SUBMISSION
OF THE
ALLIED PILOTS ASSOCIATION
AND
ASSOCIATION OF PROFESSIONAL FLIGHT ATTENDANTS

TO THE
NATIONAL TRANSPORTATION SAFETY BOARD

REGARDING THE ACCIDENT
OF
AMERICAN AIRLINES FLIGHT 1420
MD-82, N215AA

NTSB# DCA 99MA060

LITTLE ROCK NATIONAL AIRPORT
LITTLE ROCK, ARKANSAS

JUNE 1, 1999

In accordance with 49CFR831.14, The Allied Pilots Association (APA) and the Association of Professional Flight Attendants (APFA), designated parties to the National Transportation Safety Board investigation of the accident, respectfully submits to the Board its probable cause, contributing factors, findings, and recommendations.

COMMUNICATIONS WITH RESPECT TO THIS DOCUMENT CAN BE ADDRESSED TO:

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ACCIDENT AND INVESTIGATION SUMMARY

On June 1, 1999 at 2351 CDT, an American Airlines, Inc MD-82 (N215 AA) operating in revenue service as flight 1420 from the Dallas/Fort Worth International Airport (DFW) to the Little Rock National Airport (LIT) collided with airfield lighting structures after landing on and excursion from the departure end of runway four-right (4R) at Little Rock. The impact caused destructive failures of aircraft systems and structures including the fuselage, and ignition of fire. Ten passengers and one crewmember sustained fatal injuries from impact or post-impact fire. 105 other passengers sustained injuries.

The flightcrew was scheduled in accordance with 14 CFR 121 and the pilots' working agreement. The accident occurred on the flightcrew's third scheduled flight segment of the day. At the time of the accident, the crew had been on-duty for more than thirteen hours during which they had flown seven hours and forty-nine minutes (7:49).

The Little Rock airport is located within an area that was included in a National Weather Service Weather Warning for severe thunderstorms and a thunderstorm weather advisory issued by the operator. The weather observation for the airport just prior to the approach of the accident aircraft included thunderstorm (TS). The intensity of the thunderstorm, which moved across the airport, was recorded as "intense." A second thunderstorm, which was closely approaching the airport, was recorded as "extreme."

The flight was dispatched in accordance with 14 CFR 121. The Captain flew the entire flight segment. The departure, enroute, and descent segments of the flight were operated nominally. The aircraft was navigated in the LIT terminal area by ATC radar vector, with adjustments to the vector paths to avoid clouds, and the flightcrew maintained visual meteorological conditions throughout the descent and approach. The flightcrew was advised by ATC that a thunderstorm was "moving through the area." The flightcrew operated the aircraft weather radar that displayed low intensity precipitation during the approach maneuvering. The flight was vectored to the runway four-right final-approach-course and cleared for the ILS 4R approach. Prior to the flight passing the outer marker, ATC advised that there was heavy rain on the airport and that the ATIS broadcast was not valid. The controller stated the runway four-right RVR was 3000 feet, wind value of 350 degrees at 30 knots, gusts to 45 knots, and windshear alert. After the flight passed the outer marker, ATC advised that the runway four-right RVR was 1600 feet. ATC issued several wind values with significant crosswind components for the remainder of the approach of the flight.

The approach was stabilized with the exception of a lateral course excursion at approximately 400 feet above runway elevation, which was corrected, and an excessive rate-of-descent GPWS alert at approximately 100 feet above the runway. The aircraft landed on a flooded runway near centerline in the touchdown zone and immediately exhibited directional instability and a low rate of deceleration. The aircraft departed the upwind end of the runway, traveled through the Runway Safety Area and impacted the approach light stanchions for runway 22L.

Surviving passengers evacuated the aircraft assisted and unassisted. Airport rescue and firefighting resource response was delayed due to weather and airfield access to the aircraft, but rescue was effected upon arrival at the scene, and the fire was extinguished.

The flight crew was not fully supported by the infrastructure developed and available to manage known aviation hazards. The tactical decision making employed by the pilot in command (PIC) was flawed due to multiple contributing factors.

Incomplete information about a meteorological hazard with a near-precise location and time was known by others but not conveyed to the flight crew. The weather information passed to the crew from the flight dispatcher accurately described the strategic situation in the LIT vicinity, albeit a rapidly changing and dynamic condition. As the aircraft maneuvered in the terminal area the National Weather Service (NWS) was aware of a significant microburst hazard over the LIT airport. There was no requirement or practical mechanism to provide real time warning to the pilot. The flight crew was not provided critical information and not fully trained to assess the devastating potential of the weather phenomena advancing on their destination. Neither were they adequately trained to use the only tactical tool they had available -- The onboard weather radar.

Regulation and policy regarding these kinds of dynamic conditions are abundant but ambiguous. Post accident the American Airlines Flight Department stated "there is no mission," but every airline pilot knows, stated or not, that delivery of the passengers and crew to their destination is the mission. The operator, regulators, airport and crew failed to safely accomplish this task. In the case of the flight crew, the warnings and incomplete information available for decision making were clouded by unadulterated fatigue.

This accident was the result of multiple operating and oversight failures. The principal failures associated with the accident were:

1. The inability of the aircraft to decelerate after landing to stop on the available runway or within the Runway Safety Area due to environmental conditions that exceeded the performance capability of the aircraft;

2. The application of an inadequate risk-assessment strategy to the environmental conditions by the flightcrew due to impairment by fatigue.

3. Performance degradation of the flightcrew in the execution of critical procedures due to impairment by fatigue.

The most important ancillary failure of this accident was inadequate operator training programs in meteorology and aircraft weather radar operation.

1.0 FACTUAL INFORMATION

For the purposes of this submission, the content of information contained in the investigation group factual reports will not be restated unless required for direct reference, clarification, or objection.

2.0 ANALYSIS

By the Allied Pilots Association

2.1 Meteorological Factors

2.1.1 Rainfall Analysis

ASOS WIND INFORMATION/ PRECIPITATION AMOUNTS

Time	2-min	5-sec Gust	1-min Prcptn		15-min Prctn
0430Z	203/08kt	244/09kt	.00		T
0440Z	320/17	336/20	.01		
0441Z	338/17	333/22	.01		
0442Z	351/18	356/27	.01		
0443Z	359/21	360/28	.02		
0444Z	352/20	357/20	.02		
0445Z	320/17	335/20	.03		0.14
0446Z	322/14	333/16	**.03**	**(1.8 in/hr)**	
0447Z	328/15	329/26	**.06**	**(3.6 in/hr)**	
0448Z	314/14	283/11	**.07**	**(4.2 in/hr)**	
0449Z	296/12	291/20	**.03**	**(1.8 in/hr)**	
0450Z	285/16	302/22	**.04**	**(2.4 in/hr)**	
0451Z	281/18	291/21	**.04**	**(2.4 in/hr)**	Accident
0452Z	284/19	287/24	.06		

ASOS precipitation amounts per minute and in rate per hour are listed above. During the preceding five minutes to the accident, rainfall rates exceeded 1.8 inches per hour with most values per minute over 2.0 inches per hour. Public Hearing testimony of Rainer Dombrosky, Chief of Surface Observations Branch, National Weather Service, stated that the ASOS tended to "underreport" by 10 percent in high wind and precipitation situations, we can assume that the actual rainfall is greater.

There are other studies that place the "underreporting" at about 20 percent. These are available at (http://meted.ucar.edu/index3.htm) where the author Nolan referenced a Journal of Geophysical Research paper that looked at gauge performance as a function of wind for rain. For wind speed of about 7 m/s for large samples of rain, gauges missed about 20 percent of precipitation for both the shielded and unshielded gauges. In addition, rain gauge efficiency is affected by drop size. ASOS gauges, for example, though improving, have typically performed less well for summer rain (convective, big drops) than for fall or spring. Other recent academic papers show that rain gauges will

under-report the amount of precipitation in heavy wind situations. At the January 2001 Annual Meeting of the American Meteorological Society, Albuquerque, New Mexico, there were numerous studies to indicate that this was the outcome presented as part of the "Symposium on Precipitation Extremes."

The Meteorology program at Utah uses this assignment to teach students about problems with rain gauges: http://www.met.utah.edu/jhorel/class/met552/assignment_4.html. This work also teaches that underreporting is a problem.

2.1.2 Runway Rainfall Accommodation

Public Hearing witness testimony states that the accident runway can accommodate about 1.6 inches per hour rainfall rate. Further, it is stated that the accident runway would be in a flooded state with a rainfall rate of two inches per hour and, in "Under dynamic hydroplaning conditions, you need a flooded pavement, one that has at least a tenth of an inch (.1) of water on it. "The testimony states that a NWS Level 5 thunderstorm produces 2.5 inches of rain per hour, and a level 6 thunderstorm produces over 5.5 inches per hour.[1]

2.1.3 NEXRAD Data

WSR-88D composite reflectivity data at 0451Z shows reflectivities of 50 to 64 dBZ surrounding the airport. This shows NWS VIP level 5 and 6 activity. This level of storm is consistent with the large rainfall rates recorded by the ASOS.

