803
LEAR 45ZP
LEX508
1805
1804 CDT
North Range (Nautical Miles)
East Range (Nautical Miles)
5
0
-5
-10
-15
-20
-20
-15
-10
-5
0
5


AREA
LEVEL
PRECIPITATION INTENSITY
(inches per hour)
1
0.06 to 0.24
2
0.24 to 1.02
3
1.02 to 2.09
CRASH
SITE
BHM
McDEN
LEX508
1809
1808
1807
1808 CDT
LEAR 45ZP
1809
1807
1808
North Range (Nautical Miles)
East Range (Nautical Miles)
5
0
-5
-10
-15
-20
-20
-15
-10
-5
0
5


--- SELECTED CVR DATA ---
1811:27 end of recording
1811:19 (INT) ((sound of landing gear warning horn))
1811:18 (HOT1) full power.
1811:14 (HOT1) what are you doin'?
1811:10 (HOT) ((sound of increasing engine speed))
1811:06 (INT1) climb power.
1810:02 (RDO2) so far it's good ah little bit of rain and ah pretty light.
1810:00 (APP) lex five zero eight how's the ride so far?
1809:15 (INT2) okay so far it's all right.
1809:12 (INT1) if you don't feel comfortable about this let me know
1808:40 (APP) ah visibility is two and one half thunderstorn and rainshowers.
1808:37 (RDO1) what's your visibility now five oh eight?
1808:23 (INT1) okay watch out for wind shear okay.
1807:28 (INT1) flaps approach. now,
1806:44 (INT2) yeah let me brief you real quick on it
1806:22 (RDO2) understand five oh eight we'll try it.
1806:07 (APP) and Lex five zero eight the Aerostar... said the ride wasn't all that bad but the ah rain had visibility down to just about zero till they got to ah three quarter mile final,,
1805:57 (ATIS) -thousand one hundred overcast, visibility two and one half miles with thunderstorm and rain showers. wind three four zero at one two... thunderstorm overhead moving southeast-
NORTH
BHM
RWY 5/23
McDEN
LOM
CRASH
SITE
1811
2100 ft
1810
2200 ft
1809
2300 ft
1808
2600 ft
1807
3100 ft
1806
3500 ft
1805
4000 ft
Range (Nautical Miles)
Range (Nautical Miles)