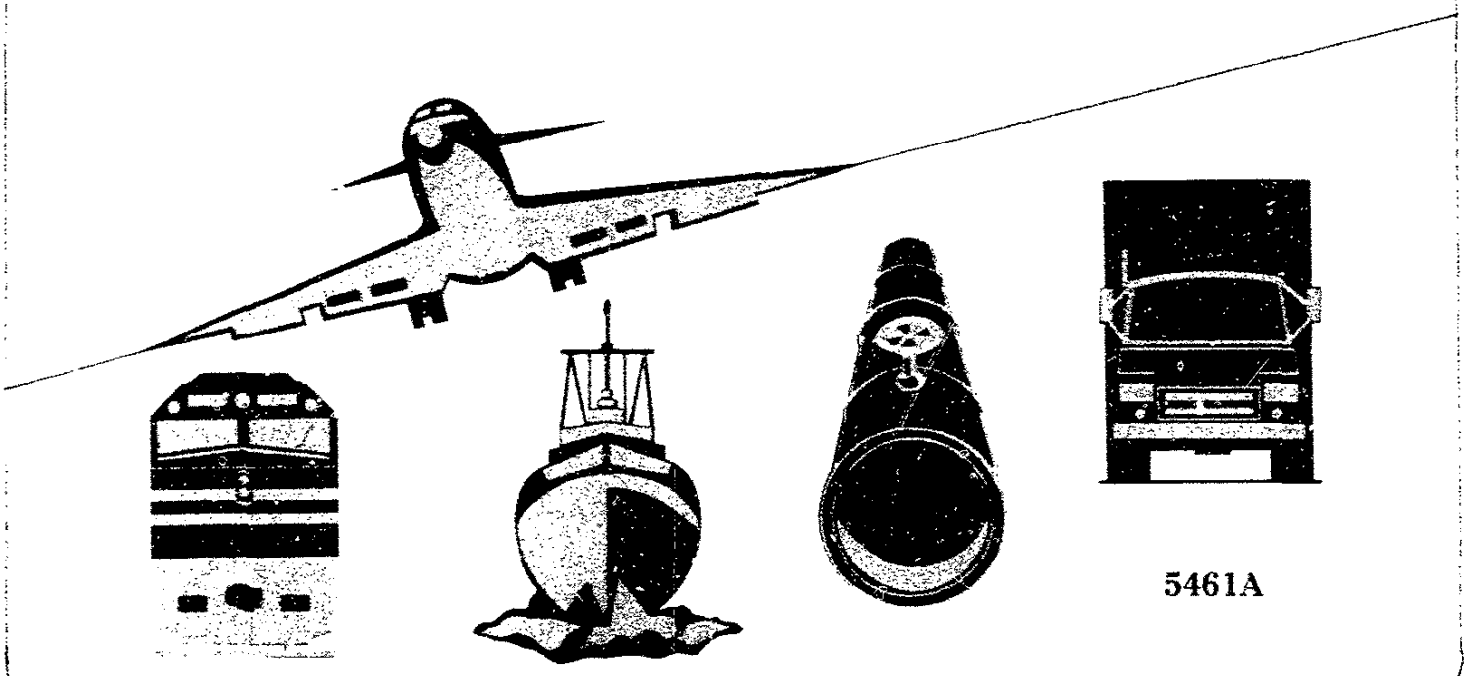
PB91-910409
NTSB/AAR-91/08

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

RUNWAY COLLISION OF USAIR FLIGHT 1493, BOEING 737 AND SKYWEST FLIGHT 5569 FAIRCHILD METROLINER LOS ANGELES INTERNATIONAL AIRPORT LOS ANGELES, CALIFORNIA FEBRUARY 1, 1991



5461A

The National Transportation Safety Board is an independent Federal agency dedicated to promoting aviation, railroad, highway, marine, pipeline, and hazardous materials safety. Established in 1967, the agency is mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The Safety Board makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

Information about available publications may be obtained by contacting:

National Transportation Safety Board
Public Inquiries Section, RE-51
490 L'Enfant Plaza East, S.W.
Washington, D.C. 20594
(202)382-6735

Safety Board publications may be purchased, by individual copy or by subscription, from:

National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161
(703)487-4600

NTSB/AAR-91/08 PB91-910409

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

RUNWAY COLLISION OF USAIR FLIGHT 1493, BOEING 737 AND SKYWEST FLIGHT 5569 FAIRCHILD METROLINER LOS ANGELES INTERNATIONAL AIRPORT LOS ANGELES, CALIFORNIA FEBRUARY 1, 1991

Adopted: October 22, 1991
Notation 5461A

Abstract: This report explains the collision of USAir flight 1493 and Skywest flight 5569 on a runway at the Los Angeles International Airport on February 1, 1991. The safety issues discussed in the report are air traffic management and equipment at the airport; aircraft exterior lighting and conspicuity; pilot situational awareness during takeoff and landing and operations on airport surfaces; air traffic controller workload, performance, and supervision; and air transport accident survivability, evacuation standards and procedures, interior furnishing flammability standards, and survival devices. Recommendations concerning these issues were made to the Federal Aviation Administration.

CONTENTS

5. **APPENDIXES**

EXECUTIVE SUMMARY

On February 1, 1991, at 1807 Pacific standard time, USAir flight 1493, N388US, a Boeing 737-300, collided with Skywest flight 5569, N683AV, a Fairchild Metroliner (SA-227-AC), while the USAir airplane was landing on runway 24 left at Los Angeles International Airport, Los Angeles, California. The Skywest Metroliner was positioned on the same runway, at intersection 45, awaiting clearance for takeoff. As a result of the collision, both airplanes were destroyed. All 10 passengers and 2 crewmembers aboard the Metroliner and 20 passengers and 2 crewmembers aboard the USAir airplane were fatally injured.

The National Transportation Safety Board determines that the probable cause of the accident was the failure of the Los Angeles Air Traffic Facility Management to implement procedures that provided redundancy comparable to the requirements contained in the National Operational Position Standards and the failure of the FAA Air Traffic Service to provide adequate policy direction and oversight to its air traffic control facility managers. These failures created an environment in the Los Angeles Air Traffic Control tower that ultimately led to the failure of the local controller 2 (LC2) to maintain an awareness of the traffic situation, culminating in the inappropriate clearances and subsequent collision of the USAir and Skywest aircraft. Contributing to the cause of the accident was the failure of the FAA to provide effective quality assurance of the ATC system.

The safety issues raised in this report include:

- Air traffic management and equipment at Los Angeles International Airport.
- Aircraft exterior lighting and conspicuity.
- Pilot situational awareness during takeoff and landing and operations on airport surfaces.
- Air traffic controller workload, performance, and supervision.
- Air transport accident survivability, evacuation standards and procedures, interior furnishing flammability standards, and survival devices.

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

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20594

AIRCRAFT ACCIDENT REPORT

RUNWAY COLLISION
OF USAIR FLIGHT 1493, BOEING 737 AND
SKYWEST FLIGHT 5569 FAIRCHILD METROLINER
LOS ANGELES INTERNATIONAL AIRPORT
LOS ANGELES, CALIFORNIA
FEBRUARY 1, 1991

1. FACTUAL INFORMATION

1.1 History of the Flights

On February 1, 1991, at 1807 Pacific standard time, USAir flight 1493 (USA1493), N388US, a Boeing 737-300 (B-737), collided with Skywest flight 5569 (SKW5569), N683AV, a Fairchild Metroliner (SA-227-AC), while USA1493 was landing on runway 24 left at Los Angeles International Airport (LAX), Los Angeles, California. SKW5569 was positioned on the same runway, at intersection 45, awaiting clearance for takeoff. (See figure 1). As a result of the collision, both airplanes were destroyed. All 10 passengers and 2 crewmembers aboard the Metroliner and 20 passengers and 2 crewmembers aboard the B-737 were fatally injured.

A special weather observation taken after the accident indicated a scattered cloud cover at 30,000 feet and a visibility of 15 miles. The official sunset for the Los Angeles area occurred at 1723.

On the morning of February 1, 1991, Skywest Airlines began its daily utilization of N683AV in Palm Springs, California (PSP). The airplane was subsequently operated under Title 14 Code of Federal Regulation (CFR) Part 135 to several southern California destinations. The Skywest flightcrew involved in the accident boarded N683AV at Inyokern, California, (IYK). They flew the airplane from IYK to LAX and from LAX to Fresno, California (FAT), returning to LAX. The accident occurred on the next flight, an intended departure for Palmdale (PMD), California, from LAX. There were 10 passengers and 2 flight crewmembers on board.

USA1493 originated in Syracuse, New York (SYR), with airplane N388US, and was destined to San Francisco, California (SFO), by way of planned intermediate stops in Washington, D.C. (DCA), Columbus, Ohio (CMH), and LAX. There was a scheduled crew change in Washington. The flight was conducted in accordance with Title 14 CFR Part 121. En route activity before the accident was unremarkable. There were 89 passengers, 4 flight attendants, and 2 flight crewmembers aboard the airplane for the CMH-LAX route segment.

USA1493's instrument flight rules (IFR) dispatch release, minimum equipment list (MEL), airplane load manifest, and recommended takeoff/landing data were generated by USAir's dispatch office and forwarded to the

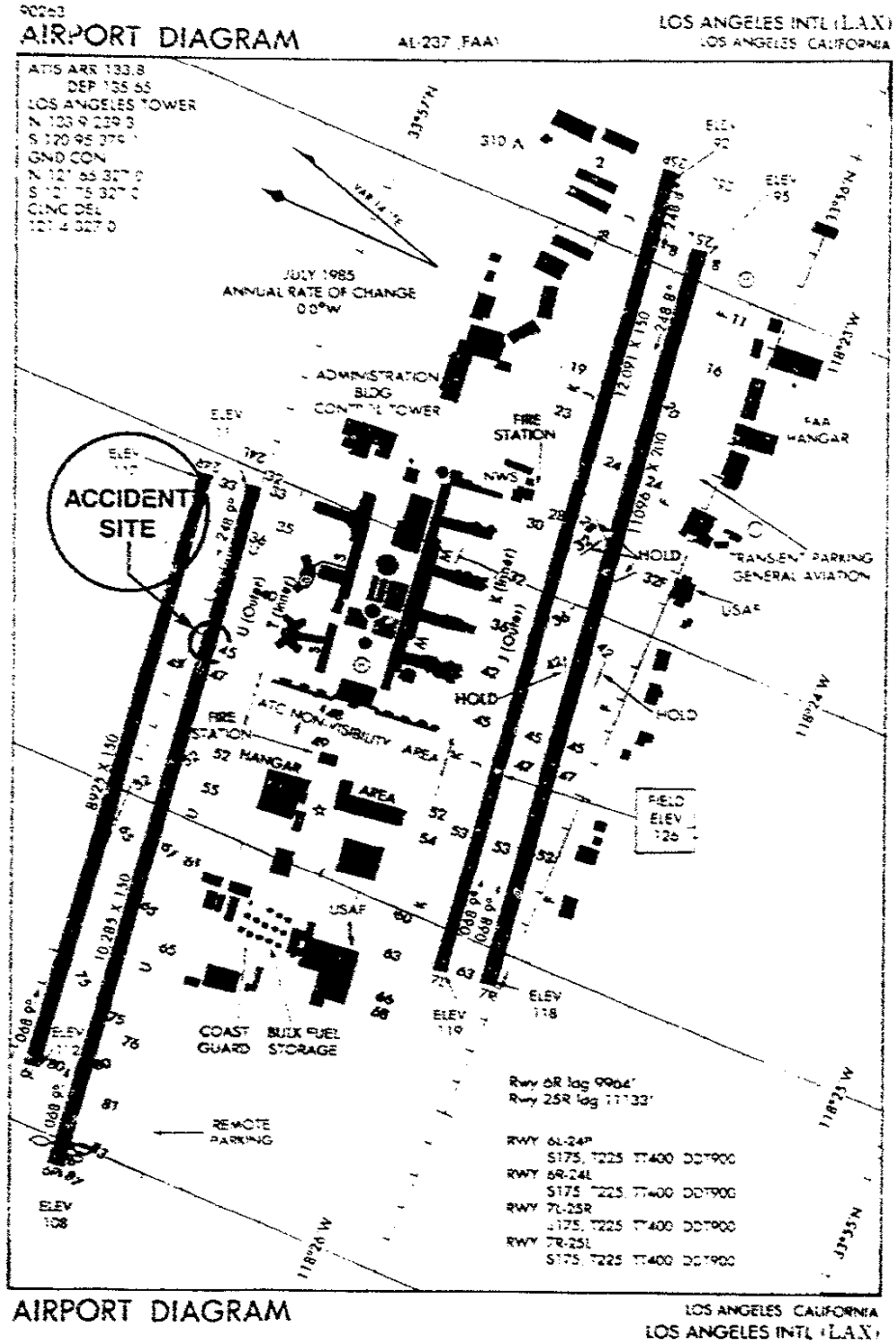


Figure 1.--Airport diagram.

flightcrew at CMH. En route time was 4 hours and 43 minutes at an altitude of flight level 350 (35,000 feet). The airplane departed CMH at 1317 with the first officer performing the flying duties. The takeoff, climb, cruise, en route and descent phases of the flight were uneventful.

Upon arrival into the LAX area, USA1493 was cleared for the CIVET Two Profile Descent[1] to LAX. While on the CIVET Profile, the LAX terminal radar approach control (TRACON) arrival radar 1 (AR1) controller instructed the flight at 1757:28 to intercept the runway 24 right instrument landing system (ILS) localizer (See figure 2) and to maintain 10,000 feet.

At 1759:00, the AR1 controller asked, "USA1493, do you have the airport in sight." At 1759:04, the captain advised, "affirmative" and also confirmed to the first officer that he had visually acquired the airport. The first officer recalled that at this point the flight was approximately 25 miles from the airport and that he could distinguish the airport environment and some runways.

At 1759:06, the AR1 controller advised USA1493, "cleared visual approach runway two four left USA1493 cross DENAY[2] at or above eight thousand." The captain acknowledged the approach clearance.

At 1759:57, USA1493 transmitted, "just confirm the visual approach for USA1493 is to two four left." The AR1 controller replied, "that's correct USA1493."

At 1803:05 the AR1 controller advised USAir 1493 to contact Los Angeles tower at ROMEN.[3]

The first officer said that the horizon was dark during the approach and landing. He lined up visually for runway 24 left and used the ILS glideslope for runway 24 right for initial vertical flightpath guidance since there was no operating ILS or visual approach slope indicator (VASI) for runway 24 left. The first officer recalled configuring the airplane for landing approximately 12 miles from the runway and confirmed to the captain that he had the runway in sight. During the approach, he called for gear down, final checklist, and responded in accordance with USAir procedures on dual response items, including "flaps 30."

---

[1] CIVET Two Profile Descent is one of several published arrival procedures intended to facilitate the flow of arriving aircraft into the Los Angeles area.

[2] DENAY is the name of the initial approach radio navigation fix for the runway 24 left ILS. It is approximately 23 miles from the threshold of runway 24 left.

[3] ROMEN is the name of the final approach radio navigation fix for the runway 24 left ILS. It is approximately 6.2 miles from the threshold of runway 24 left.

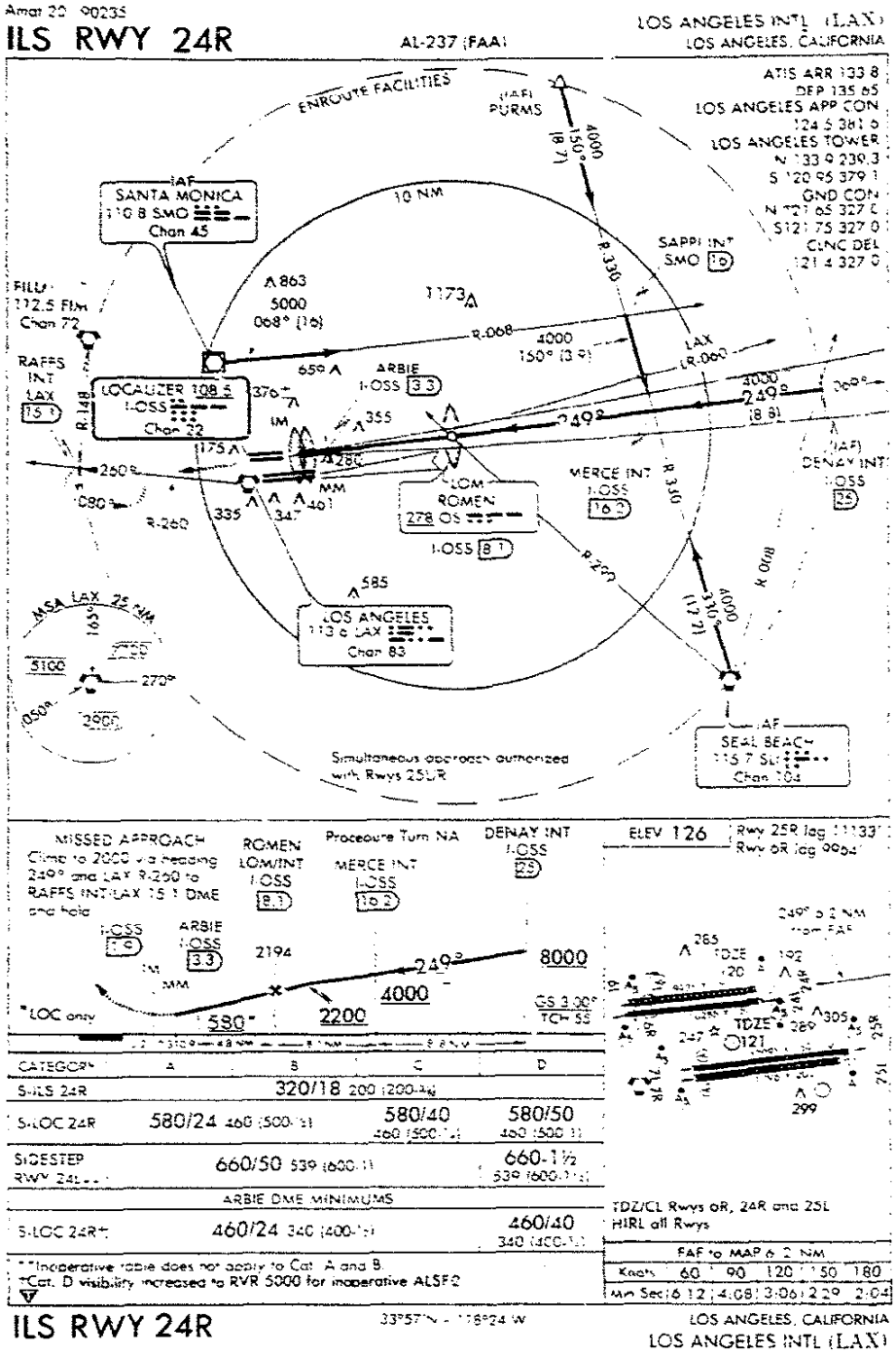


Figure 2.--ILS runway 24 right.