2.1.4 Availability of NEXRAD products to pilots

Seven miles away from the LIT airport, the NWS WSR-88D weather radar showed significant convective activity developing near the airport. The NWS radar provides greater detail than airborne radar and is better suited to proactively address microburst formation. Additionally it uses different scales of significance than onbard radar. NWS personnel manning the WSR-88D radar were aware of an eminent microburst in the vicinity of the LIT airport. They did not issue a specific microburst warning due to previous issued severe weather warnings which were relative to various convective cells moving through the LIT area. There was no practical method for the flight crew to use the WSR-88D radar information as a tactical decision making tool nor was the knowledge of a microburst hazard broadcast to the flight crew. The unique product of this radar is more focused for uses other than aviation.

2.1.5 Operator Windshear and Microburst Training

LIT had the LLWAS-2 system with five outlying and one centerfield wind anemometers. This was the lowest level of protection available at a major FAA facility. While the ATC

[1] Public Hearing transcript pages 791-894

facility provided differences between outlying and centerfield winds during wind shear alerts, this type of system did not allow the deliverer to use the words "Microburst Alert." The "microburst" cue was the signal taught by the operator for hazardous conditions and automatic reactions during all pilot recurrent training at the time of the accident. The recurrent training used two films provided by the FAA and produced by NCAR which showed verbal cues used at higher levels of protection from systems such as the Terminal Doppler Weather Radar. AA Flight Manual Part 1 did not reflect the technology available at the time and used verbal cues for wind shears that contradicted video training used in training.

2.2 Operational Factors

2.2.1 FAR 121.419 Pilots and Flight Engineers: Initial, Transition, and Upgrade Ground Training.

FAR 121.419 (a) (1) (iii) requires the operating certificate holder to provide ground training that includes instruction in "enough meteorology to insure a practical knowledge of weather phenomena, including the principals of frontal systems, icing, fog, thunderstorms, and high altitude weather situations."

In field interview questioning of Captain Eric Lewis, an AA Flight Department manager, stated, "We really don't have formal meteorology training."[2]

2.2.2 Aircraft Weather Radar Training and Guidance

In Public Hearing testimony, Captain Eric Lewis, an AA Flight Department manager, stated "the bulk of weather radar training is accomplished during the IOE phase."[3]

The AA DC-9 Operating Manual Systems 173 (1-28-98) stated "Flight operations below 10,000 feet require tilt of two to three degrees upward."

2.2.3 Visibility-Takeoff and Landing Minimums

AA Flight Manual Part I Section 12.1.4 (4/4/97) stated " if the latest weather report and/or an oral report from the control tower contains a visibility value specified as RVR or RVV for a specific runway of that airport, the value of RVR or RVV is controlling for takeoffs, landings, and straight-in instrument approaches for that particular runway (FAR 121.655)."

[2] Operational Factors, attachment 2, p 124
[3] Public Hearing Transcript, p.196

2.2.4 AA Requirements for Making CAT I ILS Approaches

The AA DC-9 Operating Manual, Normals 99 (3/16/98) restricted Category I ILS approaches to a maximum of a 15knot crosswind component when RVR is less than 4000.[4] This is understood by the crews and American Airlines to be a landing limitation, not an approach limitation.

At 0446:52 UTC, while the accident aircraft was cleared for approach but outside the outer marker, RVR was reported at 3000 feet, and wind was reported at 350 degrees at 30knots, gusting to 45 knots. Steady state crosswind component was 22 knots; gust component was 34 knots.

At 0447:53 UTC, a windshear alert was issued by ATC reporting wind values at the centerfield, north, and northeast boundary anemometers with steady-state crosswind components relative to runway 4R in excess of 15 knots.

2.2.5 AA Wind Landing Limits.

AA Flight Manual Part 1, Section 10.4 (4/7/99) restricts the landing crosswind component to a maximum of 10 knots when RVR is less than 1800 feet. [5]

At 0448:12 UTC, the accident aircraft was on the final approach segment, inside the outer marker, and RVR was reported at 1600 feet. At 0448:26, the wind was reported at 340 degrees at 31 knots, a crosswind component of 28knots. North and northeast boundary wind crosswind components exceeded 10knots.

At 0449:10 UTC the wind was reported at 330 degrees at 28 knots . At 0449:32 the aircraft was approaching 500 feet above runway elevation, and the wind was reported at 330 degrees at 25 knots.

At 1149:53 the aircraft was below 500 feet above runway elevation and the wind was reported at 320 degrees at 23, a crosswind component of 21 knots.

2.2.6 AA DC-9 Windshear Guidance

AA DC-9 Operating Manual Environmental 13/14 (8-22-97) provided criteria defining known severe windshear on the basis of pilot reported airspeed or vertical speed deviations, and provides indicators of possible sever windshear including thunderstorms, rain, and strong or gusty winds. The guidance recommends diversion or, if on approach, go-around and/or holding. There was no explicit guidance based on ground reporting systems (LLWAS/TDWR).[6]

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[4] Operational Factors attachment 25.
[5] Operational Factors attachment 26.
[6] Operational Factors attachment 27

The accident aircraft received advice of approaching thunderstorms, rain, strong winds, and windshear alerts based upon the LLWAS system.

2.2.7 Weather Deterioration after Approach has Started.

AA Flight Manual Part 1 10.3.5 states the authority of FAR 121.651 that allows an aircraft established on the final approach segment to continue the approach to minima or landing if the weather is reported to be below the published minima. There is no published guidance for evaluating the nature of the conditions that might cause weather deterioration to values below minima and the potential hazards associated with such conditions. For example, visibility reduced by heavy rain presents a greater potential for hazard than fog. [7]

2.2.8 AA Stabilized Approach Concept

AA DC-9 Operating Manual Techniques-19 (11-15-95) defines criteria for stabilized approach: final landing configuration, on approach speed, on proper flight path and at the proper sink rate, at stabilized thrust. There was no specific criteria, however, defining proper lateral or vertical flightpath. Additionally, there was no action specified for deviation from the published criteria below the minimum altitudes.[8]

At approximately 400 feet above runway elevation, the aircraft deviated to the right of the final approach course. The deviation was noted and called out by the pilot-not-flying, and a correction to course was applied. At approximately 100 feet and, again, at approximately 50 feet above runway elevation, the Ground Proximity Warning System aural warning for excessive descent rate activated.

The pilot-not-flying called "go-around" at a point below 500 feet above the runway elevation.[9]

2.2.9 Detailed Before Landing Checklist Instructions

AA DC-9 Operating Manual Normals 72 (4-26-99) Before Landing Checklist required the pilot-not-flying to call out "spoiler lever" checklist item and respond "armed."[10]

The Cockpit Voice Recorder Group Chairman's Factual Report does not reflect recorder capture of either the checklist item or the response.

2.2.10 AA Before Landing Checklist Instructions

AA DC-9 operating Manual Normals 71 (12-21-98) stated "When all items have been accomplished, the pilot-not-flying will advise, "Before Landing Checklist complete."[11]

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[7] Operational Factors attachment 18
[8] Operational Factors attachment 16
[9] Public Hearing Transcript; CVR Transcript addendum
[10] Operational Factors attachment 13

The Cockpit Voice Recorder Group Chairman's Factual Report does not reflect recorder capture of the statement.

2.2.11 Runway Conditions - Landing

AA Flight Manual Part I Section 10.6.4 stated "When ATIS or Tower states 'Braking action advisories in effect, it means PIREPS of "poor" or "nil" have been received or runway conditions are deteriorating rapidly.[12]

Neither the ATC Group Chairman's Factual Report or the CVR Group Chairman's Factual Report reflects the issuance by ATC of Braking Action Advisories.

2.2.12 McDonnell Douglas/Boeing All Operators Letter, February 15, 1996

McDonnell Douglas/Boeing AOL-9-058 stated "A landing on a runway with a braking action of 'poor' is undesirable and should not be planned unless other factors make this imperative."[13]

There is no similar statement or guidance found in the AA DC-9 Operating Manual.

2.2.13 McDonnell-Douglas Flight Crew Operating Manual (Apr 1/98)

McDonnell-Douglas Flight Crew Operating Manual section 2 page 48 stated "If spoiler lever does not move aft or does not remain at EXT position, PNF call "No Spoilers."[14]

There was a similar statement or guidance found in the AA DC-9 Operating Manual.

2.2.14 AA Landing Guidance for Spoiler

AA DC-9 Operating Manual Normals page 75 (12-21-98) stated "If Spoiler Lever does not move back to the full act (EXT) position, the Captain, regardless if which pilot is making the landing, will manually deploy the spoilers."[15]

The Systems Group Factual Report page 4 stated "The cockpit spoiler handle was found in the full aft position."

The Public Hearing testimony transcript (page 990) in the questioning of Mr. Neal Gilleran, Boeing Commercial Aircraft Company states that the spoiler handle is not recorded on the DFDR.

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[11] Operational Factors attachment 12
[12] Operational Factors attachment 24
[13] Operational Factors attachment 35
[14] Operational Factors attachment 34
[15] Operational Factors attachment 33

2.2.15 AA DC-9 Thrust Reversing Guidance

AA DC-9 Operating Manual Normals page 75 stated "When nose gear is firmly on the runway, move the Reverse Levers to reverse idle, then apply reverse thrust symmetrically to 1.6 EPR unless safety dictates more thrust."[16]

AA DC-9 Operating Manual Environmental page 7 and page 27 stated "Do not exceed 1.3 EPR reverse thrust on the slippery portions of the runway, except in an emergency."[16]

The Digital Flight Data Recorder Group Chairman's Factual Report reflects the momentary application of reverse thrust at values of 1.89 EPR (Left) and 1.67 EPR (Right) after landing and prior to impact.

2.3 Human Performance Factors[17]

2.3.1 Time of Day – Circadian Factors

The accident occurred at 2351 CDT.

The Captain of the accident flight was ordinarily asleep at this time, in this time zone. The First Officer of the accident flight resided in the Pacific time zone. The evening before the flight, he went to bed at approximately 2200 CDT (2000 PDT).

Human Performance Group witness testimony states that the accident happened a couple hours after the captain's usual bedtime and this would suggest that the captain's circadian system was in its downward phase which was significant

The time of the accident was a factor that could have contributed to fatigue in both pilots.

2.3.2 Continuous Wakefulness –Time Since Awakening (TSA)

The Captain awoke between 0700 and 0730 CDT on the day of the accident. The duration of his wakefulness has been estimated at between sixteen and seventeen hours. The First Officer awoke at approximately 0730 on the day of the accident. The duration of his wakefulness was more than sixteen hours.

Human Performance Group witness testimony states that the Captain's total awake time may have contributed to vulnerability to error and that sixteen hours of continuous wakefulness really is the limit that anyone would suggest is safe to perform within.

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[16] Operational Factors attachments 33, 36, 38

[17] Analysis of Crew Fatigue as a Causal Factor in the Crash of American Airlines Flight 1420 at Little Rock, Addendum A, and Human Performance Group Chairman's Factual Report Addendum I

Continuous wakefulness or time since awakening could have contributed to fatigue in both pilots.

2.3.3 Time on Task – Duty Time

The Captain reported for duty at 1038 CDT. The First Officer reported for duty at 1018 CDT. At the time of the accident, both pilots had been on duty over thirteen hours.

Human Performance Group witness testimony states that it is difficult to embrace the notion that we should permit individuals in safety sensitive occupations to be putting in hours that exceed twelve, and if we do go to fourteen hours, there should be frank acknowledgement of the risk and some sort of effort to mitigate it.

Time on task, or duty time, could have contributed to fatigue in both pilots.

2.3.4 Evidence of Fatigue

Statements by a cabin crewmember of the accident flight based on observations of and statements by both pilots indicate self-recognition of fatigue. The First Officer stated that he was "tired but alert."

Situational elements contributing to fatigue identified by a Human Performance Group witness were present including time pressure, increased workload due to changing conditions, deteriorating weather, and a stressful or demanding situation.

2.3.5 Fatigue Characteristics Evident in Crew Performance

Cognitive Problems - Judgment and Decision Making Errors

1. The crew did not consider diverting to alternate airport or holding for weather after receiving repeated updates of deteriorating weather conditions at Little Rock Airport.
2. There was insufficient attention to critical data and operational requirements.

3. The Captain failed to initiate a go-around during his approach to runway 4R when told that he was off course, non-stabilized, and momentary visual contact with the runway was lost.

Fixation

The Captain was extremely fixated to maintain visual contact with the airport and runway while maneuvering for the approach. During this period, he failed to call for flaps 28 and flaps 40 while maneuvering and on the approach.

Human Performance Group witness testimony states that the CVR in AAL1420 left him with the impression that the crew experienced a loss of situational awareness in space and time, and they were so focused on maintaining situational awareness outside the airplane (toward the storm, airport, and runway) that they may have lost sight of things inside the cockpit relevant to prepare for landing.

Channeled - Concentrating on a single activity or thought

Human Performance Group witness testimony states that the way things were being prioritized by the Captain during the final minutes of the flight, fit with what is known about fatigued performance. There appeared to be a focus outside of the cockpit (toward the storm and the airport), with a priority to land the plane on the target runway.

Loss of Initiative

The Captain needed to be prompted repeatedly by F/O Origel to commence the descent. He appeared unwilling to decide on a course of action regarding an instrument or visual approach after several requests from controllers and failed to initiate a go around when visual contact with the runway was lost only seconds before touchdown.

Willingness to Accept Less in Performance

By all reports, the Captain was lauded for his airmanship and good judgment as a professional aviator and Chief Pilot. It is probable that under normal circumstances he would have emphasized and demonstrated the need to accomplish all checklists carefully and ensure that landing minima and pertinent operational restrictions were met before making any landing attempt.

Memory Impairment

Captain Buschmann was reminded on two occasions to set flaps 28 and flaps 40 although he stated that he thought he had already called for them.

2.4 Aircraft Systems Factors

2.4.1 Aircraft Systems Functions

FDR, CVR, and post accident analysis described by the Systems Group Chairman's Factual Report, and addenda, indicate that all aircraft systems were capable of nominal function.

No cockpit indication of actual spoiler function is available to flightcrew.[18]

[18] Public Hearing transcript, p. 948

The cockpit spoiler handle position, including arm/disarm, is not a recorded parameter.[19]

The Systems Group Chairman's Factual Report page 4 states "The cockpit spoiler handle was found in the full-aft position."

Automatic spoiler operation and brake pressure application to the inboard wheel brakes require main wheel rotation. Wheel rotation is not a recorded parameter. [20]
Evidence of the spoiler system anomaly known as "spoiler snapback" in which the spoiler handle, and spoilers, retract immediately after automatic deployment was not captured on the Cockpit Voice Recorder or Digital Flight Data Recorder.

2.4.2 AA Flight 9503

On February 16, 2000, about 0708 Pacific Standard Time, American Airlines Flight 9503, a Boeing (McDonnell Douglas) MD-83, departed the prepared surface of the runway 13R while landing at Palm Springs, California. The airplane was on a positioning flight from Los Angeles, California, to Palm Springs, California. A main landing gear truck rolled off the pavement and through rough gravel at the edge of the runway. The airplane received minor damage, and no one was injured.[21] Certain aspects of this flight and AA flight 1420 exhibited similarities, and the NTSB opened an investigation into the cause of the incident. Hourly weather observation for Palm Springs at 1453Z, wind 210 degrees at 18 knots gusting to 26 knots, visibility 10 miles in light rain, scattered clouds at 7,000 feet, ceiling overcast at 9,500 feet, temperature 16 degrees C, dew point 8 degrees C, altimeter 29.99 inches of Hg. Remarks: automated observation, peak pressure rising rapidly, sea level pressure 1015.5 mb, precipitation since last observation less that 0.01 inches[22] Last wind reported by Palm Springs Tower to the Flight crew was, "wind now two one zero at eight."[23] Gusty, swirling winds, damp to wet runway, no evidence of ground spoiler deployment, and higher than 1.3 EPR reverse thrust may have led to longitudinal control difficulties and runway excursion.

If the spoilers were armed prior to landing, the MD-80 spoiler actuator should automatically extend the ground spoilers with main gear wheel spin-up or when the nose strut compressed. The flight data recorder (FDR) indicated that the ground spoilers did not deploy on touchdown and were not manually extended by the pilots. Additionally, a CVR sound spectrum analysis indicates that the spoilers possibly were not armed at touchdown.[24] The CVR transcript notes the F/O stating "spoilers armed", however, the sound of the spoiler handle being armed was only identified by two members of the NTSB CVR group.