About 5 minutes earlier, around 1758, SKW5559 had begun to taxi via the north route from Terminal 6, Gate 32 to runway 24 left for departure (See figure 3). At 1801:43, SKW5569 advised the ATC tower's north ground controller (GC2) "...number two at [taxiway] Tango behind an Aero Mexico airplane." At 1801:49, the GC2 advised SKW5569, "...roger, hold short Tango for right now, Aero Mexico will be moving in just a minute."

At 1802:43, the GC2 instructed the flight, "...when able turn right on Tango and then at forty five transition to Uniform, taxi to runway two four left." SKW5569 acknowledged, "Tango, forty five Uniform, two four left...."

At 1803:38, SKW5569 initiated communication with the tower's local controller 2 (LC2) on frequency 133.9 MHz stating, "Skywest ah five sixty nine at forty five, we'd like to go from here if we can." At 1803:40, the LC2 advised the flight, "Skywest five sixty nine taxi up to and hold short of two four left." At 1803:44, SKW5569's acknowledgement of this clearance was "Roger, hold short."

At 1804:33, the captain of USA1493 initiated radio communication with the LC2 on 133.9 MHz stating, "USAir fourteen ninety three inside ROMEN." The tower communications transcript indicates that this transmission was received; however, it was not acknowledged by the LC2.

At 1804:44, the LC2 stated, "Skywest five sixty nine taxi into position and hold runway two four left, traffic will cross downfield." SKW569 acknowledged the LC2's clearance at 1804:49, "okay two four left position and hold, Skywest five sixty nine." This transmission was the last one recorded from SKW5569.

Wings West 5006 (WW5006), a Metroliner at midfield taxiway 52, was waiting to cross runway 24 left. The flightcrew of WW5006 had unintentionally departed the LC2 tower frequency, and the controller was unable to issue a clearance to cross that runway, resulting in a delay. When the WW5006 crew discovered the frequency error, they returned to tower frequency, contacted LC2, and were cleared to cross runway 24 left at 1805:16. SKW5569 continued to hold for takeoff clearance in the center of runway 24 left at the intersection with taxiway 45.

At 1805:29, the captain of USA1493 transmitted a second radio call to the LC2 stating, "USAir fourteen ninety three for the left side, two four left."

The LC2 conducted other radio transmissions and, at 1805:53, stated, "USAir fourteen ninety three cleared to land runway two four left." The captain acknowledged at 1805:55, "Cleared to land two four left, fourteen ninety three." This recorded voice transmission was the last one received from USA1493. The controller then conducted transmissions with other airplanes, including a departing Metroliner and two airplanes awaiting takeoff, WW5072, a Metroliner, and Southwest 725 (SWA725), a B-737.

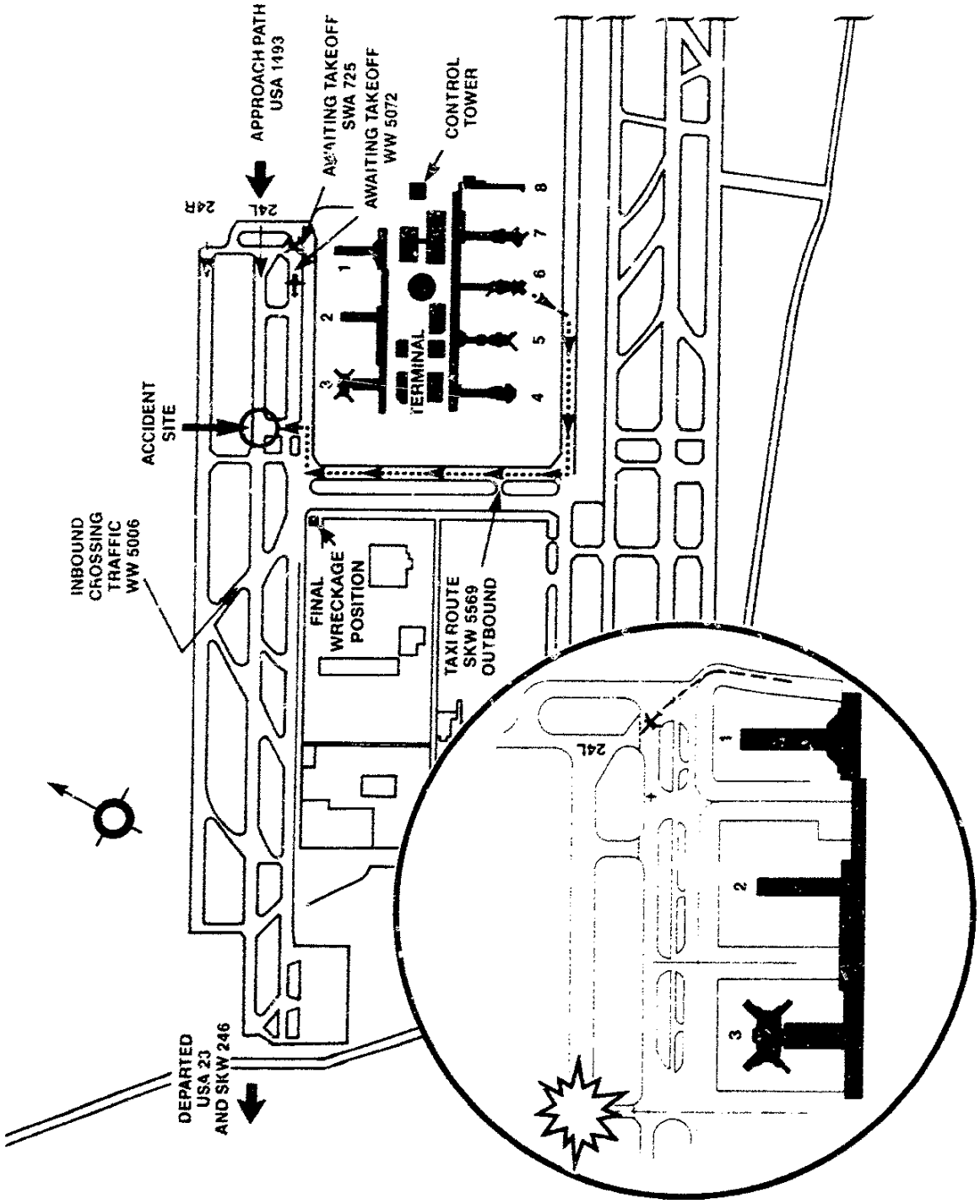


Figure 3.--Airport layout with traffic movements.

WW5072 called the LC2 at 1806:08 and stated that they were ready for takeoff. The LC2 had no flight progress strip in front of her for this airplane. She queried the flightcrew about their intended departure intersection and consulted her supervisor regarding the strip. Then, at 1806:30, she verified with the flightcrew that they had a departure squawk (radar code) indicating that the departure clearance had been issued. A search for the strip was conducted and the strip was located at the clearance delivery (CD) position, misfiled as a yet to be delivered departure clearance.

The first officer on USA1493, who was flying the approach, recalled hearing side conversations which included the tower asking an airplane about its position on the ground. He did not recall hearing hold or takeoff clearances for any aircraft for runways 24 left or 24 right. He remembered seeing aircraft that appeared to be taxiing toward him on taxiway Uniform. He said that he looked down the runway and saw the runway lights and the overall landing environment. He had no recollection concerning the runway centerline lighting but believed that the runway edge lights were on low intensity. He stated that the cockpit interior lighting was at normal intensity. He said that he did not see an airplane on the runway and did not recall any distractions during the approach.

The first officer said that he considered the approach stabilized by the time the flight reached 1,000 feet mean sea level (msl). At 500 feet, he heard the captain call out, "500 feet, bug plus 10." He confirmed that the landing light switches were in the "on" position. The autobrake feature was not selected. The first officer stated that he thought the airplane crossed the threshold at an indicated airspeed of approximately 130 knots and landed on the main landing gear about 1,500 feet from the approach end of the runway on the runway centerline. He deployed the thrust reversers and observed the engine reverse lights. He was not sure if the thrust reversers had fully deployed at the time of the accident. He said that he derotated slowly per company procedures. While lowering the nose of the airplane onto the runway, he observed, through his windscreen, an airplane on the runway immediately in front of and below him. He said that the airplane had a position light and/or a red light on its tail. The landing lights of his airplane were reflected off the propellers of the airplane in front of him.

The first officer said that there was some application of braking before the collision but that there was insufficient time for evasive action. He believed that the initial point of impact was directly on the nose of his airplane and the tail of the unidentified airplane. He said that the collision occurred simultaneous to his airplane's nose wheel contacting the runway. The collision was marked by a flash of light followed by the nose of his airplane dropping. There was an explosion and fire upon impact.

After the collision, the two airplanes slid to the left side of the runway and into an unoccupied fire station. An evacuation of 64 passengers,[4] 3 cabin crewmembers, and the first officer took place on the B-737 while the scene was involved in fire. A total of 20 passengers and 2 crewmembers on USA1493 were fatally injured. All 10 passengers and 2 crewmembers on SKW5569 were fatally injured.

The accident occurred at 33° 57′ north latitude, and 118° 24′ west longitude, during the hours of darkness.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others	Total
Fatal	2*/2**	10*/20**	0	34
Serious	2**	11**	0	13
Minor	2**	15**	0	17
None	-	37**	-	37
Total	8	93	0	101

* Aboard the Metroliner
** Aboard the B-737

1.3 Damage to Aircraft

Both airplanes were destroyed by impact forces of the collision and a postcrash fire. The value of the Fairchild Metroliner was estimated at $1,600,000 and the Boeing 737-300 was estimated at $20,000,000 prior to the accident.

1.4 Other Damage

There was minor damage to an inactive and unoccupied airport satellite fire station.

1.5 Personnel Information

1.5.1 USAir Crewmembers

The flightcrew and cabincrew of USA1493 were qualified in accordance with applicable Federal Aviation Administration (FAA) and company regulations and procedures. (See appendix B). The examination of crewmember training records revealed nothing remarkable. An investigation of the captain's background revealed the long-term use of a prescription drug

---

[4] One of these passengers succumbed to thermal burn accident-related injuries 3 days after the accident and is listed as a fatality. Another passenger succumbed to thermal burn accident-related injuries 31 days after the accident. In accordance with 49 CFR 830.2, his injuries were classified as "serious" in Section 1.2.

prohibited for flightcrews. Pertinent details are contained in section 1.13 of this report.

The accident occurred on the first day of pairing for the flightcrew following off-duty time. On February 1, 1991, they arrived at DCA at midmorning. According to their colleagues, they appeared to be well rested.

1.5.2 Skywest Airlines Crewmembers

The flightcrew was qualified in accordance with applicable FAA and company regulations and procedures (See appendix B). No cabin crewmembers were assigned to this flight. The investigation of the flightcrew's background revealed nothing remarkable. Autopsy results from the first officer indicated the presence of substances found in over-the-counter medications. Details are contained in Section 1.13 of this report. The flightcrew received more than 10 hours of off-duty time prior to reporting for duty on February 1, 1991.

1.5.3 ATC Specialists

The air traffic controllers who provided ATC services to the airplanes were qualified in accordance with current regulations. Examination of their training records revealed nothing remarkable with one exception. The LC2 had received an evaluation 6 weeks before the accident in which five performance deficiencies were identified. The investigation identified some of the same deficiencies in her performance on the night of the accident that are dealt with at length in subsequent sections of the report.

The investigation of these controllers' activities in the 2 or 3 days before reporting for duty on February 1 did not reveal anything extraordinary. Questions were raised regarding the LC2's medical history. The subject was addressed at the Safety Board's public hearing and the FAA reiterated that she was medically qualified for her position. See section 1.13 for details.

1.6 Airplane Information

1.6.1 Skywest Fairchild Metroliner

The Fairchild Metroliner was certificated in 1981 under 14 CFR Part 23 - Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes, and under Special Federal Aviation Regulation (SFAR) Part 41. Approval was based on the SA-226 airplane certificated in 1969. N683AV was manufactured in 1986. By December 31, 1990, more than 250 airplanes had been produced.

For commuter service, the Metroliner carries two flight crewmembers. It can seat as many as 19 passengers. The airplane has a certificated gross takeoff weight of 14,500 pounds.

External lighting on N683AV consisted of navigation lights, landing/recognition lights, a taxi light, ice detection lights, strobe lights, and a red anticollision beacon (See figure 4). The beacon light assembly is located on top of the vertical stabilizer forward and below the rudder cap and rudder trailing edge (See figure 5). The location of the beacon light relative to the ruoder cap results in some light obstruction; 14 CFR Part 23 permits such obstruction. The rudder cap blocks visibility of the light to an angle of 5.4 degrees above the horizontal and 2.6 degrees left and right of the centerline directly to the rear of the airplane. The beacon light luminance for certification was a candle power of 100 candles; actual luminance was 110 candles.

Skywest procedures dictated that illumination of the strobe lights, taxi light and landing and recognition lights take place after receipt of a takeoff clearance.

The airplane's weight and center of gravity (CG) at the time of the accident was about 12,500 pounds and 265.9 inches, respectively, which were within applicable limits. The takeoff weight included 1,200 pounds of fuel.

N683AV was equipped with an audio system designed to handle radio functions, as well as all onboard communications involving paging, the cabin hand telephone and cockpit interphone. It also carried an automated passenger briefing device that was prerecorded for takeoff and landing.

1.6.2 USAir Boeing 737-300

The Boeing 737-300 series airplane was approved on November 14, 1984, under 14 CFR Part 25 Airworthiness Standards: Transport Category Airplanes. N388US was manufactured in 1985 with a configuration for 2 flight crewmembers, 4 flight attendants, and 128 passenger seats. Although the airplane interior was partially refurbished in 1989, most of the interior panels were from state-of-the-art materials at the time of original airplane manufacture.

The airplane's dispatch records for the departure from CMH indicated a takeoff weight of 119,724 pounds, and a CG at 15 percent mean aerodynamic chord (MAC), which were within applicable limits. The estimated landing weight at LAX was 94,424 pounds with 7,320 pounds of fuel remaining.

Landing indicated airspeeds (IAS) at 95,000 pounds were as follows:

VRef Flap 30	124 knots
VRef + 5	129 knots

1.7 Meteorological Information

The National Weather Service (NWS) hourly weather observation for LAX taken at 1751 was: Three zero thousand scattered, visibility one five, temperature five seven, dewpoint four three, wind two six zero at six knots, altimeter three zero one zero.

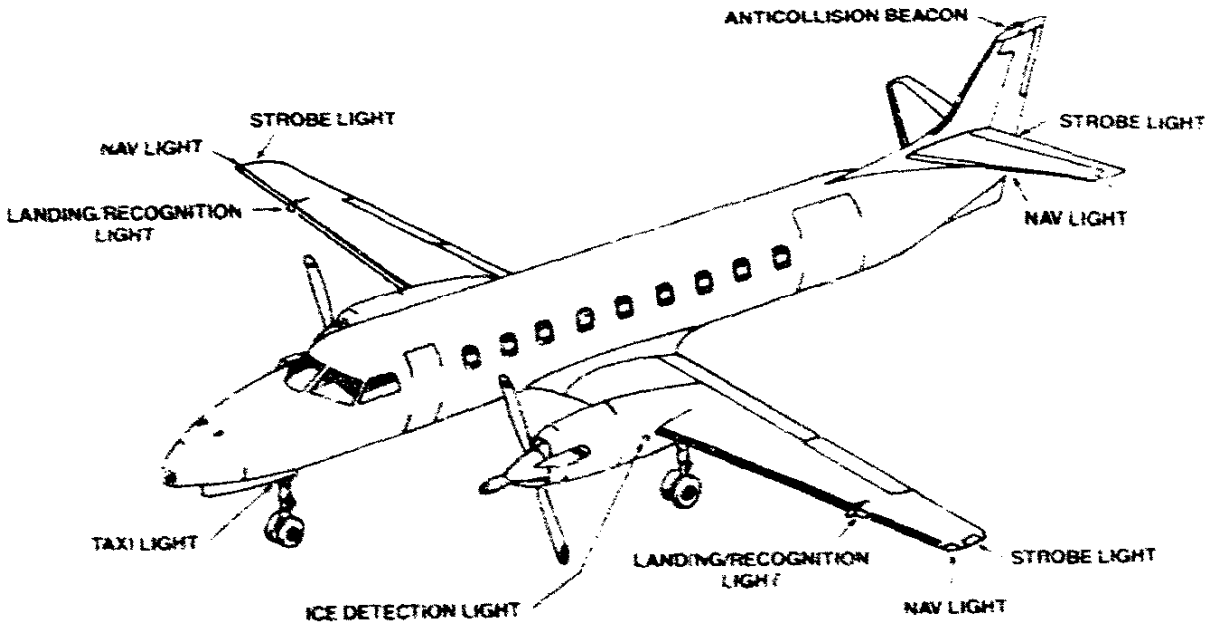


Figure 4.--Metroliner external lighting.