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[19] Public Hearing transcript, p. 990
[20] Public Hearing transcript, p. 990
[21] NTSB Ops Factual report, Flt 9503, dated February 16, 2000
[22] NTSB Meteorology Factual report, Flt 9503, dated July 17, 2000
[23] NTSB CVR Factual report, FLT 9503, dated January 21, 2001
[24] NTSB Specialist's Sound Spectrum Study, CVR, dated December 11, 2000

2.5 Aircraft Performance Factors

2.5.1 Runway Evidence

Performance Group Chairman Factual report states that tire marks were found leading from the wreckage area back through the rocks and grass and eventually onto the runway. Tire marks consistent with those of the left main landing gear began 5,228 feet from the end of the runway's concrete surface. Tire marks of the right gear began 4,303 feet from the end of the runway. Tire marks were more whitish in color than the surrounding concrete surface. The aircraft touched down around 150 knots and departed the end of the runway at around 95 knots with full brake pedal deflection applied about 6 to 11 seconds after touchdown. This is about 10 knots of deceleration per thousand feet with full anti-skid braking. There was no evidence of anti-skid cycling within the white marks left on the runway.

2.5.2 Braking Energy Loss

If an aircraft is maneuvering on the ground against a crosswind, some of the braking capability (mu) must be traded off for directional control. Boeing stated that their model does not account for this tradeoff between braking capability and tire cornering ability.

2.5.3 Hydroplaning

Performance Group Chairman's Report cites NASA's Langley Research Center and FAA staff review of the accident airplane's runway tire marks, tire tread characteristics, and runway surface condition data. Mr. Yager's preliminary review of the runway tire marks and tire treads indicate that neither dynamic, viscous, or reverted rubber hydroplaning were likely present when the tire marks were made. Mr. Yager believes the accident airplane's runway tire marks are consistent with wet traction and significant yawing action.

In the investigation of the accident of a B-737 at Charlotte, NC, in October, 1986, Walter B. Hornel states "It is believed that the polishing and scouring action developed by the locked wheel main landing gear tires sliding across [the] grass-covered soft soil removed much of the thin coating of reverted rubber normally found on the tire tread skid patches after a reverted rubber hydroplaning incident".

Total dynamic hydroplaning usually does not occur unless a severe rain shower is in progress. While the exact depth of water required for hydroplaning has not been accurately determined, a conservative estimate for an average runway is that water depths in excess of 0.1-in. may induce full hydroplaning. The exact amount of water on the accident runway is unknown, however meteorological estimates and witness statements indicate significant runway flooding.

2.5.4 Performance Data

The conditions used for certification of an aircraft involve ideal runway, aircraft, and test pilot techniques. This is important when considering arguments as to whether the aircraft could have stopped on the runway had the ground spoilers been activated. Following is a comparison for establishing landing data charts versus the factual elements of the accident aircraft.

ADVISORY LANDING DATA	AA 1420
• Sea level • No wind and no runway slope • Maximum braking (assumed at touchdown) • Reverse thrust EPR 1.3 to 80 knots or no reverse thrust. • Vref at a point 50 ft. above threshold and touchdown 1000-ft from the approach end. • Ground spoilers deployed • Nominal nose down elevator during rollout.	• 260 ft. elevation • 20+ knots crosswind • Left brake pedal 19.2 degrees approx. 10 seconds after touchdown. Right brake 18.6 degrees approx. 14 seconds after touchdown. • Reverse thrust above 1.6 EPR and cycled to forward thrust several times. • Indicated airspeed at touchdown approx. 157 knots. Vref set at 130 knots. Speed 133 knots 10 seconds after touchdown. • Air distance to landing 890 feet longer than demonstrated tests. • Possible flooded runway. • Ground spoilers not deployed. • Braking friction loss due to cornering requirements of directional control • Five degrees additional nose down elevator, causing reduced weight on wheels.

The extreme environmental dynamics created significant variance between performance data and the actual landing conditions of the accident aircraft.

2.6 Airport Facilities Factors

2.6.1 Runway Condition

The Little Rock National Airport is believed to have had a system to give indication of runway contamination installed and functioning on the accident runway at the time of

the accident. Airport management could not provide an adequate description of system function, nor was a response, if any, to an inquiry regarding the system distributed.[25]

2.6.2 Runway Condition Notice to Airmen(NOTAM)

FAA Advisory Circular AC 150/5200-28B Notices to Airmen (NOTAMs) for Airport Operators states "The management of a civil airport which is open for public use is expected to make known as soon as practical ...any condition on or in the vicinity of the airport, existing or anticipated, which would prevent, restrict, or present a hazard to arriving or departing aircraft. Public notification is normally accomplished by the NOTAM system."

There was no NOTAM related to the accident runway condition in effect at the time of the accident.

2.6.3 Runway Safety Area

The accident runway incorporated a Runway Safety Area extending 450 feet beyond the end of the runway. FAR 139.309(a)(1) requires incorporation of a Runway Safety Area extending 1000 feet beyond the end of a runway for runways constructed after January 1, 1988, with provision for waiver. Construction of the accident runway was initiated before January 1988.
Runway Safety Areas are known to effectively contain runway-overrun aircraft.[26]

A frangible structure was located within the Runway Safety Area of the accident runway and was impacted by the accident aircraft with negligible damage to the aircraft. Non-frangible structures were located beyond the existing Runway Safety Area but within 1000 feet of the runway end and were impacted by the accident aircraft with destructive force.

The airport authority had the option of reducing the available landing distance of the runway in exchange for incorporation of the full 1000 foot Runway Safety Area.

The non-frangible approach lighting system impacted by the accident aircraft was not required for the associated instrument approach to Runway 4R.

2.7 Air Traffic Control Factors

2.7.1 Braking Action Advisories

FAA Order 7110.65L stated "...whenever weather conditions are conducive to deteriorating or rapidly changing runway conditions, include on the ATIS broadcast the

[25] Ltr: C. Lewis (AA): G. Feith (NTSB) 7/28/00
[26] FAA AC150/5300-13, FigureA-8

statement 'Braking Action Advisories are in effect. Issue the latest braking action report to each arriving and departing aircraft early enough to be of benefit to the pilot. If no report has been received for the runway of intended use, issue an advisory to that effect.'"

A Braking Action Advisory was not issued to the accident flight.

2.8 Survival Factors

By the Association of Professional Flight Attendants

2.8.1 Airplane Configuration and Cabin Interior Features

The MD 82 aircraft was configured with 14 first-class seats and 125 coach class seats. There was a double occupancy, aft facing jumpseat at the L1 door exit and a double occupancy, forward facing jumpseat mounted on the aft pressure bulkhead separating the cabin and the aft tail cone compartment. A single occupancy, aft facing jumpseat was located in the forward aft galley area adjacent to the L2 door exit.

There were three type I exits on this aircraft: doors L1, R1 and L2. L1 and R1 were located in the fwd portion of the cabin, just aft of the cockpit and the L2 door was located in the left, aft forward galley area. This aircraft was also equipped with an aft tail cone exit. All floor level exits were equipped with single-lane automatic-inflation slides. There were four type III exits located in the cabin. The exits were located forward of seats 21A and 22A on the left hand side and forward of 21F and 22F on the right hand side of the aircraft. Placard diagrams illustrating exit operation were located above each type III window exit. Passenger briefing cards were also located at each passenger seat.

The aircraft was equipped with the mandatory emergency equipment including life vests and flashlights located at each flight attendant jumpseat (Figure 1: Aircraft Cabin Configuration and Emergency Equipment Location).

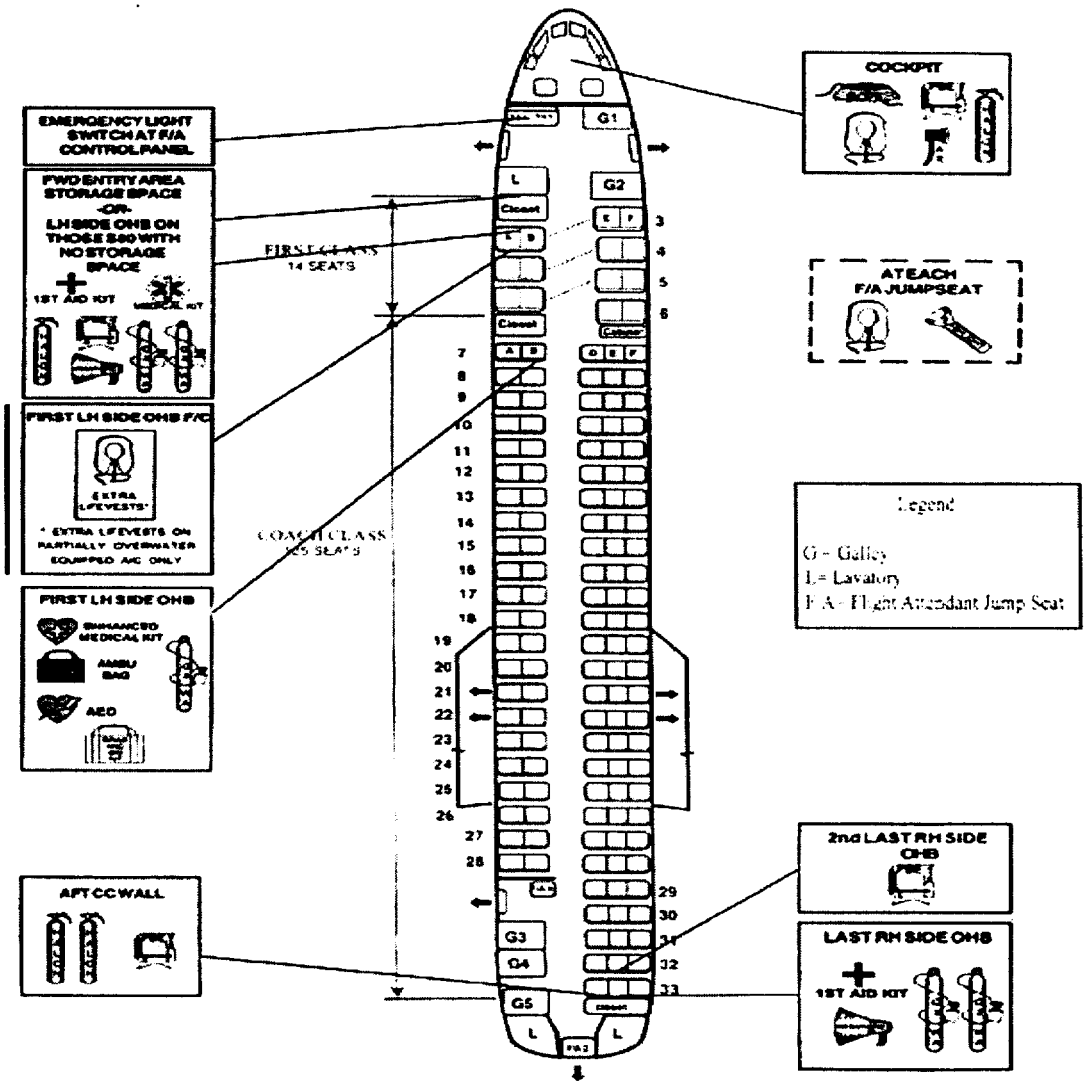

Figure 1
Airplane Cabin Configuration

The aircraft was equipped with an overhead emergency lighting system and a floor proximity escape path lighting system. The post-accident fire destroyed all but five battery/control units from the overhead and cabin floor emergency lighting systems. The five remaining battery/control units were examined on July 22, 1999. One, of two, battery/control units functioned normally, except it produced ½ normal voltage and could not be recharged. The four remaining units functioned normally.

The aircraft was not equipped with an Emergency Locator Transmitter (ELT).

2.8.2 Flight Attendant Crew Manning and Jumpseat Location

The flight was staffed with four flight attendants. Flight Attendants number 1, 2, and 4 were part of the FAA mandated minimum crew[27] and the number 3 Flight Attendant was a variable manning position.

On June 1, 1999, Flight Attendants number 1, 2 and 4 began their duty day at 11:21 CDT in San Antonio, TX. American Airlines' records show that AAL flight 1420 arrived Little Rock at 2355 CDT. Total duty day for Flight Attendants 1, 2 and 4 was 12 hours and 49 minutes which included a 15 minute debrief.
On June 1, 1999, Flight Attendant number 3 began her duty day at 1440 CDT in Dallas/Fort Worth, Texas. American Airlines' records show that AAL flight 1420 arrived Little Rock at 2355 CDT. Total duty day for flight attendant number 3 was 9 hours and 30 minutes which included a 15 minute debrief.

Flight Attendant number 1 was assigned the forward jumpseat, aft facing, outboard side. Flight Attendant number 2 was assigned the aft, forward facing jumpseat. Flight Attendant number 4 was assigned the aft galley jumpseat and Flight Attendant number 3 was assigned the forward jumpseat, aft facing, inboard side. Flight attendants 1, 2 and 4 had flown previous leg sequences together on June 1, 1999. AAL flight 1420 was the first leg sequence that flight attendant number 3 had flown with the other cabin crewmembers. All flight attendants' qualifications were up-to-date at the time of the accident.

2.8.3 Passenger Load Information

There were 139 passengers on board AAL flight 1420; 14 passengers seated in the first class compartment and 125 passengers seated in the coach compartment. Included in the coach count was a 25 month-old female child seated in an approved child restraint[28] in seat 24F.

2.8.4 Cabin Crew Statement Excerpts

Flight Attendant No. 1 (F/A No. 1)
-Occupied the forward double jumpseat, aft facing, outboard side
-Primary exit L1.

F/A No. 1 stated that she was assigned this trip sequence off of stand-by reserve approximately 20 minutes prior to the first leg's departure on May 31, 1999. She recalled a delay of AAL flight 1420's departure from DFW due to weather and awaiting inbound equipment. She said that she had a pre-flight briefing with the Captain at the gate in DFW. During the briefing she was informed that Nashville was their alternate landing airport. She commented to the agent that the flight attendants were tired.

[27] In accordance with FAR 121.391.
[28] In accordance with FAR 121.311b2.

After take-off, the flight experienced minor turbulence but then smoothed out. The flight attendants then began their service duties. Approximately three-fourths of the way to Little Rock, the Captain called back to have the flight attendants conclude their service duties and take their seats because he thought they might experience some turbulence. She recalled seeing lightning and turned down the lights in the cabin so all the passengers could see the lightning better. She stated that it never got very turbulent.

The descent was smooth but got bumpy once the gear was lowered. Initially, the landing was normal with no skidding. After about 2 seconds she felt like they were "hydroplaning" and going into the grass. She and the No. 3 F/A prepared to evacuate once the aircraft stopped moving.

She felt a "boom" at the L1 door and something push against her body. She believes that she was unconscious and was awakened by a male voice instructing her and F/A No. 3 to "get out of the plane". She felt the L1 slide with her right hand and thought it inflated into the cabin. The cabin was dark. F/A No. 3 was injured and had to be assisted out of her jumpseat and out of the wreckage. F/A No. 1 unbuckled her own restraints and felt pain in her hip when she stood. She attempted to open the R1 door but was unable to. She exited the wreckage through a "gaping hole in first class". She believed that she was the last person to exit the aircraft from that area. Once outside, she observed rain, hail, wind and lightning.

Flight Attendant No. 2 (F/A No. 2)
-Occupied the aft, forward facing jumpseat.
-Primary exit aft tail cone.

F/A No. 2 reported to the aircraft once it arrived at the gate. Passenger boarding began shortly after. Another flight attendant told her that there was weather in Little Rock and that Nashville was their alternate city. She recalled the boarding process as being rushed. She saw one child in a child restraint device.

She recalled nothing unusual about the flight except a little "chop" out of DFW. She finished her service duties and sat down early at the Captain's request. She noticed lightning outside. She claimed that the approach into LIT was a little turbulent.

She stated that the touch down was normal. The aircraft did not slow down and it felt like they were "sliding down the runway, crooked to the right". She felt the Captain apply the brakes again but they did not "grip at all". She heard the thrust reversers and felt the Captain apply the brakes again. The aircraft was tilting to the right. She heard F/A No. 4 yelling "brace, brace". She observed luggage coming out of the overhead bins and seats "coming out of their brackets". She got out of her jumpseat once the aircraft stopped. She saw smoke and a glow forward of her. She began her evacuation commands instructing passengers to her exit location.

She was unable to open the tail cone exit door. She instructed passengers to turn around. She did not see any emergency lights. The cabin was dark and full of smoke.

It was difficult for her to see. No one was exiting from the L2 door exit. She and a couple of male passengers got the tail cone exit door open and people followed her onto the catwalk. She noticed that the tail cone did not deploy. She pulled the manual jettison release handle repeatedly. A lightning flash enabled her to see a crack between the fuselage and the tail cone and she saw grass outside. She began to kick at the crack until it opened enough to exit through. She yelled for the others to follow her out. There was lightning, rain and wind outside.

Flight Attendant No. 3 (F/A No. 3)
-Occupied the forward double jumpseat, aft facing, inboard side.
-Primary exit R1.

This was F/A No. 3's third leg sequence that day. She met the first officer at the departure gate in DFW. She recalled being delayed out of DFW. She remembered some conversations regarding Nashville being their alternate. She claimed that the boarding process was rushed due to pilot duty time issues.

After take-off, the flight attendants delayed their service duties due to "bumpy air". They completed their service duties and picked up early at the Captain's instruction. Touch down seemed longer than usual.