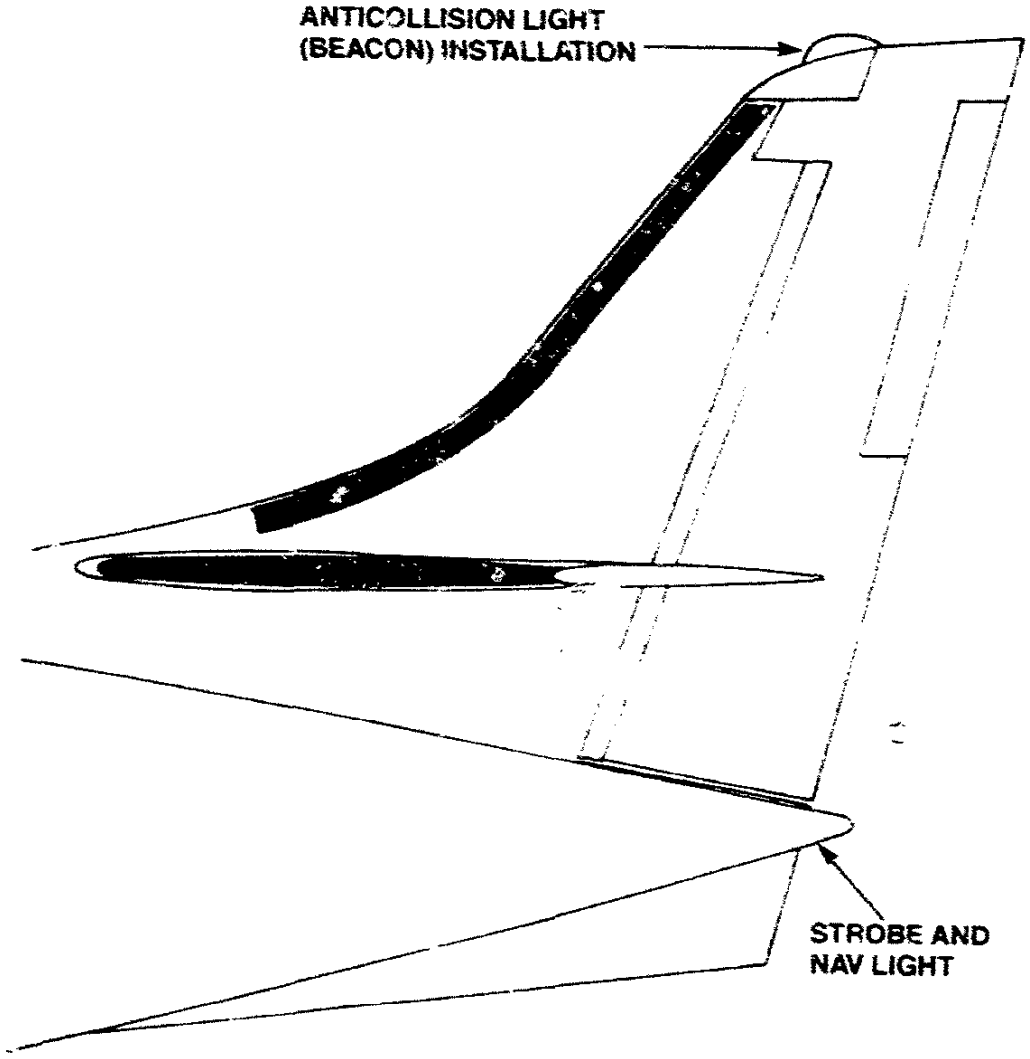


Figure 5.--Metroliner tail, side view.

A special local weather observation taken at 1816 indicated: three zero thousand thin scattered, visibility one five, temperature five seven, dewpoint four three, wind two six zero at six knots, altimeter three zero one one.

At LAX on February 1, 1991, official sunset and the end of official twilight occurred at 1723 and 1748, respectively.

1.8 Aids to Navigation

There were no reported difficulties with aids to navigation.

1.9 Communications

No communications equipment outages or discrepancies were noted in the LAX facilities log that would have contributed to this accident. Postaccident certification of very high frequency transmitter and receiver equipment indicated that all equipment was operating within specifications. There was no evidence that either aircraft experienced communication malfunctions.

At the time of the accident, based on a review of transcripts of recorded radio communications, seven aircraft were on the LC2's frequency. Four aircraft were located on the surface of the airport (Philippine Airlines flight 102, SKW5569, WW5072 and SWA725). USA1493 had just touched down, and the two remaining airplanes were airborne (USA2858 and WW5212). The LC2 described the traffic workload and complexity as "light to moderate" at the time of the accident.

1.10 Aerodrome Information

The Los Angeles International Airport is owned and operated by the City of Los Angeles, Department of Airports (DOA). The published elevation of the airport is 126 feet msl.

The airport has dual parallel runways between 9,000 and 12,000 feet long. Runways 25 left and right comprise the south runway complex, and runways 24 left and right are referred to as the north runway complex. Part of the south complex has been in use since 1928. The north complex began operations in June 1960, and the second north runway was added in 1970.

Runway 24 left, the accident runway, is 10,285 feet long by 150 feet wide and is of concrete construction. The runway is equipped with high intensity runway lights (HIRL), runway centerline lights (CL), and a medium intensity approach light system with runway alignment indicator lights (MALSR).

Tower personnel stated that there were no difficulties with runway and taxiway lighting systems prior to, or at the time of, the accident. They

reported that the HIRL, CL and MALSR systems were illuminated at the Step 2[5] intensity level and that the taxiway lights were set on low intensity at the time of the accident.

A review of airport facility maintenance and ATC tower operations logs indicated no reported difficulties with the HIRL, CL, taxiway lights, and the runway 24 left (MALSR) systems prior to the accident. A postaccident certification check indicated that all components were operating within specifications.

The elevation of runway 24 left at the approach end of the runway is 111 feet msl. The elevation of runway 24 left at the intersection of taxiway 45 is about 120 feet msl.

There are currently eight passenger terminals operating at LAX. In 1988, Phase I of Terminal 2 was opened. In June 1989, Phase II for Terminal 2 was completed. Terminal 2 lighting includes eight high pole stanchions mounted on top of the terminal building to provide ramp illumination. Each pole, about 37 feet high, (198 feet msl, and 81 feet above ground level (agl), included three 1,000-watt high-pressure sodium lamp fixtures (See figure 6).

1.10.1 ATC Tower

The ATC tower, operated by the FAA, is classified as a level V[6] limited radar ATC facility. The existing tower structure was completed in 1961. The location of the tower was based on its relative position to the runway 25 (south) complex. Eye-level elevation for personnel in the tower cab is about 264 feet msl (160 feet agl).

The entire runway 24 complex is north and west of the tower. The straight line distance from the tower cab to the approach end of the runway 24 left centerline is approximately 2,350 feet. The distance from the tower cab to the intersection of the centerline of runway 24 left and the centerline of taxiway 45 is approximately 3,900 feet.

The only parts of the airport specifically designated as an "ATC NON-VISIBILITY AREA" are taxiways 48 and 49 between taxiway Kilo in the south complex and taxiway Tango in the north complex. This area provides the only ground taxi access between the two runway complexes and is approximately 3,400 feet west of the tower. The area of taxiways 48 and 49 at the north-south midway point, referred to as the "50 Yard Line," is designated as the point where aircraft taxiing from one complex to another must change to and contact the appropriate ground control frequency.

---

[5] Intensity levels for runway edge, centerline, and approach (MALSR) lights vary from Step 1 (low) to a maximum intensity of Step 5. Taxiway light intensity levels are low, medium or high.

[6] Air traffic movements involving 100 or more IFR operations per hour for 16 hours per day. Level V is the highest level classification.

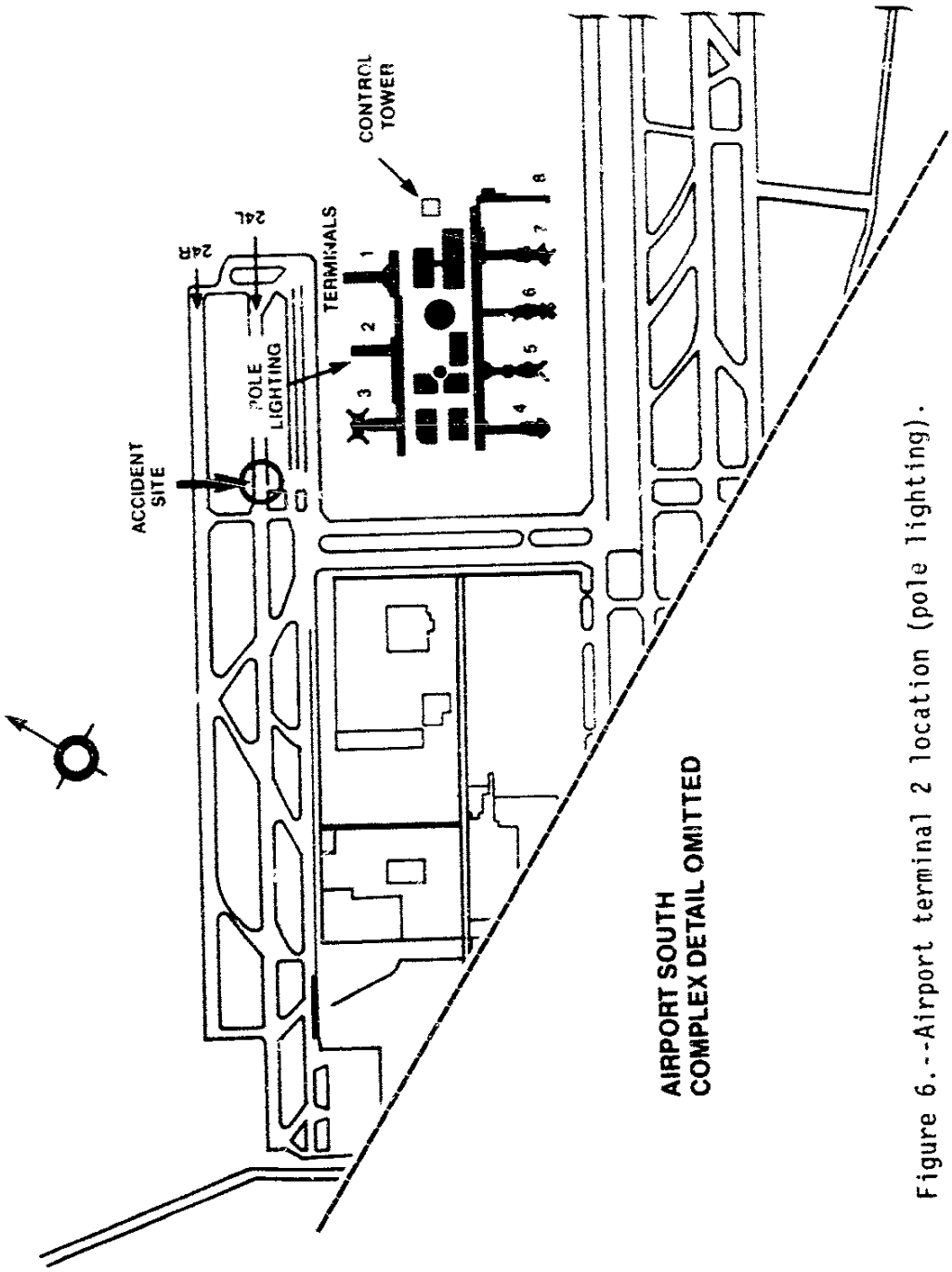


Figure 6.--Airport terminal 2 location (pole lighting).

During interviews, tower personnel stated that a series of four ramp lights on the northernmost portion of the Terminal 2 complex were a restriction to vision during the hours of darkness because of their height, brightness, and relative line-of-sight location to taxiways 45 and 47 and runway 24 left.

The only documentation regarding Terminal 2 lighting conditions relative to ATC operations was obtained from the manager of the Terminal 2 complex in the form of a letter dated February 6, 1991, to the Chief of Operations for the Los Angeles DOA. In his letter, the manager stated, based on his recollections shortly after phase I of the Terminal 2 complex opened on May 31, 1988, "...the tower contacted someone, I do not know who, regarding glare from the southernmost apron lights. The tower requested that the lights either be shielded or redirected. The Terminal 2 electrical contractor complied by redirecting the lights down, thus eliminating the glare. Upon completion of this work the tower was contacted and we were advised the problem had been taken care of satisfactorily. To the best of my knowledge, all conversations were telephonic and nothing was ever put in writing." The letter added that Terminal 2 personnel were never contacted regarding the repositioning or shielding of the northernmost apron lights that became operational upon completion of phase II construction, approximately June 1, 1989.

The Safety Board was unable to locate any documentation about Terminal 2 light glare problems.

After the accident, tower personnel contacted DOA, in writing, requesting that the Terminal 2 lights be redirected and/or shielded and adjustments were accomplished.

The DOA plans to construct a new control tower on the airport, and several possible locations are currently undergoing mathematical modeling and shadow studies. The proposed height of the new tower, at the cab floor level, is 252 feet agl. The planned completion date for the new structure is May 1995.

1.10.2 ATC Operations

The total air operations at the airport during the last recorded fiscal year were 632,312, of which 584,246 were scheduled air carrier and commuter operations.

The exact number of hourly airport operations for LAX is not maintained by the FAA. At the end of the duty day, the number of total airport operations is determined by tower personnel and recorded on the Airport Traffic Record (FAA Form 7230-1). A portion of the data recorded on the form includes air carrier, air taxi, general aviation, and military flights completing a full-stop landing or a takeoff from the airport.

The data recorded for the day of the accident indicated the following information:

Air Carrier	Air Taxi	General Aviation	Military	Total Local[7]	Total Operations
1,010	448	112	26	26	1,622

1.10.3 ATC Personnel Staffing

A typical complement of 13 persons was scheduled for the evening shift in the LAX ATC tower covering the period between 1300 and 2300, February 1, 1991. They included 11 ATC specialists (ATCS), 1 traffic management coordinator (TMC), and 1 area supervisor (AS). The TMC reported for duty at 1430 and departed the facility at 1530 on annual leave.

At the time of the accident, the LAX tower (cab) was staffed by four full-performance-level (FPL) controllers, a developmental (DEV) controller, qualified through his assigned operating position (GC1), and an area supervisor (AS). During the course of events leading up to the accident, two FPL controllers (CD1 and GC2) and the DEV (GC1) communicated with only one of the airplanes (SKW5569). One FPL controller (LC2) communicated with both of the accident airplanes, and the AS activated the crash phone in response to the accident. The remaining controller (LC1) was working the south runway complex and had no contact with the accident airplanes. Additionally, the remaining ATCS personnel were on duty but were not in the tower cab at the time of the accident.

1.10.4 Airport Surface Detection Equipment

The airport is equipped with an Airport Surface Detection Equipment (ASDE)[8] radar system. The ASDE is specifically designed to detect principal features on the surface of an airport, including aircraft and vehicular traffic, and to present the entire image in the control tower. The primary use of the ASDE is to augment visual observations by tower personnel of aircraft and/or vehicular movements on runways and taxiways.

Information is displayed on two ASDE radar indicators located in the tower cab between the north and south local control and ground control operating positions. At the time of the accident, the north ASDE indicator at the LC2 position was inoperative and logged out of service. The south ASDE indicator at the LC1 position was operating normally.

---

[7] Local operations represent visual flight rules (VFR) helicopters operating within the Terminal Control Area (TCA). Although most recorded "local" aircraft do not land or depart from the airport runways, they represent a workload factor in the facility ATC operations.

[8] Although currently referred to as ASDE, the system in place at LAX was originally known as Airport Surface Detection (ASD), without the word "Equipment," upon initial construction and installation.

The use of the ASDE at LAX is prescribed in LAX ATC Tower Order 7110.7E, dated January 15, 1989. The order states, in part, that the AS "shall ensure the ASDE is operated from sunset to sunrise and any other time the entire length of all runways is (are) not visible." Additionally, the order states that the local controller shall, "when applicable, use ASDE, in addition to visual observation, to ensure the runway is clear."

FAA national procedures regarding use of the ASDE are contained in FAA Handbook 7110.65F, Paragraphs 3-70 through 3-72. Paragraph 3-70, outlining ASDE equipment usage, states:

> Use ASDE to augment visual observations of aircraft and/or vehicular movements on runways and taxiways:
>
> a. When visibility is less than the most distant point in the active movement area, and
>
> b. When, in your judgement, its use will assist you in the performance of your duties at any time.

Paragraph 3-71, outlining the usage of information obtained from the ASDE, states:

> a. Use ASDE-derived information:
>
> (1) To determine that the runway is clear of aircraft and vehicles prior to a landing or departure.
>
> (2) To monitor compliance with control instructions by aircraft and vehicles on the taxiways and runways.
>
> (3) To confirm pilot reported positions.
>
> (4) To provide directional taxi information on pilot request.

The Safety Board documented the operating history of the ASDE system at LAX through interviews with maintenance personnel, equipment maintenance records and office correspondence. The earliest written documentation was a letter dated January 9, 1980, describing an evaluation conducted by an airways facility (AFS) team, which determined that the manufacturer's operating specifications could not be met. The evaluation was in response to complaints from ATC personnel that the quality of ASDE coverage was poor and that the system was unreliable.

In February 1986, in an effort to eliminate the potential for runway incursions at ASDE-equipped airports, the FAA's Air Traffic Service directed that the ASDE system be utilized between the hours of sunset and sunrise, 7 days a week. Prior to receiving these directions, the LAX ASDE was utilized only during periods of reduced visibility, usually associated with poor weather conditions other than at night.

In a letter dated March 24, 1986, the AFS manager stated that spare parts support had been a significant problem in maintaining the ASDE since the system was not FAA standard equipment. The letter said that the problems with the ASDE began in the middle of February 1986 when ATC started using the system between sunset and sunrise, on a daily basis.

On December 9, 1987, the AFS manager at LAX recommended to the LAX airport tower manager (ATM) that, in an effort to extend the operational life of the ASDE system and to reduce the number of outages, ATC personnel operate the ASDE only when visibility was "poor" versus the 12-hour per day, 7 days a week use mandated by Air Traffic Service policy.

On December 18, 1987, in a joint letter to the FAA's Western Pacific Regional Headquarters, the ATM and the AFS manager stated, "The increase in ground traffic and the historical performance of the ASDE at the Los Angeles International Airport is evidence that we have a serious problem. It is imperative that a more reliable ASDE system be installed at LAX." This letter requested that managers from regional headquarters contact the FAA's Washington Headquarters in order to obtain the highest priority for a replacement ASDE at LAX.

On January 7, 1988, the LAX ATM, in a written reply to the AFS manager's letter of December 9, 1987, stated that because of air traffic requirements, the ASDE would continue to be operated between the hours of sunset and sunrise, in accordance with air traffic directives.

In early 1988, the planned October 1988 installation date for a more modern ASDE-3 system had slipped to an undetermined date. The equipment remains in the development stage.

On January 28, 1991, (4 days prior to the accident) the AFS manager requested, in writing, that Western Pacific Region personnel contact FAA Washington Headquarters to ensure that replacement of the ASDE received the highest priority. The letter stated that because of the lack of supply support and the continued extended use of the ASDE, excessive and prolonged outages had been experienced the previous year. The letter added that without supply support for the system, it was very difficult to maintain the ASDE at a level that would provide consistent, reliable service required for air traffic operations.