She recalled that the landing was hard and fast with the aircraft bouncing and swerving. She believed that she was hit in the head and blacked out. A passenger yelling at her and F/A No. 1 awakened her. She could not stand and knew her leg was broken. A passenger carried her out of the wreckage.

There was rain, hail and a lot of lightning outside.

Flight Attendant No. 4 (F/A No. 4)
-Aft galley, aft facing jumpseat.
-Primary exit L2.

F/A No. 4 met both members of the flight crew prior to departure. She recalled discussing the cockpit's duty day and stated that the Captain said he was tired. They continued to discuss the weather and that Nashville would be their alternate airport. The boarding process was rushed and the agent assisted in closing the overhead bins once all passengers had boarded.

Once airborne, their service duties were delayed due to the "bumpy ride". The service was completed and the remainder of their service duties was expedited due to possible weather during their approach into Little Rock.

On approach into Little Rock she felt the aircraft make a couple of turns, felt the aircraft was going slower than usual and noticed rain outside the windows.

She stated that touch down seemed to take longer than usual. Once on the ground, she felt the aircraft sliding and heard a rumbling sound. The aircraft seemed to be "swaying and veering to the right". She began to yell "brace" and grabbed her knees. She felt a "thump" on the back of her head. She recalls landing on the lap of the passenger in seat 29D. She does not recall the aircraft coming to a stop nor did she recall getting up out of her jumpseat.

F/A No. 4 assessed her exit and noticed it "caved inwards and bent at the top" and that there was a "hole at the top of the door frame". She began directing passengers to the window exits because she noticed F/A No. 2 having trouble opening the tail cone exit door. She recalled two passengers helping F/A No. 2 open the exit door. She instructed passengers to follow her out of the hole on top of the L2 door. She exited feet first, stepping down the side of the aircraft and jumping to the ground. At least one passenger followed her out of the hole. She looked back at the aircraft and saw smoke and fire in the mid section of the cabin just aft of the window exits.

Outside she recalled heavy rain, marble size hail and strong winds.

2.8.5 Passenger Interview Excerpts

Seat 21A - Forward Left Window Exit
Male Passenger – Age unknown

The passenger stated he was at a left emergency exit in the middle of the cabin. He spoke with a flight attendant during boarding and recalled her saying that the F/A crew was tired. He read the safety-briefing card and the window placards because he knew he was seated in an exit row.

After impact he claimed he saw smoke and fire a few rows forward of him. He tried to open the window exit but was unable to. Another passenger had to assist him in opening the exit. He recalled seeing fire outside the exit and the wing was gone. He did not exit out of this window; he exited the aircraft out of one of the right window exits.

Seat 21D – Forward Right Window Exit
Male Passenger – Age 42

He recalled being asked about sitting in the exit row but did not know who asked him.

Once the aircraft crashed, he recalled flames around the ceiling, on the right hand side. He was seated in the aisle seat and went around to the exit behind him. He did not exit out of the window exit in his row. He did not know why. The passenger seated at this exit (Aft Right Window Exit, Seat 22F) was having problems opening the exit. He "reached into the pocket where the handle is" and opened the exit. He attempted to throw the exit out but it would not go. He dropped it into the cabin. He stepped onto the wing.

While on the wing, he pulled passengers out of the exit. He noted that the passengers were tripping on something inside the aircraft. He realized that they were tripping on the exit plug inside. He was able to reach into the cabin and pull the exit plug out of the aircraft.

Seat 21F – Forward Right Window Exit
Male Passenger – Age 74

He recalled a flight attendant briefing him on exit operation before departure. He looked at the safety-briefing card. He watched the safety demonstration prior to take-off.

After the aircraft landed, he was unable to open the exit next to him. He operated the handle but the window exit would not move. He pulled up on it and tried to lift it out. Someone reached in above him and opened the exit.

Seat 22A – Aft Left Window Exit
Male – Age 42

He did not look at the safety-briefing card or the safety demonstration.

Once the aircraft stopped moving, a female passenger next to him told him to open the exit. He had difficulty at first because he had not released his seat belt and could not reach the exit handle. He reached for the handle and the window popped out easily.

He does not recall what happened to the exit plug once he removed it from the window.

Seat 22D – Aft Right Window Exit
Male Passenger – Age 49

He is a frequent flier so he did not pay attention to the safety demonstration and he did not look at the safety-briefing card.

Once the aircraft stopped, he told the passenger in the "F" seat to open the exit. He saw the passenger "grappling" with the exit. The exit was pulled in and set on the seats.

Seat 22F – Aft Right Window Exit
Male Passenger – Age Unknown

He did not read the briefing card. He had a discussion with a flight attendant who claimed that she was tired and had already been on duty 13 hours.

After the aircraft crashed, the passenger in the aisle seat told him to open the window exit. He did not know he was in an exit row and recalled that no one ever discussed it with him. He looked at the window exit, saw the word "pull" and pulled on the handle. He thought that the exit would open outward. He unbuckled his seatbelt and pulled the

lever, then hit the exit hard with his shoulder from a crouching position. He pulled on the exit and ripped the top part of some sort of hinge. The exit opened and fell into his lap. He put the exit plug on the floor and exited out.

Seat 24 E
Female – Age 28

The female passenger was traveling with her 2 small children, age 4 and 25 months. The 4 year old was seated in 24 D and the 25 month old was seated in a child restraint in seat 24 F. She installed the child restraint into the seat and had used the restraint on prior flights. The restraint was secured to the best of her ability.

She recalled impact being very violent. She claims that she would not have been able to hold onto her youngest child had she been sitting in her lap.

After the crash she and her children exited through the aft right window exit. Other passengers in that area assisted her.

2.8.6 Rescue Operations – Emergency Response

Airport Information

The Federal Aviation Administration (FAA) has certified Little Rock Airport as an Aircraft Rescue and Fire Fighting (ARFF) index C[29] airport. Runway 4R/22L is 7200 feet long and 150 feet wide. The runway safety area is 500 feet wide and 451 feet from the runway threshold. Runway 22L is also equipped with a partially[30] frangible approach lighting system.

Airport Rescue and Fire Fighting Equipment

The Little Rock Airport ARFF Department is operated by the Little Rock Fire Department. In accordance with the applicable Federal Aviation Regulations[31] the ARFF Station was manned with 4 fire fighter personnel and 3 apparatuses, each containing 1500 gallons of water and 200 gallons of AFFF. The apparatuses were not equipped with Driver's Enhanced Vision Systems (DEVS)[32].

Emergency Response

At approximately 2355 CDT, according to witnesses, the Little Rock ARFF station was notified by the Little Rock controller of an American Airlines plane down on 4R. (The

[29] In accordance with FAR 139.315/317.
[30] A portion of the structure above runway elevation is considered frangible. The support structure located in the Arkansas River is non-frangible.
[31] FAR 139.315/317 – Index C Airport
[32] In 1996, the FAA produced AC 150/5210-19 giving guidance to ARFF apparatus to have DEVS installed to improve response times to accidents.

documented touch down time for AA flight 1420 was 2351 CDT.) The exact location of the aircraft was unknown by the controller. All ARFF apparatuses and personnel were dispatched to respond. Due to the unknown location of the aircraft and the poor weather conditions, which were hampering visibility and driving capabilities, the ARFF units proceeded cautiously to the approach end of runway 4R. Once no aircraft was located, the ARFF units began a sweeping search of 4R heading northwest. Several ARFF units reported hydroplaning on the runway. The aircraft was spotted on fire off the northern end of the runway of 4R. The wreckage site was difficult to reach, as there was no direct access to its location. The first unit reached the wreckage site at approximately 0011CDT. The fire was reportedly extinguished in less than 60 seconds. The Little Rock Fire Fighters stated in an interview that they did not don their Self Contained Breathing Apparatus (SCBA)[33] because their initial priority was to extinguish the fire immediately and donning the SCBA was time consuming. They also claimed that, initially, the four fire fighters were involved in the extinguishing of the fire and there were no other personnel available to begin rescue operations.

Once Rescue personnel were able to obtain access to the aircraft, several witnessed that the Emergency Floor Lighting System was operable and functioning in the forward part of the cabin. None recalled seeing overhead lights on.

The first 2 Metropolitan Emergency Medical Services (MEMS) units reported in the area at approximately 0017 CDT. They were unable to reach the wreckage site due to a locked gate on the access road. They proceeded to the south gate and obtained entry. The first three MEMS unit arrived at the accident site at 0022 CDT.

According to the Little Rock Fire Department, the total apparatuses that responded to the accident were 13 engine companies, 1 ladder truck, 1 heavy rescue unit, 1 hazardous materials unit, and 9 staff vehicles. 2300 gallons of AFFF and water were used to initially knock down the fire and a total of 520 gallons of AFFF concentrate. MEMS reported that 19 ambulances plus other support vehicles responded. A total of 40 to 50 patients were triaged and treated on-scene within 2 hours.