Information regarding LAX ASDE equipment outages was obtained from a review of Facility Maintenance Logs, FAA Form 6030-1, for the period between February 1, 1989, and February 8, 1991. The list appears in appendix E.

1.10.5 Bright Radar Indicator Tower Equipment (BRITE)

The tower is equipped with the BRITE system, designed to display primary and secondary (transponder) radar returns of aircraft and alphanumeric target symbology generated by the Automated Radar Terminal System (ARTS) to a radar display in the ATC tower at the LC1 and LC2 positions. The equipment is specifically intended to present a usable visual

display in the tower of the traffic inbound to the respective runways during both day and night conditions. It augments visual observations by tower personnel of arrival, departure, and overflight aircraft.

A review of maintenance logs between February 1, 1989, and January 15, 1991, indicated a number of entries related to the quality of the BRITE system regarding display focus and intermittent display presentation. The AFS manager described the current BRITE system as "fairly reliable."

The LAX tower AS, who was on duty on the night of the accident, stated in an interview that she was aware of the carryover entry in the operations log of February 1, 1991, indicating that both BRITE scopes were reported as intermittently out of focus and that target position correlation was off by about 1/2 mile. She stated that she checked the presentation on both indicators shortly after assuming the responsibilities of tower supervisor and noted that they appeared normal. She added that she contacted the BRITE maintenance technician regarding the carryover log entry and informed him that both BRITE indicators appeared to be operating normally.

1.11 Flight Recorders

1.11.1 Skywest Metroliner Recorders

At the time of the accident, there was no requirement for the Skywest Metroliner to be equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR). However, after October 11, 1991, 14 CFR Part 135.151 requires aircraft, such as the Metroliner used for commuter operations, to be equipped with a CVR.

In preparation for this CVR requirement, in May 1990, Skywest Airlines forwarded a letter to its FAA Principal Operations Inspector (POI) seeking authorization to install and operate CVR's in its Metroliner fleet. The airline also sought temporary relief from the provisions of the Master Minimum Equipment List (MMEL), whereby an otherwise airworthy airplane would have to be grounded in the event of a malfunctioning CVR before the October 11, 1991, deadline. Skywest cited its belief that valuable operational and maintenance experience would be gained by using the CVR before its mandatory installation and that, "in the unhappy event of an accident involving one of the airplanes so equipped, we would have valuable data for the subsequent investigation."

In June 1989, the Manager of the FAA's Aircraft Evaluation Group, (ACE-270) forwarded a memorandum to the Skywest POI. The memorandum stated the following:

> Skywest Airlines' request for additional relief on Cockpit Voice Recorders was discussed with AFS-200 [Flight Standards]. It has been determined that the Flight Operations Evaluation Board cannot grant any additional relief to either the Cockpit Voice Recorder or the Flight Data Recorder at this time. Please advise your operators accordingly.

In a subsequent followup letter, dated June 29, 1989, to the POI, Skywest stated the following:

> In the spirit of cooperation, and Skywest's continued effort to fully comply with all regulations, even before they become required, we had intended on installing CVR equipment in the aircraft. However, the potential for a cockpit voice recorder, that is not required, to ground an aircraft, is something that Skywest Airlines at this time cannot tolerate. Therefore, we will not be installing these recorders in the aircraft at this time.

The Safety Board determined during its investigation of this accident that Skywest had purchased and had CVR's available to install on its airplanes before the accident involving N683AV.

1.11.2 USA1493 Cockpit Voice Recorder

USA1493 was equipped with a Sundstrand model AV557C CVR, serial number (S/N) 11627. Following the accident, the unit was removed from the airplane and transported to the Safety Board's facilities in Washington, D.C. Although a transcript of the CVR tape was prepared (See appendix C), problems were encountered with the recording.

Some areas of the recording were of substantially poorer quality than others, and there was a significant reduction in recording speed in the areas of reduced quality. Furthermore, the recording was fragmented and discontinuous, with conversations apparently cut off by segments of other portions of the landing conversations. These recording aberrations were determined to be the result of small imperfections in the tape that caused the CVR internal end-of-tape sensor circuits to function abnormally.

Sundstrand representatives stated there were no tests available, or feasible, that could detect the presence of these small imperfections. The self-test procedure, required to be performed routinely by the flightcrews, cannot detect minor imperfections.

1.11.3 USA1493 Flight Recorder

The FDR, a Sundstrand Data Control model UFDR-FWUS, S/N 692, was removed from the airplane after the accident and sent to the Safety Board's laboratory in Washington, D.C., for processing and evaluation.

Examination of the FDR revealed extensive heat and smoke damage to the external dust cover sleeve and internal electronic components. However, the FDR components inside the thermal environmental enclosure did not reveal any indications of damage.

Playback data indicated the following flight trends moments before the end of the recording:

1. During the final 45 seconds of recorded data, the magnetic heading was recorded consistently at approximately 248°.

2. During the last 45 seconds, the indicated airspeed was approximately 135 knots, except for the final 7 seconds, during which time the airspeed decreased to the last recorded airspeed, 117.73 knots.

3. The pressure altitude data indicate a steady rate of descent for the final 45 seconds, except for the last 7 seconds when the descent stopped and the altitude remained essentially constant.

4. The final 8 seconds of recorded vertical acceleration data reveal acceleration peaks of 1.14 G's, 1.16 G's, and 1.43 G's 8, 7, and 5 seconds prior to the end of recording, respectively. A minimum acceleration value of 0.66 G's was recorded 3 seconds prior to the end of the data.

5. There were no radio microphone keyings recorded in the final 45 seconds of recorded data. The last recorded microphone keying occurred 62 seconds before the end of the recording.

Several correlations between FDR data and CVR/ATC transcripts were prepared to provide insight into the workload presented to the flightcrews in the few minutes prior to the accident. These documents are in appendix D.

1.12 Wreckage and Impact Information

1.12.1 The B-737

After the collision, the B-737 and the part of the Metroliner that was crushed beneath the left side of the B-737 continued 500 feet down runway 24 left before veering left and impacting the vacant fire station, about 1,200 feet from the collision point and approximately 600 feet to the left (southeast) of the runway centerline (See figures 7 and 8). Although parts of the Metroliner were scattered among the wreckage, the only parts of the B-737 that separated from the airplane were the nose cone, nose gear doors, and left pitot tube. The B-737 was destroyed by the resulting ground fire, which burned through the top of the fuselage both forward and aft of the wing, the latter causing the aft fuselage to drop down. The impact with the building destroyed the B-737 cockpit and damaged the left engine and an area of the left wing leading edge. The top and left sides of the cockpit were crushed inward, and the forward section of the cockpit on the captain's side was crushed in, down, and to the right (See figure 9). Both forward cockpit windshields were cracked. Several propeller slashes were on the lower right side of the B-737 fuselage skin in the area of the forward galley door.

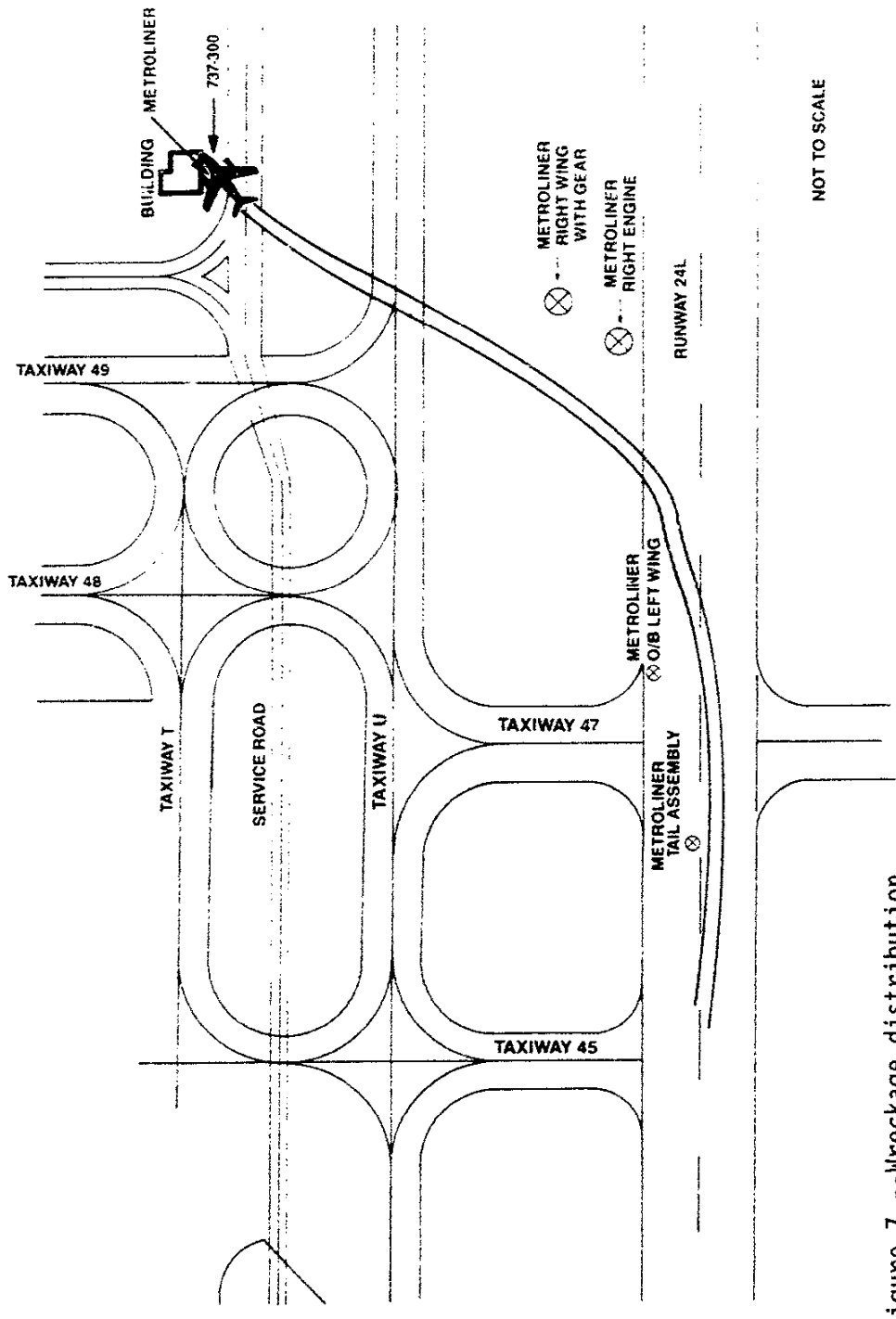


Figure 7.--Wreckage distribution.

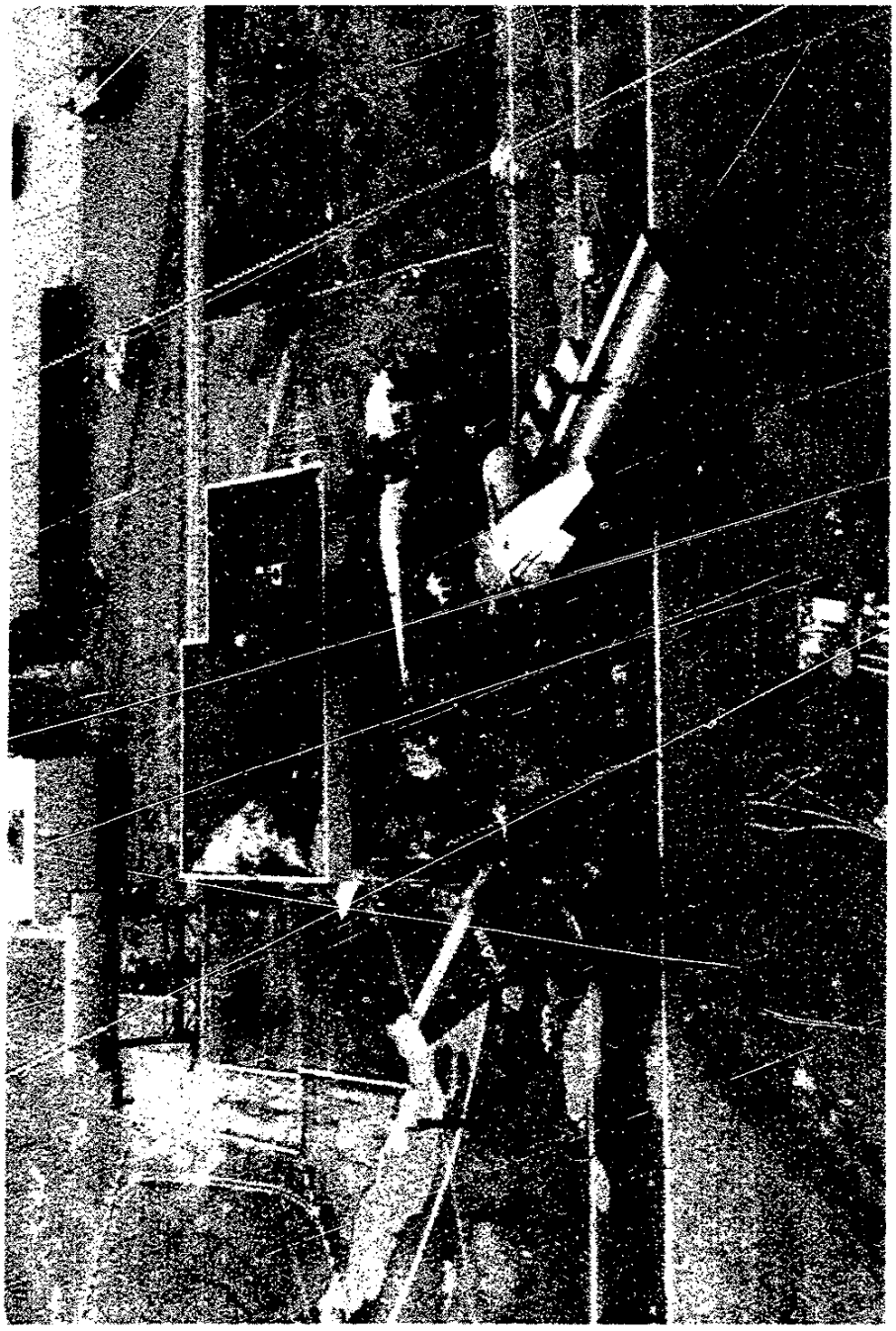


Figure 8.--Overall accident scene.

Figure 9.--Damage related to building impact.

The burned area in the top of the B-737's fuselage was in the forward cabin between the first-class and coach sections. Interior fire damage in this area was extensive. The right forward area of the forward cargo compartment, including the cargo liners, the cargo floor, and the cabin floor, was also severely damaged by fire. Several small holes in the right side of the fuselage below the floor line indicated inward penetrations and fire damage. This area also housed the crew oxygen cylinder, which was found loose. The cylinder contained heavy amounts of soot, except for the area of an attaching strap. The pressure gauge and regulator were extensively fire damaged, and the overpressure and supply lines were broken (See section 1.16.2 for further information).

Soot and fire had damaged both sides of the fuselage exterior from the forward area to the break in the fuselage aft of the wing. The most severe fire damage was on the left side of the fuselage around the wing, where much of the skin below the window line had burned through.

The top of the fuselage was also burned away from just aft of the wing to the aft doors. The fuselage along the floor beams was still attached near the fuselage break aft of the wing. However, the entire tail section drooped to the ground.

The forward passenger door (L-1) was jammed shut, and the lower half of the door was displaced inward approximately 6 inches. There was no fire damage to the exterior of the door. The forward service door (R-1) was open. The door was structurally intact, but its interior had sustained significant fire and heat damage. The exterior of the door contained soot near its bottom forward side. The aft passenger door (L-2) was open, and both sides of the door were fire damaged. The aft service door (R-2) was open. There was no soot on the interior surface of the door, and minor amounts of soot were evident on the exterior (See section 1.15 for details of emergency escape slide deployment).

Both left and right overwing emergency exit hatches had been opened by passengers during the evacuation. The left overwing exit hatch was outside the airplane on the ground forward of the left wing. The interior surface of the hatch did not contain soot. The right overwing exit hatch was inside the airplane and was severely fire damaged.

The left wing was attached to the fuselage but had sustained fire damage, the most severe of which was inboard of the engine on the underside of the wing, the leading and trailing edge devices, and the trailing edge of the inboard spoiler. The No. 1 leading edge slat (farthest outboard) had impact damage corresponding to impact with a support pole of the fire station. All left wing leading edge devices were in their fully extended positions.

The right wing was attached to the fuselage but had sustained fire and heat damage. This damage was generally in the area inboard of the engine but was less severe than that on the left wing. There was a gash of about 12 inches in the wing leading edge just above the outboard end of the

No. 3 leading edge flap. All right wing leading edge devices were in their fully extended positions.

The vertical stabilizer and the right and left horizontal stabilizers were structurally intact but severely fire damaged. Heavy amounts of soot were on the left side of the vertical stabilizer, which had sustained fire damage that melted composite resins in the lower part of the rudder. The right side of the vertical stabilizer was virtually free of soot and exhibited little discoloration from heat. The rudder was in the faired position (no deflection).

The entire aft section of the airplane was lying on the ground and had rotated counterclockwise (aft-looking-forward) to the extent that some of the weight of the aft section was supported by the left horizontal stabilizer. The outboard 3 feet of the left horizontal stabilizer was bent upward from its normal position. Several areas of the stabilizer skin along the inboard portion of the underside and the leading edge had been burned away. Both upper and lower skin surfaces were covered with soot. The elevator trim tabs were found faired. Both the elevator and the trim tab had been burned enough to melt some of the composite resins.

All gear were down and locked. The left main gear exhibited impact damage and extensive fire damage. Both left main gear tires were burned but remained inflated. The left gear shimmy damper valve body was torn from the damper assembly and was hanging from its hydraulic line. The left engine nacelle and wing box section of the Metroliner were wrapped around the left landing gear strut of the B-737. The right main gear of the B-737 exhibited moderate amounts of soot, and both tires were still inflated.

The B-737 nose landing gear wheel well structure (doghouse) was torn from the airplane, folded back and resting underneath the forward fuselage. The airplane was resting on its nose section. Both nose gear tires were intact and inflated but had sustained fire damage. A piece from the inboard end of the Metroliner's right trailing edge flap was wrapped around the front of the B-737's nose gear lower drag link.

No fuel tank rupture or leakage from the wing or center tanks was observed. The total amount of fuel offloaded from the B-737 after the accident was estimated at 6,600 pounds, including fuel removed on scene and from the left wing after the airplane had been relocated to a hangar.

The main engine control valve was closed on the No. 1 engine and open on the No. 2 engine. These valve positions are consistent with the positions of the engine start levers in the cockpit--"fuel off" for No. 1 and "fuel on" for No. 2. Both fuel shutoff valves, located on the wing front spar aft of each engine, were open. None of the fire handles for the engines or the auxiliary power unit had been pulled. The fusible plug on each of the three fire bottles had melted, and the bottles were found discharged. (When the bottle temperature gets high enough, the fusible plug melts and the bottle pressure is released into the wheel well).

An asymmetry between left and right wing trailing edge flaps was documented. All measurements from left wing flap ballscrews indicated 10 units of extension; all measurements from right wing flap ballscrews indicated 40 units of extension. All eight ballscrews were intact and attached to the transmissions. The flap handle was jammed beyond the "Flap 0" (full retract) detent, and the detent pin on the flap handle had been broken off. The cockpit flap position indicator showed the left flap pointer at 6 units and the right flap pointer at 12 units. The glass face of the flap indicator was smashed.

An examination of the flap torque tubes revealed that a section of the right torque tube located in the wheel well was broken. The torque tube was fractured approximately 13 inches from the tube's outboard end, and high local temperatures had produced bulging and white discoloration in the area of the fracture. (The entire wheel well area, including the torque tubes located there, had been subjected to severe fire damage. The intensity of the fire in the area of the torque tube fracture was enough to melt hydraulic-line block clamps and to burn off electrical wiring insulation). The metallurgical examination revealed that the fracture was the result of extensive heat damage and subsequent overstress.

The "A" and "B" hydraulic system reservoir quantities read 0 and 1/4 full, respectively. When the reservoirs were drained, no fluid was obtained from the "A" reservoir, and less than 1 quart was obtained from the "B" reservoir.

The examination of the airplane revealed breaks in both the "A" and "B" hydraulic lines that could have allowed the depletion of fluid. Breaks in the "A" system were identified in the hydraulic lines along the nose gear strut. System "B" hydraulic lines leading to the left wing Krueger flap actuators were punctured as a result of the impact damage to the flaps.

All landing and taxi lights from the B-737 were removed and examined. Continuity tests showed that the bulbs were intact and operational. All cockpit switches for the landing lights were found in the "on" position.

1.12.2 The Metroliner

The major portion of the Metroliner had been crushed beneath the B-737's left wing. The airplane was totally destroyed by the initial impact, the subsequent dragging along the ground by the B-737, and by ground fire.

The empennage with the vertical stabilizer, rudder and left horizontal stabilizer were located approximately 240 feet from the initial impact location. The left wing section outboard of the engine was located at the intersection of taxiway 47 and the runway. The right wing separated at the root and was found, with the right landing gear attached, between the runway and taxiway Uniform.

The right engine (minus the propeller section) was found along the debris path. The right engine propeller was found embedded in the B-737's right engine lower cowling. The left engine and propeller remained attached to the main wreckage.

The remaining portion of the main fuselage sustained severe impact and fire damage. The main cabin door was in the closed and locked position. The upper cockpit section from the center post outward to the right was missing. The nose section forward of the cockpit sustained only minor impact and fire damage. The landing gears were extended.

The left wing tip forward navigation light bulb was broken, and all glass and filament material was missing. Only one filament post remained. The left wing tip rear navigation light bulb was broken, and all glass was missing. However, the filament was intact and was grossly stretched.[9] The right wing tip forward navigation light bulb was intact. The right wing tip rear navigation light bulb was broken, and all glass was missing. However, the filament was intact and stretched. The tail cone navigation light bulb was broken, and all glass was missing. However, the filament was intact and stretched. The vertical stabilizer anticollision beacon light bulb was broken, and all glass was missing. However, the filament was intact and stretched.

The left and right wing tip strobe lights and their respective power supplies were removed from the wreckage and tested for preimpact operational status. The right strobe was found to be functional. The left strobe light flash tube was determined to be inoperative but the preimpact status could not be determined. The tail cone strobe light glass components were not located.

1.12.3 Witness Marks on the Metroliner and the B-737

A match of rivet pattern witness marks was found between the nose cone of the B-737 and the trailing edge of the right elevator of the Metroliner. A dent was found 4.66 feet from the outboard tip of the Metroliner's right elevator. Alignment of the dent and the most forward rivet that attached a brace to the B-737's nose cone at the top center contained a match of rivet patterns and scratch marks. Other rivets were located on the trailing edge of the Metroliner's right elevator, one on each side of the dent. The scratch marks were located on the B-737's nose cone, one on each side of the forward rivet. The nose cone was also scraped on top, with the scrape extending from the top center rivet of the B-737's nose cone to the aft edge of the nose cone.

One vertical mark and seven vertical tears consistent with propeller slashes were on the right side of the B-737's nose cone and fuselage, in an area below the right side of the cabin service door. The

---

[9] Filament stretch is indicative of impact on an illuminated bulb. Brittle fracture of filaments is generally associated with bulbs that are not illuminated at the time of impact.

vertical mark was found on the tip of the nose cone. The vertical tears were several inches wide, and the edges were curved into the fuselage consistent with penetration into the fuselage. The amount of separation between each mark for the first three tears was 22 inches.

1.12.4 Marks on the Runway

The first mark on the runway associated with the accident was a scrape on the concrete with metal deposits located 7,254 feet from the threshold of runway 24 Left, a point adjacent to taxiway 45 Uniform. A wreckage distribution diagram is provided as figure 3. Red and blue scrubbing marks consistent with the paint colors on the Metroliner were intermixed with other concrete marks.

Evidence of soot patterns on the runway surface began about 2,425 feet from the runway threshold. The soot pattern expanded and continued along the wreckage path to the final position of the B-737.

Four tire tracks were on the runway near the initial collision point. They were in pairs, and the relative distances between the tracks were consistent with the tire geometry of the B-737. At various points, one or two tracks faded from view, but at least two tracks were present at all times from the initiation point to the edge of the runway. Ground scar marks continued from the marks made by the tires to taxiway Uniform, followed by tire and scraping marks on taxiway Uniform to the final resting place of the wreckage.

A set of gouges on the runway consistent with propeller slash marks was on the right side of the runway centerline, near the initial collision point starting at 2,395 feet. The beginning of the gouges was perpendicular to the runway centerline. The distance between the gouges became greater along the direction of travel. Some of the later gouges were curved as if they were formed by a left to right motion. The right side of the gouges was found farther down the runway in the direction of travel of the wreckage. A total of 19 gouges was found.

1.13 Medical and Pathological Information

Of the 89 persons aboard the B-737, 20 passengers 1 flight attendant, and the captain were fatally injured. Autopsies of the 19 passengers and 1 flight attendant who were removed from the wreckage revealed that they died of asphyxia due to smoke inhalation. One person who evacuated the airplane died as a result of thermal burns a few days later. The captain succumbed to multiple traumatic injuries. In addition, one passenger died of thermal burn injuries 31 days after the accident. In accordance with 49 CFR 830.2, his injuries were classified as serious as noted in Section 1.2 of this report.

All of the 12 persons aboard the Metroliner were fatally injured. The captain and first officer, as well as nine passengers, succumbed to multiple traumatic injuries, and one passenger died as a result of smoke inhalation and thermal burns.

1.13.1 Air Traffic Controllers Toxicological Information

Approximately 4 hours after the accident, the LC2 and the AS submitted urine specimens for toxicological analysis for specific drugs at the direction of FAA ATC management and in accordance with Department of Transportation requirements. No positive results were reported following analysis of these specimens and a review of the case by the FAA Medical Review Officer.

The Safety Board's subsequent requests for blood and urine specimens were refused by the individuals.

1.13.2 Surviving Flight Crewmembers' Toxicological Information

The first officer of USA1493 submitted a urine specimen following the accident in accordance with Federal requirements. At the Safety Board's request, USAir collected a blood specimen that was provided voluntarily by the first officer. The blood and urine analysis did not detect drugs or alcohol.

The first officer agreed to release his FAA medical certification records to the Safety Board. The records contained three reports of first-class medical examinations conducted during the 3 years prior to the accident. Each report reflected normal examinations without limitations. At the time of the accident, the first officer possessed a valid medical certificate dated April 20, 1990.

1.13.3 Deceased Flight Crewmembers

The Los Angeles County Medical Examiner determined that the cause of death for the captain and first officer of SKW5569 was multiple traumatic injuries and the cause of death for the captain of USA1493 was traumatic injury to the head. Toxicological specimens were collected from the fatally injured crewmembers of both aircraft during autopsy. The body of the captain of SKW5569 was not retrieved from the wreckage for about 18 hours after the accident because of danger to the personnel involved in the body recovery. Toxicological specimens collected during the autopsy were sent to the FAA's Civil Aeromedical Institute (CAMI). In addition, specimens collected from the captain of USA1493 were sent to the Center for Human Toxicology (CHT) in Utah.

The toxicological analysis of the blood taken from the captain of SKW5569 showed 0.015 percent ethanol and 0.004 percent acetaldehyde. The kidney tissue showed an ethanol concentration of 0.05 percent and an acetaldehyde concentration of 0.008 percent. The acetaldehyde found in the specimens was generated by putrefaction. Thus, the ethanol found was due to postmortem generation and not to ingestion.

Urine collected from the first officer of SKW5569 had 57.8 micrograms/milliliters (ug/ml) of salicylate and 176.8 ug/ml of acetaminophen. The liver contained 1.17 ug/ml of pseudoephedrine (over the counter cold or allergy medication).

CAMI reported that the captain of USA1493 had 1.6 ug/ml of phenobarbital in his urine, 0.587 ug/ml in the liver fluid, and 0.324 ug/ml in the brain tissue. No blood values were reported. White tablets found in a container in his flight bag each contained 15 milligrams (mg) of phenobarbital.

Portions of the toxicological specimens from the captain of USA1493 were forwarded to the CHT for verification of the findings. On March 27, 1991, CHT reported that phenobarbital was detected in the blood at a concentration of 436 nanograms/milliliters (ng/ml). Phenobarbital was detected in the brain tissue at a concentration of 528 ng/gm.

As a result of the findings of phenobarbital, a drug that is contraindicated[10] for use by airline pilots, the Safety Board examined medical, pharmacy, FAA, and other records pertaining to the medical history of the captain. The investigation revealed that the captain had used phenobarbital for a gastrointestinal problem. The captain had never reported this problem or the use of this drug to his aviation medical examiner. A summary of the captain's medical history, as it pertains to the use of phenobarbital, is included as appendix F.

1.13.4 Air Traffic Controllers Medical Information

A review of controller medical records did not reveal anything remarkable, with the exception of the LC2. FAA reviews of her records prior to the accident indicated her ability to meet applicable medical standards as a controller. A summary of the medical records of the controllers in the tower at the time of the accident is included as appendix G.

1.14 Fire

1.14.1 Fire Fighting Notification and Response

Immediately following the collision, the LAX tower notified the airport rescue and fire fighting (ARFF) services on the red phone circuit of an aircraft crash near runway 24 left. The senior ARFF officer immediately requested a full response that included 4 crash units, 2 task forces (consisting of 1 ladder truck, 2 engines and 10 fire fighters) as well as 1 engine company, 1 ambulance and a battalion chief. He also requested five additional ambulances.

The first ARFF trucks responded from Fire Station 80, which was about 1/4 mile away from the accident site. They observed black smoke as they departed the station. These units arrived at the scene less than 1 minute after notification.

The fire fighters found the B-737 resting against the unoccupied fire station. Flames from an apparent pool of fuel under the airplane

---

[10] FAA Advisory Circular 91.11-1 "Guide to Drug Hazards in Aviation Medicine" indicates airman duties contraindicated for 24 hours after use.

engulfed the fuselage and were visible inside the forward passenger cabin.[11] No fire was evident in the cockpit area. As the fire fighters began their initial fire attack, they observed 40 to 50 people outside the airplane. The fire fighters also witnessed six or seven people evacuating through the right rear door and the right overwing exit. Using both roof and bumper turrets, the four crash units were able to extinguish most of the ground fire in about 1 minute, but they were unable to extinguish it completely.

While the initial attack on the fire was in progress, three fire fighters departed their vehicles and began rescue operations. One fire fighter removed the first officer of the B-737 through the sliding window on the right side of the cockpit and, assisted by another fire fighter, moved him to a safe area. One of the firefighters then returned to the cockpit area through the sliding window and attempted to rescue the captain but was unable to do so because he was pinned in the wreckage. He said that the captain appeared lifeless.

A fire fighter brought a foam-producing hand line to the cockpit to protect the captain. Around the same time, another fire fighter brought a hand line to the R-1 door. Before fire fighters could attack the cabin fire through this door, the fire had intensified quickly and burned a large hole through the cabin roof. Despite the ventilation afforded by the opening in the roof, the fire fighter, who had entered the forward cabin, could only advance a few seat rows toward the rear because of the fire's intensity. However, the fire fighters remained in the cabin until the interior fire was extinguished. About 10 minutes into the attack, fire fighters discharged 600 pounds of Halon 1301 into the cabin. They stated, however, that as expected, the Halon had little or no effect on the fire.

One fire fighter, using a foam-producing hand line under the B-737, found a propeller in the right engine of the B-737, and reported this discovery to his supervisor. His supervisor asked the tower whether a second airplane was involved. About 1814, the tower indicated that a "Metroliner" might be involved. The Incident Commander then initiated a search of the runway for any survivors. They found five fatally injured persons and debris scattered along the path of the B-737. As the fire fighters extinguished the fire under the B-737, the fuselage of the Metroliner was found crushed under the B-737.

Although the fire fighters were able to control the fire under the B-737, the fire continued in the cabin. About 1825, the aft section of the fuselage, including eight rows of seats, drooped to the ground. The fire fighters then advanced into this opening. Both the exterior and the interior fires were extinguished about 30 minutes after the fire fighters arrived on the scene. In addition to LAX ARFF units, manpower and resources that were directly involved in the fire suppression/support activities included 5 engine companies, 10 task forces, and 134 personnel. An estimated 20,000 gallons of water, 1,046 gallons of aqueous film-forming foam and 600 pounds of Halon 1301 were used during the fire suppression operation.

---

[11] Also see sections 1.15 and 1.16 related to fire in the B-737 cabin.

1.14.2 Medical Response

The first ambulance arrived about 8 minutes after the crash, established medical communications and began triage activity. The primary triage area was set up 300 feet west of the accident site. Twenty-four survivors were evaluated at the primary area and 11 people, 5 of whom were in critical condition, were transported to six different medical centers and hospitals.

A secondary triage area was established at Terminal 1. Fifty-seven survivors who had no obvious injuries were transported to Terminal 1 by bus and reevaluated, and 14 of them were transported to hospitals or medical centers. The first patient departed LAX within 20 minutes of the accident, and the last patient in the primary triage area was dispatched to a hospital about 1 hour and 15 minutes after the accident.

The resources made available during the medical operations included 7 fire department ambulances, 10 private ambulances, 2 task forces for manpower, and 3 air ambulances.

1.14.3 LAX Operations and Security

About 2 minutes after notification of the accident, airport operations/police responded to the scene and began establishing early perimeter control. Within 10 to 15 minutes, airport operations/police responded to the scene with their mobile command post and collocated with the fire department incident command post. Also, within this timeframe a large airport bus arrived on scene to accommodate the ambulatory passengers. They were placed in this controlled environment to assure their safety. Triage tags and associated reference numbers were subsequently distributed to them.

The LAX Operations Manager stated that the north complex was closed immediately after the accident. He added that it was not reopened until February 3, 1991, at 2156, because of a LAX DOA decision to keep it closed until all airport investigative activities were completed and the majority of the wreckage could be removed.

1.14.4 Disaster Preparedness

LAX had at the time of the accident a current FAA-approved emergency plan in accordance with 14 CFR 139. The facility last conducted an emergency exercise on October 4, 1989. Title 14 CFR 139.325(g)(5) requires that a full-scale exercise be conducted every 3 years. In addition, responses were made to significant incidents on August 21, 1990, (a Boeing 737-300's right landing gear was not extended) and on August 27, 1990, (a Boeing 747-400's outboard main gear and nose gear were not extended). The actions and commitments of resources involving these two incidents met the requirements for a triennial emergency exercise by the FAA Regional Airport Certification Office.

1.15 Survival Aspects

Three cabin crewmembers and 63 passengers aboard the B-737 survived (See figure 10), of which 48 persons were interviewed during the on-scene investigation. The following summarizes their interviews:

Four of the six exits were used during the emergency evacuation: the R-1 forward service door, the left and right overwing emergency exits, and the R-2 service door. The L-1 exit was damaged subsequent to the secondary impact with the abandoned fire station. The L-2 exit was opened by the L-2 flight attendant during the slide to a stop between the first and second impacts; however, because of flames along the left side of the airplane, she stated that she closed the door and elected not to use it thereafter. Investigators found the door open with the slide deployed. It was determined that ARFF personnel had opened the door well after the accident.

The R-1 slide pack did not deploy. It was found below the door in an area where the floor was burned away. The postcrash examination of the girt bar and its two retaining brackets revealed that the bolts that secured the retaining brackets to the floor on the inboard side of the door were bisected (sheared off at floor level). The R-2 slide pack deployed as designed when the door was opened by the R-2 flight attendant to initiate the emergency evacuation.

Several passengers noted that the landing appeared to be routine; however, within a few seconds of touchdown they recalled feeling the airplane move up and down, consistent with heavy brake applications. They noticed "an orange glow through the cabin windows on both sides of the airplane; flight attendants were heard yelling repeated commands "get down, stay down." After the impact with the building, the flight attendants commanded the passengers to release their seatbelts. The two rear flight attendants and several passengers had unbuckled their seatbelts after the first impact and were thrown forward when the airplane struck the building.

The R-1 flight attendant stated that the "touchdown felt normal" and that shortly thereafter "I heard a big metal scrape, and felt like they slammed the brakes real hard." Within 2 or 3 seconds, the emergency lights came on and he began to shout commands, "grab ankles, heads down, stay down."