2.8.7 Survival Factors Analysis

Flashlights

F/A No. 1 and F/A No. 2 commented on the darkness of the cabin after impact. F/A No. 2 was unable to see in the tail cone until a lightning flash lit up the area. None of the 4 flight attendants obtained their flashlights located at their jumpseats. Once the tail cone exit door was opened, F/A No. 2 would have been unable to obtain her flashlight because the flashlight location is in the aft entry area on the right lower entry wall. Access to the flashlight is impossible when the door is open as the door opens inward and locks against the right entry wall. At the time of this accident, American Airlines' Flight Attendant Evacuation Procedures did not include flight attendants obtaining

[33] Standard equipment used by firefighters when atmospheric conditions may endanger personnel.

flashlights in an evacuation.[34] Currently, there is no hands-on training at American Airlines for flight attendants to practice obtaining the flashlights during an evacuation drill.

Emergency Lighting Systems

None of the Flight Attendants recalled seeing either of the Emergency Lighting Systems on. However, several Emergency Response Personnel witnessed an Emergency Lighting System operating in the forward portion of the aircraft. Currently, American Airlines' MD-82/83 fleet contains two different Emergency Floor Proximity Lighting Systems. Crewmembers are unaware which type of system is present until they board the aircraft. Furthermore, training on these systems depicting an actual demonstration of the systems especially during an emergency evacuation drill is limited.

Although the tail cone contains 3 emergency lights, the No. 2 F/A recalls that the tail cone was dark. However, several passengers recalled seeing lights in this area. There is no reference to emergency lights in the tail cone in American Airlines' Flight Attendant Safety Manual nor is it discussed during flight attendant emergency training. At the time of the accident, American Airlines' initial and recurrent training did not include emergency drills to operate emergency exits in the dark or with only emergency lights illuminated.

Emergency Locator Transmitter (ELT)

The presence of an operating ELT on the aircraft may have assisted ARFF personnel, trained on the ELT operation, in locating the wreckage site. According to the Public Hearing transcript the Little Rock Fire Chief testified that he believed that the Department's response time could have been reduced if the aircraft was equipped with an ELT and if his personnel were trained in using such equipment. [35] The Joint Aviation Authority, responsible for aviation regulation in Europe and representing the Civil Aviation Regulatory Authority, requires all aeroplanes to carry an ELT after January 1, 2002.[36] ICAO Annex 6 recommends all aeroplanes carry an ELT.[37]

Flight Attendant On-Duty Time

Flight Attendants numbers 1, 2 and 4 were on duty a total of 12 hours and 49 minutes on June 1, 1999. Their original scheduled duty day was 10 hours and 35 minutes. Flight Attendant number 3 was on duty a total of 9 hours and 30 minutes on June 1, 1999. Her original scheduled duty day was 7 hours and 16 minutes.

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[34] American Airlines' flight attendant Safety Manual, General Principles of Evacuation, section 130-2.1, revision dated October 15, 1998.
[35] Testimony by Chief Tyner, Little Rock Fire Department; Friday, January 28, 2000, page 1218.
[36] JAR-OPS 1.820- Emergency Locator Transmitter, dated February 1, 2001.
[37] ICAO Annex 6- 6.17.3.

F/A No. 1 admitted to the agent prior to leaving DFW that the flight attendants were tired. The passenger in seat 21A recalled a flight attendant stating that they were tired. The passenger in seat 22F recalled having a conversation with a flight attendant who stated that they were tired and had been on duty 13 hours.

At the Public Hearing, American Airlines Vice Chairman, Robert Baker testified to American's fatigue policy for crewmembers.[38] He explained that American has a no-fault policy if and when a crewmember calls in fatigue. He continued by saying that that crewmember would receive no "adverse consequences" for that action. When asked, in further testimony, "if this fatigue policy continued past the cockpit door", he replied that he was unable to answer.

Currently at American Airlines, there is no fatigue policy for flight attendants.

The expectation for these cabin crewmembers to perform safety responsibilities, especially in an accident, with such an extended duty day may be unrealistic and a high-risk practice.

Passenger Briefings in Emergency Exit Rows

Passenger interviews revealed that several of the passengers (Seat 22A and Seat 22F) did not know that they were in an emergency exit row. The seats mentioned above were located adjacent to the overwing emergency exit. The passenger in Seat 22A stated that a female passenger next to him told him to open the exit. The passenger in Seat 22F stated that he did not know he was seated at an emergency exit. Neither passenger looked at the passenger safety-briefing cards.

All passengers seated in the exit row obtained their seat assignments from the customer service agents prior to boarding. Once boarding began, and approximately 5 minutes prior to departure, the No. 1 F/A made a Public Announcement (P.A.) instructing passengers seated in the exit rows to refer to the safety-briefing card for the exit row criteria. Prior to the aircraft doors being closed, the flight attendants were required to make a "visual check" of the passengers seated in the exit rows to ensure compliance to the exit row criteria.[39] American Airlines' procedures did not require flight attendants to verbally brief passengers in exit rows of emergency exit operation.

The National Transportation Safety Board's Safety Study on Emergency Evacuation of Commercial Airplanes, adopted June 27, 2000, made a recommendation to the Federal Aviation Administration that all passengers seated in an exit row receive a preflight personal briefing on what to do in the event the exit may be needed in an emergency.[40]

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[38] Testimony by Robert Baker, Vice Chairman of American Airlines; Thursday, January 27, 2000, pages 481, 505, and 506.

[39] American Airlines' flight attendant Safety Manual, Exit Row Procedures, section 100-4.8, 4.9, revision dated May 15, 1999.

[40] NTSB Recommendation number A-00-77.

Overwing Emergency Hatch Placement

The safety-briefing card, the placards above the overwing emergency exits and flight attendant procedures[41] all direct that the overwing exit be placed in a seat once removed. According to the passenger interviews, the passengers in seats 21D, 22D, and 22F either witnessed or personally placed the overwing exit hatch either on the floor or in the adjacent seat. The passenger in seat 22F further stated that he attempted to throw the exit out the window but was unable to. He exited out of the window and stood on the wing and assisted passengers out. He noticed that passengers were tripping on something inside the cabin while exiting. He realized that it was the hatch. He reached into the cabin and pulled the hatch out.

Overwing Exit Operation Placards

Above each overwing emergency exit were placards affixed to the aircraft with graphic instructions on the exit operation. There were a series of 5 graphic pictures on the placard. Graphic number 3 showed an illustration of a person removing the hatch from the window. Arrows above the hatch illustrate that the person is to lift the window upward. Actual operation of the exits is to pull on the exit handle and pull the exit inward.[42] Lifting up on the hatch hampers exit operation and is not required. The passenger in seat 21F at the Forward Right Emergency Exit stated in his interview that he pulled up on the hatch and tried to lift it out. He did not open the exit. Someone reached over him and opened the exit. The passengers seated in seats 21A, 21D, 21F, 22A, and 22D and 22F stated in their interviews that they personally experienced or witnessed various degrees of difficulty in operating the overwing emergency exit.

Use of Child Restraints

The passenger seated in 24 E placed her 25-month old child in a child restraint, and secured it to seat 24 F. The passenger stated in her interview and testified at the Public Hearing[43] that she would have been unable to hold her child securely in her lap. She testified that the use of the child restraint protected her child from serious injury on AAL flight 1420.

The mandated use of child restraints is currently on the National Transportation Safety Board's Most Wanted Transportation Safety Improvements.[44]

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[41] American Airlines' flight attendant Safety Manual, S-80 General Emergency Procedures, S-80 Window Exit Operation, section S80-5.1, revision dated August 15, 1998.

[42] American Airlines' flight attendant Safety Manual, S-80 General Emergency Procedures, S-80 Window Exit Operation, section S80-5.1, revision dated August 15, 1998.

[43] Ms. Manus testified at the Public Hearing on Friday, January 28, 2000. A transcript of her testimony is located in the Public Hearing Transcripts; Friday, January 28, 2000, beginning on page 1129.

[44] This list is dated May 3, 2000.

Rescue Operations

The Little Rock ARFF station was notified by the controller of an aircraft down on 4R. Due to this limited amount of information, the ARFF apparatuses proceeded to the approach end of the runway. The aircraft was actually located at the opposite end of the runway, down an embankment.

The Little Rock ARFF station apparatuses were not equipped with DEVS, of which the Forward Looking Infrared (FLIR) [45] subsystem may have assisted the ARFF personnel in the location of the wreckage.