After the first impact, and while the airplane was still moving, he noted that the cabin became "really warm," and he observed smoke coming from underneath the floor in front of him. He saw the floor in front of him moving up and down about knee high. He also remembered seeing smoke and fire on top of the valet closet in front of him. He described the smoke as "very thick."

As the airplane struck the abandoned fire station and stopped, the R-1 flight attendant departed his jumpseat and went to his exit door. After assessing the area outside the door for fire, he rotated the handle to the open position and attempted to open the door. During this time he said that the smoke got so bad that he could no longer see anything. After forcing the

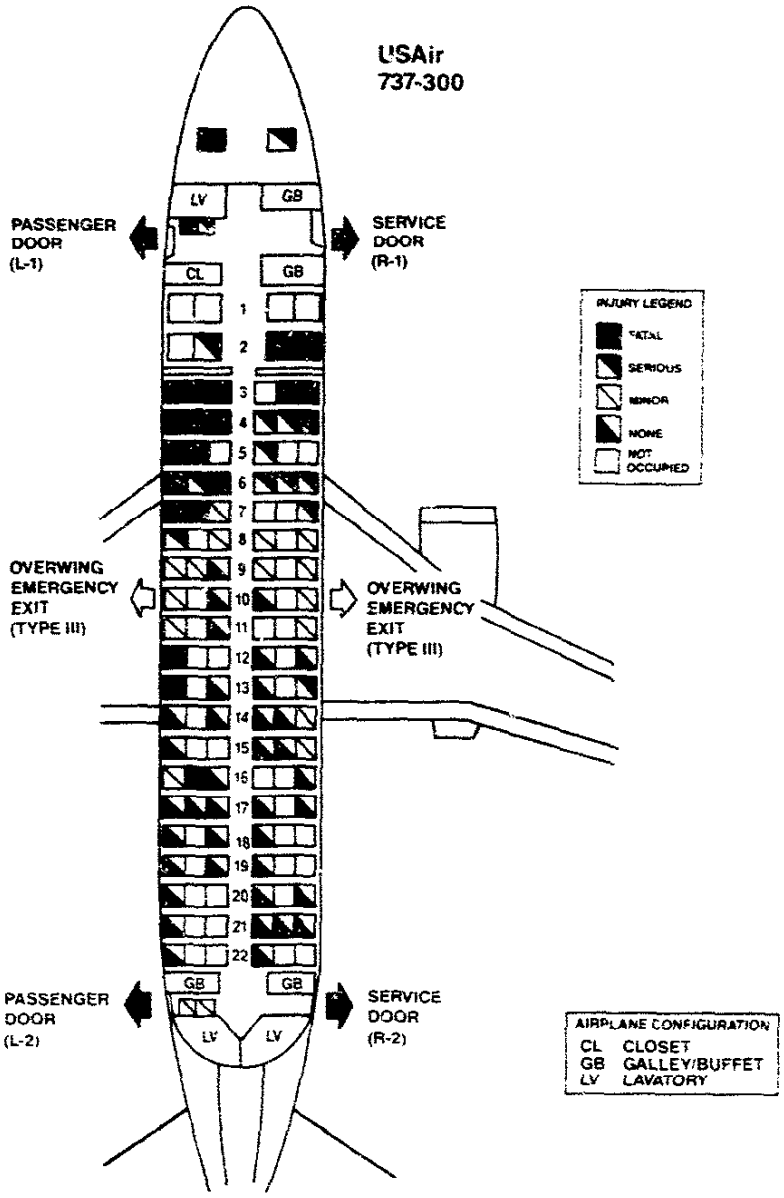


Figure 10.--Seating and injury chart.

door, he was able to open it about 12 inches and shortly thereafter he was able to open it fully. At that point, a passenger was standing by the door, and he pushed the passenger out of the airplane. The distance from the door sill to the ground was about 5 feet. Another passenger then passed the R-1 flight attendant and jumped out. The flight attendant then attempted to enter the cabin near row 1; however, the smoke and flames were too intense. Returning to the R-1 door, he jumped to the ground.

Several passengers who had been seated in the coach cabin between rows 4 and 13, escaped via the two overwing emergency exits and the R-2 service door. Because of the fire, only two passengers were able to escape from the left overwing emergency exit. They crawled along the left wing and jumped from the leading edge of the wing to the ground.

About 37 passengers escaped via the right overwing emergency exit. Their egress was hampered by the passenger seated in seat 10-F who stated that she was very frightened and "froze," and was unable to leave her seat or open the window exit next to her. The male passenger seated in 11-D climbed over the 10-E seatback and opened the overwing exit; he pushed the passenger seated in 10-F out the window and onto the wing and then followed her. During the subsequent evacuation through the right overwing exit, two male passengers had an altercation at the open exit that lasted several seconds.

The outboard seatback at 10-F adjacent to the right overwing exit was found folded forward after the accident blocking approximately 25 percent of the exit opening. The retaining bolt at the seat's pivot point was sheared. The timing of this occurrence could not be determined.

Passengers who escaped by the right overwing exit made their way across the right wing and slid down the extended flaps. They were directed away from the airplane by flight attendants and fire fighters who, they estimated, arrived on scene 1 to 2 minutes after the B-737 struck the abandoned fire station.

Passengers seated around row 10 stated that prior to departure the flight attendant assigned to the R-1 position interviewed a young passenger who was seated in 10-D about whether he could fulfill the duties of an able-bodied person in the event of an emergency. The passenger advised the flight attendant that he was 17 years old; however, to be sure the youth understood his responsibilities, the flight attendant conducted a special oral briefing for the persons seated in and around row 10. Passengers stated that the instructions provided by the R-1 flight attendant aided in their evacuation.

Fifteen passengers seated aft of the overwing area who made their way to the rear of the cabin reported using the emergency floor path lighting. All of the passengers stated that the cabin filled with thick black smoke within seconds of the impact with the building.

The L-2 flight attendant stated that she slightly opened her door without difficulty before impact with the building; however, the outside of the door was ablaze so she closed the door. She had taken about two steps into the cabin when the building was struck. She did not return to the door.

After the final impact, she attempted to make her way to the overwing exits in accordance with company procedure. Because of the number of passengers moving aft, she was only able to advance forward to the seats at rows 19 and 20 on the left. From there, she directed the passengers to the rear of the cabin.

After the final impact, the flight attendant who was assigned to the R-2 door opened the door, deploying the emergency slide, and evacuated about 15 passengers. He then exited and directed passengers away from the airplane.

1.16 Tests and Research

1.16.1 Conspicuity Exercise

On February 11, 1991, a lighting and conspicuity exercise was conducted to observe the ease or difficulty in visually acquiring a Metroliner from the cab of the ATC tower and from an aircraft on a visual approach to runway 24 left. A helicopter was used as a visual platform in the latter effort. The test airplane used in the exercise was identical to the one involved in the accident. Weather conditions at the time of the exercise were unrestricted. The test airplane was observed at three locations: On taxiway Uniform, at the intersection of Uniform and taxiway 45, heading 060°; holding short of runway 24 left at taxiway 45; and holding on the centerline of runway 24 left at the point were the collision occurred. During the part of the exercise in which the Metroliner was holding on the centerline of the runway, the tower controllers placed the runway 24 left lighting in the same configuration and at the same intensity that existed at the time of the accident. Various lighting configurations/conditions were observed on the Metroliner at the aforementioned locations. These conditions were as follows:

Lighting Condition 1:	Only (red) anticollision beacon, navigation, taxi, and recognition lights on.
Lighting Condition 2:	Only (red) anticollision beacon and navigation lights on.
Lighting Condition 3:	Except for ice-detection lights, all lights on, including strobes.

The results of the exercise produced the following agreements among members of the Safety Board's operations group, as well as representatives of the pilots' union and the airline, who were in the helicopter conducting visual approaches to the runway:

1. The Metroliner's white tail navigation light blended with the runway centerline lighting, especially when the centerline lighting was set to step 2.

2. The Metroliner's red anticollision beacon, located on top of the vertical stabilizer, was not as conspicuous as anticipated prior to the exercise. The effect of the variety of lights on the airport surface, combined with the runway lights, appeared to diffuse the intensity of the beacon.

3. The Metroliner's taxi, recognition, wing tip navigation, and strobe lighting were not readily detectable.

4. The Metroliner's white strobe light in the tail of the airplane was the most visible light. However, with the runway centerline lighting at step 2, the airplane strobe's luminance blended with the centerline lighting.

5. Offsetting the approaching helicopter aircraft to either side of the Metroliner's 6 o'clock position, (left or right of the runway centerline) enhanced the ability to detect the red anticollision beacon and the white navigation and strobe light in the tail of the airplane.

The participants in the tower portion of the exercise agreed that the three northernmost lighting fixtures mounted on poles on the roof of Terminal 2, northwest of the control tower, produced a glare that impeded visual observation of the area in which the collision occurred. The fixtures and glare did not totally block the view of the accident area.

1.16.2 Examination of Oxygen System Parts and Fuselage Structure

Witnesses agreed that both airplanes were ablaze shortly after initial contact on the runway. The 76-cubic-foot capacity crew oxygen cylinder that was installed in the forward cargo compartment of the B-737 was depleted, the low-pressure oxygen supply line was broken, and the oxygen regulator was severely damaged, collectively indicating that oxygen had escaped. This discovery suggested that oxygen from the cylinder contributed to the fire in the forward cargo compartment near the oxygen cylinder. In addition, several holes in the fuselage structure were in close proximity to the oxygen cylinder installation (See figures 11 and 12). Boeing reported that a full cylinder would bleed down in about 90 seconds. Two segments of fuselage structure, the oxygen regulator and the low-pressure supply line, were examined metallurgically to attempt to determine the fracture modes and to determine if the fractures were present before they were involved in the fire. The following was determined:

The low-pressure supply line fractured in a ductile manner after the fire was extinguished;

The mode of fracture of the oxygen regulator could not be determined because of excessive heat damage;

Figure 11.--Fuselage damage in area of oxygen cylinder.

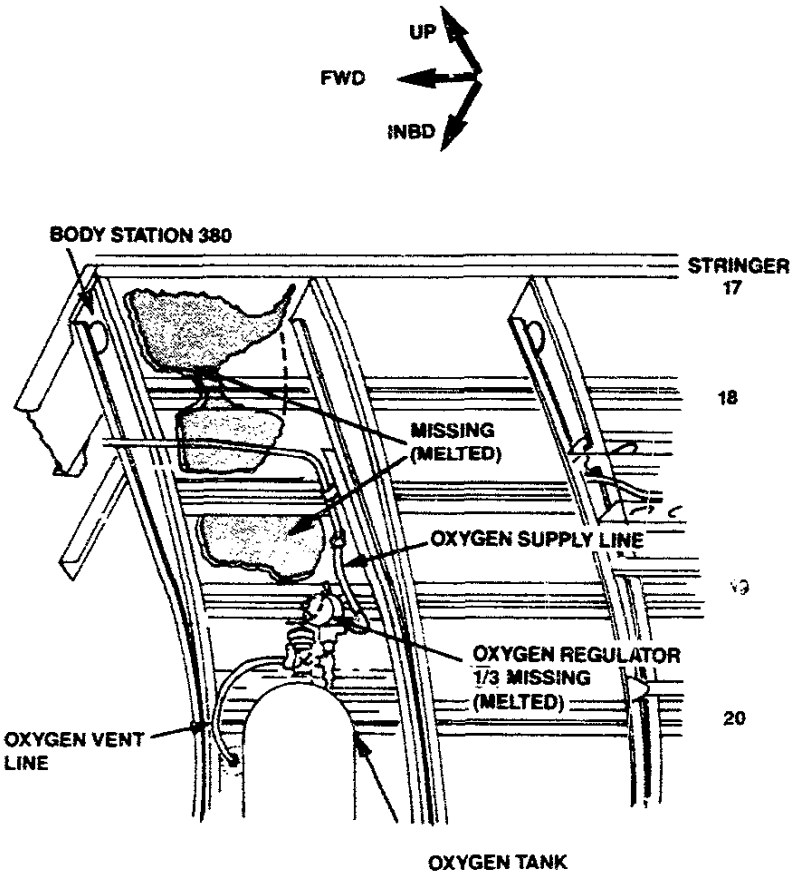


Figure 12.--Fuselage damage/crew oxygen system installation.

The fuselage skin near the oxygen system installation was damaged mechanically, prior to high temperature exposure.

1.16.3 Cabin Fire Research Test

The Safety Board has investigated several fires on transport airplanes in which gaseous oxygen was thought to contribute to the rapid spread of fire and smoke within the passenger cabin.[12] In these cases, passengers and crew reported that evacuation was impeded as thick black smoke filled the cabin within about 45 seconds. During the evacuating of USA1493, flight attendant testimony and passenger reports also indicated that thick black smoke quickly entered the cabin of the B-737. The Safety Board requested that the FAA Technical Center Fire Safety Branch conduct preliminary "burn tests" to examine the effects of an introduction of compressed gaseous oxygen into the environment of an aircraft cabin fire.

Tests were conducted on July 30 and August 13, 1991, using similar cabin configurations. However, the first test, on July 30, 1991, utilized an experimental water mist suppression system. This test was conducted first because it was believed to be potentially less destructive. On August 13, 1991, a test was conducted approximating the cabin configuration of the USAir B-737.

The cabin of a test fuselage was configured to be similar to the USAir B-737 in terms of seat and cabin furnishings. Seats were equipped with fire-blocking material, and the carpet, side walls, and over-head stowage compartments complied with older requirements for fire retardancy. Additionally, the right front galley door was open, and an air/oxygen line was affixed to an oxygen cylinder that was positioned about 6 inches inboard of the galley doorway. A pan containing approximately 50 gallons of aviation fuel was located on the outside of the galley door.

Visual observation of the tests indicated that the release of compressed gaseous oxygen into the cabin exacerbated the rate at which the fire and smoke spread into the cabin. In both tests, the forward cabin area became totally engulfed by flames and smoke in less than 2 minutes. Previous baseline tests with similar test articles, but without the introduction of compressed gaseous oxygen, have demonstrated that fire and smoke spread into the cabin in about 5 minutes.

Such tests are instrumented by the FAA Fire Safety Branch staff to measure cabin environmental changes and temperatures in relation to survival time. The scientific data will be published in future technical reports.

---

[12] Fire During Taxi, Scheduled Skyways Inc., Flight 478, Fairchild Swearingen SA226TC, N503SS, Hot Springs, Arkansas, August 27, 1983, DCA-83-AA-037; and Fire During Passenger Boarding, Delta Air Lines, Flight 1558, Salt Lake City International Airport, N530DA, Boeing 727-232, October 14, 1989, DCA-90-MA-002.

1.17 Additional Information

1.17.1 ATC Procedures

As it pertains to the landing clearance issued to the flightcrew of USA1493, the Air Traffic Control Handbook, 7110.65F, Section 10, "Arrival Procedures and Separation," paragraph 3-122, "Same Runway Separation," states:

> Separate an arriving aircraft from another aircraft using the same runway by ensuring that the arriving aircraft does not cross the landing threshold until one of the following conditions exits....

As it pertained to USA1493, the required condition was, "the other aircraft (SKW5569) has departed and crossed the runway end."

In addition, on January 11, 1990, the LAX ATC facility issued Supplement 1 to National order 7220.2A, which prescribed facility level procedures to be used by tower personnel. Among those items contained in the local Facility Operational Position Standards (Facility OPS) were the requirements for flight progress strip marking and the use of flight progress strips by control tower personnel.

Item 22-12b3, regarding flight progress strip management at the clearance delivery position, stated that the strip be forwarded to "the appropriate local control position."

Regarding operations by the ground controller, the LAX supplement, item 23-43c stated, "all intersections are designated departure points." Additionally, item 23-43d stated, "there is no strip marking required of ground control."

1.17.1.1 Postaccident Procedure Change

The FAA Air Traffic Services initiated a procedural change shortly after the accident. The change was circulated to all terminal ATC facilities by a general notice (GENOT) as follows:

> Do not authorize aircraft to taxi into position and hold at an intersection between sunset and sunrise. Additionally, do not authorize an aircraft to taxi into position and hold at any time when the intersection is not visible from the tower. These procedures shall be implemented at 7:00 a.m. local on February 16, 1991. The contents of this notice shall be briefed to all ATCT operational personnel.

1.17.2 Air Traffic Procedures Operational Position Standards (OPS)

In June 1988, the FAA implemented the National Operational Position Standards (National OPS), which established procedures for use at ATC operating positions within ATC facilities in the United States. The

order defines how control positions are to be operated and is supplemented by Facility OPS, established by the facility manager for use by personnel at the facility.

The National OPS, which are mandatory, require that controllers at the ground control position:

1. Prepare or obtain a flight progress strip.

2. Review the flight progress strip for required information.

3. Revise flight progress information if discrepancies are detected.

4. Mark the flight progress strip, to include "The designator for the departure point on the runway when an aircraft will depart from a point other than that designated as the standard operating procedure for that runway."

5. Forward the flight progress strip to the appropriate position.

An excerpt copy of the OPS is included as appendix H.

1.17.3 Excerpt From Skywest Metroliner Checklist, Standard Operating Procedures, July 1, 1988, Page 17

The first officer will perform the passenger briefing during taxi. The passenger briefing can be accomplished at any time prior to taxiing by either crewmember as long as one crewmember being off the radio will not jeopardize safety during taxi in and around congested areas or the ability to maintain close listening watch to ATC.[13]

1.17.4 Excerpt From Skywest Operations Manual, Company/ATC Operating Policy Part III, Page 2.60, June 25, 1989

Item 2.b. Pilots are cautioned to be extremely vigilant in maintaining proper listening watch of proper ATC frequencies.

1.17.5 Use of Headsets by Skywest Flightcrew Personnel

Skywest flightcrews are required to purchase an FAA-approved headset. The airline does not have a specific policy addressing the use of headsets. However, company representatives report that because of the

[13] As noted in Section 1.6.1, the accident airplane was equipped with an automated passenger briefing device. The effort required by the crewmember is limited to selecting the device "on" at the appropriate time.

decibel level in the cockpit, nearly all of its pilots wear them. Both pilots on SKW5569 were using the hard shell (noise suppressing) type of headset.