Interviews of the ARFF personnel revealed that they were unable to begin rescue operations once reaching the accident site due to limited personnel resources.[46]

[45] A night vision device that improves visual awareness in smoky, foggy, or dark environments by sensing thermal radiation instead of visual light.

[46] The Little Rock ARFF Department was staffed with 4 fire fighting personnel.

3. CONCLUSIONS

3.1 The flight crew was properly certificated, qualified, and scheduled in accordance with 14 CFR 121.

3.2 The aircraft was properly certificated and airworthy.

3.3 The flight was dispatched in accordance with 14 CFR 121.

3.4. Thunderstorms of NWS VIP levels five and six were present in the airport area.

3.5 The flight crew was not trained by the operator to differentiate between thunderstorm intensities, nor was adequate reference guidance provided in operating manuals.

3.6 The flight crew was not adequately trained by the operator in the operation of the aircraft weather radar, nor was adequate guidance provided in operating manuals. If operated as recommended by the aircraft operating manual, the intensity of the thunderstorms would not have been accurately displayed.

3.7 Sufficient precipitation was available to create a flooded condition for the entire length of the runway.

3.8 Analysis of the flightcrew's performance and errors committed during the flight of AA 1420 reveals definite characteristics of impairment due to fatigue. These include degradation in judgment and decision-making (cognitive problems), channeled thinking, fixation, loss of initiative, memory impairment, and a willingness to accept less in performance standards.

3.9 AA Wind Landing Limits policy was not satisfied because crosswind limitations were exceeded.

3.10 AA DC-9 Windshear Guidance policy was not satisfied because the criteria of thunderstorms, rain, strong winds, and windshear alerts were present and the action of diversion, go-around, or holding was not initiated. The pilot-not-flying did, however, call for go-around.

3.11 The flight crew did not recognize the hazard associated with the deterioration of RVR to 1600 feet caused by heavy rain.

3.12 The approach became unstable at 100 feet and the GPWS alerted.

3.13 The CVR did not record the spoiler arming challenge or response on the Before Landing Checklist, nor the announcement "Before Landing Checklist Complete." The CVR did not record autospoiler actuation or malfunction. The FDR did not record any ground spoiler deployment.

3.14 The operator's flightcrew procedures varied from the manufacturer's Flight Crew Operating Manual in regard to recommended spoiler operation.

3.15 The operator failed to observe recommendations of the manufacturer's All Operators Letter 9-058.

3.16 Operating manual aircraft performance data inadequately covers the variables of actual aircraft operating conditions.

3.17 Evidence from this accident and others similar indicates that research of tire traction dynamics is incomplete. The conditions existing at the accident runway contributed to the inability of the aircraft to establish traction and braking friction. It is probable that wheel rotation was inhibited. Present science inadequately explains the evidence found at this accident.

3.18 The environmental conditions existing at the runway exceeded the certificated, demonstrated, and practical capabilities of the aircraft to establish directional control and decelerate on the runway or within the Runway Safety Area.

3.19 The Runway Safety Area associated with the accident runway was inadequate.

3.20 The absence of an ELT on the aircraft contributed to delayed notification of ARFF resources.

3.21 The absence of available vision enhancement devices on ARFF apparatus inhibited the search for the accident aircraft.

3.22 The lack of functional access from the airfield operating surfaces to perimeter areas delayed ARFF access to the accident aircraft, thus delaying rescue and fire suppression.

3.23 Fatal injuries from the effects of fire were sustained by five passengers who had survived impact.

4. PRINCIPAL AND ANCILLARY FAILURES

4.1 Principal Failures

1. The inability of the aircraft to decelerate after landing to stop on the available runway or within the Runway Safety Area due to environmental conditions that exceeded the performance capability of the aircraft.

2. The application of an inadequate risk-assessment strategy to the environmental conditions by the flightcrew due to impairment by fatigue.

3. Performance degradation of the flightcrew in the execution of critical procedures due to impairment by fatigue.

4.2 Ancillary Failures

1. Inadequate operator training programs in meteorology and aircraft weather radar operation.

2. Inadequate regulatory oversight of training and operator programs.

3. The failure of the regulatory agency to ensure availability and dissemination of critical weather services to the aviation community.

4. The failure of the aircraft manufacturer to equip this model aircraft with error-tolerant critical systems.

5. The failure of the aircraft manufacturer to equip this model aircraft with active warnings related to critical systems.

6. The failure of the operator to incorporate the aircraft manufacturer's recommendations into operating manuals.

7. The failure of the accident airport authority to monitor and report runway conditions.

8. The failure of the regulatory agency to ensure charting of non-standard Runway Safety Areas.

9. The failure of the accident airport authority to assure accessibility to airfield perimeter areas by ARFF resources.

5. RECOMMENDATIONS

by the Allied Pilots Association

5.1 Hour-of-service regulations for flight and cabin crewmembers should be effected to reflect contemporary science on fatigue.

5.2 Existing Federal Aviation Regulation related to operator training programs should be enforced.

5.3 Formal programs should be established between FAA and National Weather Service to ensure the delivery of critical meteorological information to the aviation community, particularly WSR-88D products.

5.4 Critical flight information including the existence of non-standard Runway Safety Areas should be charted.

5.5 Amend FAA Order 7110.65M section 2-1-6 to add language to include hazardous environmental conditions to Safety Alert criteria.

5.6 The aircraft manufacturer should incorporate a warning indication to advise flightcrews of the abnormal operation of critical flight controls.

5.7 Fatigue awareness training should be incorporated into the operator's training program for all crew members

5.8 Technologies should be evaluated for strengthening frangible materials used in airfield facility structures.

5.9 Advanced research should be conducted to determine if wet runway phenomena beyond current theory exist.

6. RECOMMENDATIONS

by the Association of Professional Flight Attendants

To the Federal Aviation Administration:

6.1 Amend FAR 121.309, Emergency Equipment, to include an Emergency Locator Transmitter or a comparable locator device on all passenger aircraft.

6.2 To continue reviewing the current FAR 121.467 addressing Flight Attendant Duty Limitations and Rest Requirements and accomplish practical research in the area of fatigue and performance in safety sensitive functions, especially those who are required to perform physical and mental activities in an emergency.

6.3 Amend FAR 121.585, Exit Row Seating, section (h) and (i) to include each Certificate Holder shall further verify that all passengers seated in an exit row are thoroughly briefed on exit operation by a working crewmember on that flight and that crewmember will verify that the passenger meets the criteria set forth by the regulation.

6.4 Require all Certificate Holders who operate aircraft with an overwing, detachable hatch (Type III exits) to change their procedures on the hatch placement once removed from the exit during an evacuation. The hatch should be thrown out of the window.

6.5 Amend FAR 121.311, Seats, safety belts, and shoulder harnesses, (and all applicable FARs contained in 14 Code of Federal Regulations) to mandate that all occupants be restrained during takeoff, landing, and turbulent conditions, and that all infants and small children be restrained in a separate seat in a manner appropriate for their size.

6.6 Amend FAR 139.317, Aircraft rescue and firefighting: Equipment and agents, to include the recommendation of the use DEVS or a mandatory subpart of the system, specifically FLIR, with approval from the Administrator.

6.7 Amend FAR 139.319, Aircraft rescue and firefighting: Operational requirements, to ensure that airports meet minimum ARFF response time requirements with sufficient personnel to require strategic and tactical operations which would likely occur simultaneously or concurrently in the initial stages of the event. For example:

-Command- incident organization
-Rescue- passenger evacuation and passenger extrication
-Firefighting operations- exterior attack, interior attack
-Medical operations- occupant assembly, triage, treatment

To American Airlines:

6.8 Standardize the Emergency Floor Proximity Lighting System on the entire MD 82/83 fleet to one type.

6.9 Equip the MD-80 cabin trainer, including the tail cone area, with the standardized Emergency Floor Proximity Lighting System and allow flight attendants to be exposed to and practice their emergency drills annually with only the those Emergency Lights illuminated.

6.10 Relocate the flashlight at the aft bulkhead wall so that it is obtainable when the tail cone exit door is opened. Also, locate a flashlight in the actual tail cone area.

6.11 Revise flight attendant emergency procedures, adding the procedure to obtain the emergency flashlight during an evacuation. Incorporate this procedure into flight

attendant initial and recurrent training on all aircraft types so that the flight attendant can practice obtaining the flashlight during an emergency drill.

6.12 Adopt a no-fault fatigue policy for flight attendants, equal to that of American Airlines' Flight Department's policy for their pilots.

6.13 Redesign the Overwing Exit Operation Placards to reflect accurate information on exit operation.

6.14 Alter type III evacuating procedures, on all aircraft with removable hatches, to throwing the hatch out of the aircraft once removed from the exit as opposed to bringing the hatch into the aircraft.