1.17.6 Skywest Airlines Policy Concerning the Use of Metroliner External Lighting

Mention of exterior lights is contained in the Before Takeoff Expanded Checklist. Page 18, of the standard operating procedures (SOP), dated July 1, 1988, under the subheading titled "Takeoff Procedures" states "When takeoff clearance has been received the last four items of the Before Takeoff Checklist will be accomplished and the checklist announced complete."

The four items are:

Transponder/encoder.....	On	F/O
Bleed Air.....	Off	F/O
Speed Levers.....	High	PF [Pilot Flying]
Ignition Mode Switches.....	Set	CP

Additionally, the next paragraph states "The captain will position the Strobes, Taxi, Landing and Recognition Light Switches to the On position."

The Takeoff and Climb Checklist on page 19 of the SOP dated July 1, 1989, states "Landing and Recognition Lights for all operations in the Terminal or Airport traffic unless such use causes a cockpit distraction."

Skywest published a bulletin to all flight crewmembers, dated October 24, 1989, as the result of a ground accident in which a fuel truck ran into one of its Metroliners. The bulletin further details the procedures for the use of exterior lights. Effective on that date for all ground operations at all airports from sunset to sunrise was the following:

> External Lights to include Rotating Beacon, Navigation, Taxi and on Metroliners, Recognition Lights will be illuminated, and the Passenger Cabin Interior Lights will also be Illuminated. You are, however, expected to use your good judgement in use of Recognition and Taxi Lights to avoid blinding oncoming Aircraft, Vehicles, and/or ramp people.

An additional bulletin to all flight crewmembers, dated November 2, 1989, was a verbatim restatement of this policy.

1.17.7 Skywest Use of Intersection Takeoffs

The Skywest Metroliner Operations Manual, Part 3, Chapter 6A, Page 2.41, dated March 25, 1988, entitled "Flight Crew Operating Policy," authorizes intersection takeoffs at LAX provided there is 6,000 feet or more of runway remaining.

Historically, the airline has initiated departures on runway 24 left from taxiways 45 and 47. Factors leading to this operating procedure include the conservative length of runway remaining for aborts from these locations and more expeditious handling by ATC. Upon receipt and acknowledgement of a clearance to taxi onto a runway, flightcrews align the airplane on the runway centerline.

1.17.8 Skywest Airlines ATC Communication Procedures

The chief pilot for Skywest stated that the airline subscribes to the phraseology and communication procedures contained in the Airman's Information Manual (AIM) and that discussions rather than written material on the subject are offered in the flight and ground training programs.

1.17.9 Excerpts From the USAir Flight Operations Manual (FOM)

The FOM contains numerous passages on procedures and techniques for collision avoidance. The subject is primarily addressed from the perspective of an in-flight hazard.

> FOM Reference Section 4-35-2, October 6, 1989
> LANDING LIGHTS
> When approaching to land at night at busy airports, the landing lights should be positioned down when speed permits to provide ready position identification for the tower and other traffic.
>
> FOM Reference Section 3-37-1, July 20, 1990
> DESCENT
> LANDING LIGHTS
> Inboard landing lights should be used particularly during times of reduced visibility below 10,000 feet for traffic avoidance. Outboard, taxi, wing and runway turnoff lights should normally be OFF.
>
> LOGO LIGHTS (if installed)
> LOGO lights should normally be turned ON below 10,000 feet at night, unless operating in IMC [instrument meteorological conditions].
>
> FOM Reference Section 8-5-1, July 29, 1988
> COLLISION AVOIDANCE
> "SEE AND AVOID" CONCEPT
> The flight rules prescribed in Part 91 of the Federal Aviation Regulations set forth the concept of "See and Avoid." This concept requires that vigilance shall be maintained at all times, by each person operating an aircraft, regardless of whether the operation is conducted under Instrument Flight Rules (IFR) or Visual Flight Rules (VFR).

FOM Reference Section 8-5-2, July 29, 1988
VISUAL SCANNING (cont'd)
Visual search at night depends almost entirely on peripheral vision. In order to perceive a very dim lighted object in a certain direction, the pilot should not look directly at the object, but scan the area adjacent to it. Short stops, of a few seconds, in each scan will help to detect the light and its movement. Lack of brightness and color contrast in daytime and conflicting ground lights at night increase the difficulty of detecting other aircraft.

1.17.10 Excerpt From the USAir B737-300/400 Pilot's Operating Handbook (POH)

POH Reference Section 3-5-1, Dated December 14, 1990
PILOT SEAT ADJUSTMENT
Fasten the seat belt and shoulder harness. Adjust the seat position with the appropriate controls to obtain the optimum eye reference position. Use the handhold above the forward window to assist. The correct eye reference position is established when the topmost flight mode annunciators are just in view below the glare shield and at the same time, a slight amount of the aircraft nose structure is visible above the forward lower window sill.

POH Reference Section 18-75-2, Dated July 28, 1989
NORMAL LANDING (cont'd)
APPROACH
The aiming point should be approximately 1,000 feet down the runway. Frequently cross check sink rate, pitch attitude, and visual position of the 1,000 foot touchdown target to maintain airplane in the approach slot.

1.17.11 USAir Radio Communication Phraseology and Techniques

USAir's literature on radio communication phraseology and techniques parallels the information contained in the AIM. The airline's publications do not contain specific language that addresses the need for pilots to be vigilant in maintaining a proper listening watch of ATC frequencies.

1.17.12 Use of Headsets Versus Overhead Cockpit Speakers

USAir does not have a formal policy on flightcrew use of headsets instead of overhead cockpit speakers. The airline's Senior Director of Quality Assurance and Flight Safety stated that flightcrews are encouraged to wear headsets and that to the best of his knowledge nearly all of them do, especially flightcrews assigned to Boeing aircraft.

1.17.13 The Airman's Information Manual (AIM)

The AIM is published by the FAA, Department of Transportation. The AIM is the official guide to basic flight information and ATC procedures.

The AIM does not contain information on communication procedures for midfield/intersection runway departures or specific language on the need for pilots to be vigilant in maintaining a proper listening watch of ATC frequencies for information that may affect the safety of flight.

The following information was excerpted from the December 13, 1990, issue of AIM:

> 1. Chapter 4. Air Traffic Control Section 2. Radio Communication Phraseology and Techniques. 4-190. General. Paragraph b.
>
> The single, most important thought in pilot-controller communications is understanding. It is essential, therefore, that pilots acknowledge each radio communication with ATC by using the appropriate aircraft call sign. Brevity is important, and contacts should be kept as brief as possible, but the controller must know exactly what you can do before he can properly carry out his control duties. And you, the pilot, must know exactly what he wants you to do. Since concise phraseology may not always be adequate, use whatever words are necessary to get your message across.
>
> 2. Section 3. Airport Operations. 4-230. Paragraph a.
>
> In order to enhance airport capacities, reduce taxiing distances, minimize departure delays, and provide for more efficient movement of air traffic, controllers may initiate intersection takeoffs as well as approve them when the pilot requests. If for any reason a pilot prefers to use a different intersection or the full length of the runway or desires to obtain the distance between the intersection and the runway end, HE IS EXPECTED TO INFORM ATC ACCORDINGLY. (Emphasis in original)

2. ANALYSIS

2.1 General

Both the USAir and Skywest flightcrews were certified and trained for their duties. The Safety Board did not discover any physiological factors or unusual cockpit distractions that precluded either flightcrew from hearing air traffic clearances as they were transmitted from the control tower. In addition, the Safety Board does not believe that any physiological factors or unusual cockpit distractions were present that prevented the USAir flightcrew from seeing the Skywest airplane on the runway.

All FAA ATC personnel were trained, certified, and qualified for their duties in accordance with the applicable directives. The control tower staffing was considered adequate. There were no apparent physiological disabilities that detracted from their ability to perform at an acceptable level on the evening of the accident.

The air traffic volume in the Los Angeles area during the timeframe of the accident was moderate. The workload was normal. There were no flow control or gate hold procedures in effect at LAX.

Both the USAir and Skywest flightcrews were familiar with the airport arrival and departure procedures, runway layout, and taxiway routes. Likewise, LAX ATC personnel were familiar with the operations of USAir and Skywest Airlines. From experience, the controllers expected commuter airplanes departing from the north runway complex to request midfield departures either from runway 24 left or 24 right.

Weather conditions were well above the criteria for VFR. In postaccident interviews, neither the surviving flight crewmember of USA1493 nor the air traffic controllers identified environmental factors as a constraint to the normal performance of their duties.

The physical evidence on the surface of runway 24 left at the intersection of taxiway 45 and the witness marks on the surfaces and structure of both airplanes indicated that the collision occurred on a runway that was the responsibility of the LC2.

2.2 Air Traffic

After the crew of SKW5569 had received the flight plan clearance from the controller at Clearance Delivery in accordance with local procedure, the flight strip for the flight was forwarded directly to the LC2 position. Because the boarding gates for Skywest Airlines are on the south side of the airport at terminal 6, the flightcrew received initial taxi instructions from the GC1 (south complex) ground controller. Due to the northeastbound route of flight, the airplane was cleared to proceed to the north route via taxiway 48 and made initial contact with the GC2 (north complex) ground controller at the appropriate changeover point. The flightcrew was then instructed to taxi to runway 24 left.

In an effort to reduce workload at the ground control position, LAX ATC procedures did not specify the use and handling of flight progress strips at that position. As a result, aircraft could request intersection departures directly from the local controller. The ground controller was thereby relieved from coordinating with the local controller and marking flight progress strips accordingly. Although intended to reduce the ground controller's workload, the procedures eliminated redundancies that were built into the system and increased the local controller's workload. Without the flight progress strip information, the local controller was required to determine the flightcrew intentions and rely on memory and observations of aircraft moving on the ground to identify and track the progress of aircraft under his/her control. If a controller is unable to recall such details or unable to observe or recognize an aircraft, however briefly, the possibility of error is greatly increased.

A review of the communications transcript of the LC2 position provided the following insight regarding a previous airplane's request for an intersection takeoff: When SKW246 advised, "two forty six will take forty seven," the response, "hold there," indicated that she was aware of this particular aircraft's position. This awareness is again apparent when she asked the flightcrew of SKW246, "...you still holding short of forty seven?" When she received an affirmative response, she advised the flightcrew, "you're next," indicating her intention to take specific action with this flight after the departure of USA23, which she had just cleared for takeoff on runway 24 left.

On its initial radio contact with the LC2 at 1803:38, the flightcrew of SKW5569 advised, "at forty five we'd like to go from here if we can." In later testimony, she stated that she did not hear the "at forty five portion of the transmission." The Safety Board is unable to determine conclusively whether the LC2 heard the flightcrew of SKW5569 state that they wished to depart, "at forty-five." However, subsequent transmissions by LC2 indicate that she was briefly aware of SKW5569's presence on runway 24 left at intersection 45. At 1804:44, she cleared the flightcrew of SKW5569, "taxi into position and hold runway two four left, traffic will cross downfield." At 1805:02 she cleared the flightcrew of SWA725, "taxi up to and hold short of 24 left,...you'll follow the Metroliner." The Metroliner referred to in this instruction must have been SKW5569. This transmission authorized SWA725, a B-737 to come up to the active runway. The transmission could not have been intended for another Metroliner, (WW5072) which was holding short on taxiway Uniform. Such an instruction to WW5072 would have positioned SWA725 in front of the aircraft that it had just been instructed to follow. In addition, her transmission to the flightcrew of WW5006, "traffic will hold in position," indicates that as late as 1805:16 she continued to be aware that SKW5569 was on the runway.

Between 1804:11 and 1804:52, the LC2 made four transmissions in an attempt to clear WW5006 across 24 left. At 1805:09 communication with WW5072 was reestablished. Her repeated attempts to communicate with the flightcrew of WW5006 generated additional workload, and subsequent unnecessary and extraneous conversation with them created a distraction. The resultant effect on her is evident from the fact that at one point she identified the

flightcrew of WW5006 as "Sundance 518," an aircraft that she had cleared to the south complex (runway 25 right) almost 4 1/2 minutes earlier. The Safety Board believes that during her communication with WW5006, the LC2 became preoccupied and forgot that SKW5569 was on the runway.

Her attempts to correct the situation appear to be confused after 1806:08 when the flightcrew of WW5072 called for takeoff. The LC2 immediately asked the flightcrew, "you at forty seven or full length?"

Instead of considering the ramifications of the flightcrew's response to her query, "we're full length," she initiated and participated in a search for the WW5072 flight progress strip. This situation created another distraction that took her away from her duty to scan the runway. If the flight progress strip had been at the LC2 position, this diversion of attention would not have occurred.

As a result of the demanding workload and a lack of other memory aids such as the progress strip, she subsequently "forgot" that SKW5569 was on the runway and misidentified WW5072 for SKW5569. Observing the Metroliner, which she now thought was SKW5569, taxiing in front of her on Uniform, she developed a mental picture and a reasonable expectation that the runway was clear and issued the landing clearance to the flightcrew of USA1493. She testified that following the accident, and after she was relieved from the operating position, she returned to the tower cab of her own volition because:

> "I realized there was something wrong. I went back over to local control to find out, ask him what strips he had in front of him...I said see if you can find Skywest 569. I went to the ground control and I said see if you're in contact with Skywest 569. I went to the supervisor and I told her, I said this is what I believe USAir hit."

The Safety Board believes that the LC2's performance was related to facility procedures in place at LAX on the date of the accident that did not allow for lapses in judgment and decisionmaking and removed human performance redundancies. The LC2 was required to assume full responsibility for strip marking and position determination, in addition to departure and arrival sequencing. As a result, these duties, in addition to working a combined position (helicopter control) and performing the coordination responsibilities to operate that position, created a situation that was abnormally burdensome for the LC2 to respond to successfully. As the workload increased, she initially forgot about and then subsequently misidentified SKW5569. The compelling distractions of her concern over the lack of communication with the flightcrew of WW5006 and her untimely search for the flight progress strip of WW5072 led to this accident.

The Safety Board was unable to determine if the use of the ASDE, if it had been in service, would have prevented this accident. Given the sequence of events, even if she had included a normal scan of the ASDE in her activities, she would not have had a reason for scanning the ASDE specifically in the area of taxiway 45 if she had forgotten about the

aircraft or if she believed the aircraft was on taxiway Uniform. The visibility that prevailed on the night of the accident required only that the ASDE be used as a tool to confirm visual observations. As a part of normal situational awareness, both the BRITE and the ASDE are factored into a controller's normal scan. However, under visual conditions, the controller's primary focus is on the visual observation of the airport environment.

The Safety Board remains concerned that the ASDE at the LAX tower has an extensive history of failure and believes that special efforts must be made to ensure that this equipment is maintained to the highest state of operational readiness. The Safety Board is aware that because this particular equipment is unique to LAX, the facility must rely on limited resources outside the agency to provide parts and other hardware. In testimony at a public hearing conducted by the Safety Board at Detroit, Michigan, from April 18 to 23, 1991, it was learned that the FAA's schedule for the ASDE-3 had slipped and that delivery of this equipment will not take place as soon as was originally anticipated. In addition, the Airport Movement Area Safety System software, which will provide controllers with aural and visual alerts, has developed technical difficulties that may delay the implementation schedule further. The Safety Board encourages the FAA to provide the resources necessary to maintain the current ASDE at LAX until the ASDE-3 is available.

The FAA's Operational Position Standards, 7220.2, were developed during the mid-1980's. The original order was superseded by edition 7220.2A (National OPS). The purpose of the document is to provide detailed guidance on how operations should be conducted at the different positions and to standardize, "how the job is to be done." The order states, "this order contains National OPS that apply to all facilities and instructions that shall be used to write the Facility-level OPS."

As it pertains to facility responsibilities, the National OPS state, "The Air Traffic Manager shall be responsible for ensuring that the requirements of this handbook are met in the facility."

Paragraph 3-7, of the Order entitled "Modifications to the National OPS Prohibited," states, "The National OPS shall not be modified when including the details to produce the Facility-level OPS." The supplemental portion of the National OPS entitled, "Facility Level Details," ensures that all of the local details required to complete a particular step in the OPS procedure are included. For example, if coordination was required to complete a step outlined in the National OPS, the facility would note this step as, "Call Los Angeles TRACON via GP376 voice line; use GP404 line as a backup."

The National OPS state "The required Facility Level Details shall be added, where so instructed in the National OPS, such that the sequences of procedural steps given in the National OPS are not altered by the additions." The order continues, "If the Air Traffic Manager authorizes additions to the Facility-level OPS, the additions shall be made in such a way that the elements, functions, and procedural steps required by the National OPS are

not modified or deleted, and the required sequences of procedural steps are not altered."

The GC position is outlined in Chapter 23 of the National OPS. Under Section 5, "Process Flight Progress Strips," paragraph 23-43, "Mark Flight Progress Strip," states that the flight strip will be marked with, "the runway the aircraft is assigned."

The Facility OPS for the LAX GC position stated, "strips are not required." Testimony received from the previous facility manager, who is currently the Assistant Division Manager of the Air Traffic Terminal Procedures Branch in Washington, D.C., and from the current facility manager, indicated that the facility was in compliance with the National OPS. Their testimony indicated that because the National OPS states that a flight progress strip will be forwarded to the "appropriate position," the decision to forward the flight progress strip from the CD position to the LC position was appropriate and in compliance with the intent of the National Order. The Safety Board believes that the originators of the National OPS recognized that unique circumstances would preclude estal ,shing an exact sequence of flight strip forwarding and accounted for those occurrences, such as "gate hold" procedures that would be in effect, or a coordinator position that would be manned, and therefore purposely allowed each facility to compensate for those special circumstances. The FAA's testimony indicated that facility management could determine, independently, the sequence for flight strip processing. If this rationale was followed to its conclusion, it would render the FAA's attempt to standardize operations in all ATC facilities moot.

Regarding the marking of flight strips, the Facility OPS for the GC position stated, "There is no strip marking required of ground control." However, the National OPS state that the GC should, "Mark the flight progress strip as follows: (b) the runway the aircraft is assigned." It should be pointed out that the National OPS state that as used in the Handbook, the word "shall" or an action verb in the imperative sense means a procedure is mandatory. The decision by facility management to remove the GC from strip marking and flight progress strip forwarding removed a vital redundancy in aircraft tracking.

The Safety Board recognizes that the GC and LC have a shared responsibility for operations on the airport surface. The procedures in effect at LAX at the time of the accident allowed taxiing aircraft flightcrews to randomly communicate with LC on the tower frequency, precluding advance notification from the GC. The LC was then required to select the flight progress strip and determine the aircraft's position on the airport. The Safety Board believes that the intent of the National OPS, which requires the flow of flight strip information from position to position, is to distribute the workload and incorporate redundancies, such as strip marking, to confirm verbal instructions to flightcrews. The Safety Board is concerned that testimony provided by the Assistant Division Manager for Air Traffic Procedures indicated that the LAX tower was in compliance with the National OPS. However, when he was asked, "Does the National OPS allow a facility to deviate from the National standards in that order," his

response was, "I don't believe so, no." Despite FAA testimony, the Safety Board concludes that the LAX ATC tower was not in compliance with the National OPS Order.

The search for the flight progress strip for WW5072 should not have occurred at the CD position and should not have taken the LC2 away from her responsibilities of separating aircraft. If the GC had been "in the loop" when the flightcrew of WW5072 requested their taxi clearance, the GC would not have had the flight progress strip for the aircraft. As a result, the GC would have been required to coordinate with the CD position, and the issue of the misplaced flight strip might have been resolved in a timely fashion.

The Safety Board believes that there is no existing automated monitoring system on which a tower can rely to ensure that human performance errors will always be detected. Unlike radar controllers, who have conflict and minimum safe altitude alerting, or most air carrier flightcrews, who have ground proximity and traffic conflict alerting, local and ground controllers must rely almost totally on their eyes, ears and memory to perform their duties. The expectation that controllers can perform for any length of time without error is unwarranted. In addition, the FAA's expectation of flawless human performance is unrealistic in rapidly changing and dynamic environments that exist at airports such as LAX. Therefore, the Safety Board believes that any job aids and procedures, such as strip marking and flight strip forwarding, which are designed to improve each tower controller's performance, should be adopted and empnasized, repeatedly, until other independent, automated systems become available. The Safety Board also believes that procedural redundancy through the use of tower cab coordinators, local assist controllers and ground control assistants, who can provide a "second set of eyes and ears," should be utilized to the maximum extent possible, especially when traffic conditions warrant that such an additional position be manned.

In the aftermath of the accident at the Atlanta Hartsfield International Airport, involving a B-727 and a Beech King Air that collided on the runway, the Safety Board concluded that the cause of the accident was, "the failure of the FAA to provide air traffic control procedures that adequately take into account those occasional lapses in performance that must be expected." The Safety Board believes that the circumstances of the Los Angeles runway incursion underscore the need to recognize, acknowledge, and take into account those lapses in performance. The designers and operators of complex systems, such as the ATC system, who fail to fully implement required design features and operating procedures, and who allow a single individual to assume the full burden for safety-critical operations, must share responsibility for occasional human performance errors. The Safety Board believes that FAA adherence to the National OPS would have provided the redundancy that could have prevented this accident.

The Safety Board was concerned about informal reports regarding the possibility of the National OPS being abolished. As a result, on July 23, 1991, Safety Board and FAA staff met to discuss the National OPS. During this meeting, Safety Board staff learned that the FAA had formed an ad hoc group to review and determine what changes or modifications should be made to

the National OPS. Safety Board staff was informed by the group leader that their review had determined that the most probable course of action would be to cancel the existing National OPS order and to incorporate portions into the FAA Air Traffic Control Handbook, 7110.65F. This determination was made as a result of a survey conducted at several ATC facilities which had responded that the National OPS was difficult to revise and maintain, and that portions of the National OPS were redundant to other FAA orders. The Safety Board is concerned that this endeavor will dilute the intent of the original National OPS. The FAA's intent in issuing the National OPS was to standardize operations in all air traffic control facilities. The Board believes that merging this order with other ATC operational documents would be counterproductive to this intent.

In view of the circumstances of this accident, and other recent accidents investigated by the Safety Board that have demonstrated human performance deficiencies, the Safety Board believes that the FAA should review and strengthen the language in the current National OPS and retain it as a separate, independent order. The Safety Board also believes that this review should determine the adequacy of human performance redundancies currently called for in the National Order. The Safety Board believes that the review should be conducted by the FAA's Human Factors and Air Traffic Service staffs and that any resultant recommendations, if feasible, should be incorporated into the National OPS.

In addition, the Safety Board is aware that Chapters 5 through 10 of the National OPS for supervisory and controller-in-charge positions have not been completed. The Safety Board believes that the FAA should expedite the development of these chapters and incorporate these standards into the National OPS.

The Safety Board notes that the local assist position at LAX tower was not contained in the local facility OPS. The Safety Board believes that the LAX tower management should revise and implement, at the earliest date, the local facility OPS so that they are in compliance with the National OPS.

The FAA Air Traffic Service management's perception that LAX procedures contained sufficient redundancies as provided by the National OPS may have been reinforced following a facility evaluation that was conducted from July 24 through 28, 1989. The Safety Board is aware that these evaluations, which review the operational and administrative functions of the facility, are designed to ensure adherence to National directives. A review of this evaluation disclosed that it did not identify that essential redundancies were absent.

A followup evaluation from February 12 through 15, 1990, was conducted by observation, monitoring positions, review of actions taken to correct identified problems, and limited interviews. Control positions were monitored for 12 hours. Again, this evaluation failed to identify that essential redundancies were absent.

The Safety Board's investigations of previous accidents and incidents involving ATC deficiencies, as well as its investigations of ATC

operational errors, have been critical of the FAA's safety oversight and quality assurance of the ATC system. For example, following the Safety Board's investigations of a series of operational errors at Chicago's O'Hare Airport during 1987, the Safety Board issued Safety Recommendation A-88-90 to the FAA that urged the establishment of an independent national division that would be responsible for the quality assurance of the ATC system and that would report directly to the Administrator of the FAA. On November 4, 1988, the FAA Administrator responded to this recommendation by stating that the FAA had established the Office of Air Traffic Evaluations and Analysis to perform the overall quality assurance function of the ATC system and that, by design, the office was separate from other elements of the air traffic organization.

Following the Safety Board's investigation of an operational error that involved the U.S. President's airplane during 1988, the Safety Board reiterated its Safety Recommendation A-88-157 stating that the national quality assurance of the ATC system, "would be better discharged by a unit that had no allegiance to the Air Traffic Service and reported directly to the FAA Administrator." On December 8, 1988, the Secretary of Transportation moved the air traffic quality assurance function from the FAA's Associate Administrator for Air Traffic to the newly created Office of Quality Assurance under the Associate Administrator for Aviation Safety.

Following the change of administration in early 1989, the newly appointed Secretary of Transportation informed senior FAA officials that the quality assurance program would be reinstituted within the Air Traffic Service. Concurrently, the FAA established the Office of Safety Quality Assurance to provide safety oversight to operational programs including the Air Traffic Service. This office would report directly to the FAA Administrator. The Safety Board closed its initial Safety Recommendation A-88-90 to the FAA and classified it "Superseded" by Recommendation A-89-41, which urged the FAA to implement and provide adequate staff and funding for the Office of Safety Quality Assurance. On August 17, 1989, the FAA Administrator informed the Safety Board in response to this recommendation that the Office of Safety Quality Assurance would provide quality assurance and safety evaluation of activities to include the Air Traffic Service. He added that this office would "participate in program evaluations [and] independently analyze evaluation reports, conduct its own evaluation of the technical and managerial aspects of those program areas, develop recommendations for correcting deficiencies and actively track the implementation of the recommendations."

The Safety Board responded to the FAA Administrator on January 22, 1990, noting that this office would be staffed by 19 persons but would only have 2 individuals dedicated to ATC issues. The Safety Board concluded that because of the small number of persons tasked with ATC quality assurance and the magnitude of the ATC system, the FAA's Office would not be capable of providing the necessary oversight of the ATC system. It therefore classified Safety Recommendation A-89-41 as, "Open--Unacceptable Action."

On April 12, 1990, the FAA Administrator had informed the Safety Board, in response to Safety Recommendation A-89-41, that, "the FAA's

intention in establishing the Office of Safety Quality Assurance was not to exercise "total oversight" in a manner that would routinely involve its staff in the day-to-day events occurring in the system, but to monitor and assess programs on a broad national scale." Further he stated, "The principal role of the Office of Aviation Safety is to monitor the system and to ensure that the Office of the Associate Administrator for Air Traffic has an effective quality assurance organization in place and functioning properly."

On September 11, 1990, the Safety Board classified Safety Recommendation A-89-41 as, "Closed-Unacceptable Action/Superseded," and issued a new safety recommendation (A-90-125) to the FAA urging it to, "Modify the functional statement of the Federal Aviation Administration Office of Safety Quality Assurance and provide sufficient resources to it to make it capable of providing effective quality assurance and safety oversight of the air traffic control system."

On December 18, 1990, the FAA Administrator in his response to Safety Recommendation A-90-125, informed the Safety Board, "The responsibility for the overall quality assurance and safety oversight functions of the air traffic control system is assigned to the Office of Air Traffic System Effectiveness. This organization provides a thorough and comprehensive national program of system effectiveness and evaluation, air traffic accident and incident investigation, and system analysis and improvements. The office is staffed adequately and empowered to accomplish its mission." He added, in part, "...I continue to believe that the Office of Safety Quality Assurance has a proper mission within the FAA, and that its staff is accomplishing the mission in a professional manner."

The Safety Board questions the FAA's depth of commitment to provide effective quality assurance and safety oversight of the ATC system. This fatal accident, which might have been prevented if FAA national facility evaluations had identified that mandatory redundancies were not present, demonstrates conclusively an inadequate and ineffective quality assurance and safety oversight program. The Safety Board also believes that because of inadequate authority and resources, the Office of Safety Quality Assurance is unable to effectively monitor and provide the necessary oversight of the ATC system. The Safety Board is concerned by the FAA's failure to recognize the need for and to establish an office that would be independent, and therefore objective, and empowered with the responsibility to conduct system safety oversight of the ATC system. The Safety Board concludes that the Office of System Effectiveness, which is embodied within the Air Traffic Service, is, in effect, evaluating itself. It is organized in such a way that no actual oversight exists.

The Safety Board believes that the Office of Air Traffic Service should have an oversight capability to manage, identify and correct day-to-day events that occur in the system; however, an independent national office, which is separate, organizationally, from the Air Traffic Service and would be responsible for the total quality assurance of the ATC system, is required to ensure that compliance and system safety are being achieved. It is apparent to the Safety Board that the FAA has not been receptive to any safety recommendation that urges the development of an independent office

that has the responsibility for quality assurance and system safety oversight of the ATC system. On July 11, 1991, the Safety Board classified Safety Recommendation A-90-125 as "Closed--Unacceptable Action." The Safety Board firmly believes that the FAA should reconsider its position and provide the authority and resources to the Office of Safety Quality Assurance to independently evaluate air traffic control facility compliance with FAA directives and to audit facility evaluations performed by the Office of Air Traffic System Effectiveness to determine that noted deficiencies are corrected.

The Safety Board also recognizes the important aspect of personnel training related to this accident. A month after the LC2's certification as a full-performance-level (FPL) controller at LAX, her first such certification at a Level V facility, she was assessed on performance by her supervisor in accordance with the requirements of the Technical Appraisal Program (TAP). The TAP, which provides a means to identify areas of performance deficiency through firsthand observations, is intended to assist supervisors in determining training needs for controllers so that they may improve their performance.

The supervisor's observations, 6 weeks prior to the accident, were made while the controller was assigned to the LC position. He conducted an over-the-shoulder evaluation and identified deficiencies that were indicative of weaknesses in her performance. Two of these deficiencies were "critical training indicators" (CTI). The supervisor's written report identified:

- o A loss of awareness of aircraft separation (CTI)
- o The misidentification of an aircraft by use of an incorrect call sign (CTI)
- o The failure to complete two required coordinations with other controllers
- o The failure to issue a required advisory to an aircraft

Two of these previously identified CTI performance deficiencies--loss of awarness of aircraft separation and aircraft misidentification--were again evident in the LC2's performance on the night of the accident, suggesting that they were not addressed and remedied after they were initially documented. In fact, the supervisor's subsequent testimony at the Safety Board's public hearing indicated that although he completed the evaluation and discussed these items with the controller, he did not initiate any other remedial action. Under further questioning, he also indicated that he did not have a clear understanding of the TAP. Regarding the definition of CTI's he stated "...I'm not completely clear on that point."

The Safety Board is concerned that the FAA may not benefit from the full potential of the TAP because of inadequate understanding of the intent and purpose of the program at the supervisory level. Therefore, the Safety Board believes that more effective training of supervisors concerning the TAP is warranted. In addition, it was noted that the effectiveness of the TAP

could be enhanced if the records of observations were retained for periodic review. The Safety Board believes that training requirements could be better determined if TAP evaluations were retained for 2 years.

The Safety Board is aware that the current operational procedures at LAX permit departures and arrivals to be sequenced to all runways. These procedures create an additional burden on the LC position because the focus and span of attention must include all runways for potential departures and landings and interconnecting taxiway traffic; these procedures may also increase the number of runway intersection takeoffs, position and hold clearances and runway crossings that will occur. The Safety Board believes that LAX and the FAA assume an additional risk under current operational guidelines, unlike the airports in Atlanta and Dallas-Ft. Worth that primarily segregate arrival and departure traffic to specific runways. In public testimony, the FAA's Executive Director for System Development recently stated that the priorities of the FAA are, "safety first...capacity second." The Safety Board concurs with this FAA position and believes that the operating procedures at LAX should be modified so that arrivals and departures are segregated to specific runways. In addition, the Safety Board believes that the FAA should undertake a thorough risk based evaluation of ATC procedures at LAX to determine whether changes are required and implement those changes necessary to enhance safety. The evaluation should consider at least the issues of runway intersection takeoffs, position and hold clearances, displaced runway thresholds, runway crossing traffic, local assist controller manning and ASDE use and maintenance.

2.3 Airplane Conspicuity

The investigation disclosed that the Metroliner's navigation/position lights and red anticollision beacon located on top of the vertical stabilizer were the only lights illuminated on the airplane at the time of the collision. However, during an additional conspicuity exercise, it was visually evident from both the tower and the final approach that the aircraft and runway lights tend to blend together, perceptually.

During the field phase of the investigation, members of the Safety Board's technical staff, with support from representatives of the airline industry and the FAA, conducted an aircraft external lighting detection task/exercise at LAX during night visual meteorological conditions (VMC). A Metroliner identical to the one involved in the accident was placed at the same location on runway 24 left where the collision occurred. The airplane was aligned with the centerline of the runway and its navigation and anticollision lighting were on and operating. The runway edge lighting and centerline lighting were at low (step 2) intensity. During visual approaches to the runway, cockpit observers found it difficult to differentiate between the Metroliner and the lighted runway environment. The size of an aircraft and its proximity to the runway lighting, especially on runways with centerline lighting, make these light sources virtually indistinguishable when viewed from directly behind and above.

The visual approach exercises also indicated that the likelihood of detecting an aircraft from the rear on an active runway by an approaching

aircraft can be increased if the first aircraft is displaced from the runway centerline lighting by approximately 3 feet. Moreover, when this offset procedure was used in conjunction with high-energy strobe lighting and anticollision and navigation lighting, aircraft conspicuity was enhanced. The Safety Board notes that most air carriers, and a considerable number of general aviation aircraft operating in the National Airspace System (NAS), are equipped with some form of high-energy strobe lighting. Therefore, this combination of actions, as well as equipment, would be available to nearly all users in the NAS.

Officials from the Aviation Safety Reporting System of the National Aeronautics and Space Administration (NASA) have conducted several analytical studies of reports by pilots and controllers involved in runway transgressions. The latest study, published in 1985, revealed that the most frequently cited factor in controller-enabled departure transgressions was "controller failure to visually locate traffic."

The Safety Board believes that the use of strobe lighting, along with the practice of displacing the aircraft off the centerline lighting, would significantly enhance the ability of pilots and air traffic controllers to visually detect traffic conflict situations. The use of strobe lighting by aircraft occupying an active runway would also ease the controllers' memory load by assisting them in locating, identifying, and segregating aircraft on an active runway.

During the Safety Board's public hearing on the Los Angeles accident, testimony was received from representatives of the FAA and industry concerning aircraft external lighting standards and conspicuity. An FAA lighting specialist testified that the federal standards for aircraft external lighting are primarily intended to serve in-flight conspicuity needs and that no effort has been made by the FAA to address the issue of conspicuity of aircraft on airport surfaces.

The Safety Board believes that the FAA should study and evaluate ways of enhancing the conspicuity of aircraft on airport surfaces during night or periods of reduced visibility. The concept of displacing an aircraft away from the centerline lighting and the use of lighting enhancements, such as high-energy strobe lighting and logo lighting, by aircraft on active runways should be explored and evaluated for their value to the conspicuity issue.

A representative of the Fairchild Aircraft Company, the manufacturer of the Metroliner, testified that the flightcrew of USA1493, due to line-of-sight obstruction, may have been unable to see the anticollision beacon on top of the vertical stabilizer. The Metroliner's rudder cap obstructs the beacon when viewed from the rear. As the flight descended below 100 feet over the runway surface, "it is very possible he couldn't see the beacon." When the surviving flight crewmember of USA1493 was asked to account for the fact that he didn't see the Metroliner earlier, he testified, "It wasn't there. It was invisible."

Federal Aviation Regulations permit some aircraft structural obstructions, which, in this case, interfered with the flightcrew's ability to see the anticollision beacon. Nevertheless, the anticollision beacon obstruction on N683AV was within the allowable criteria.

The Safety Board has been unable to determine with certainty whether the inability of the flightcrew to detect the anticollision beacon when USA1493 was below 100 feet over the runway surface contributed to the accident. Nevertheless, the Safety Board believes that in establishing permissible areas of obstruction, the coverage compliance standards should give consideration to the approach, overtaking, and takeoff situations; that is, the anticollision light of an aircraft in position on a runway should be clearly visible to the pilot of another aircraft planning to land or take off on that runway. The Safety Board therefore believes that the FAA should reevaluate and redefine the permissible areas in which the illumination of an anticollision light is obstructed by aircraft structure.

The intensity and vertical coverage of the anticollision beacon on N683AV met the performance standards under which the airplane was certificated. The Safety Board is aware that airplanes certificated after September 1, 1977, are required to have an anticollision light with an intensity of 400 candles and a vertical coverage of 75 degrees above and below the horizontal plane of the airplane. This represents a fourfold increase in light intensity and a significant expansion of the demands of vertical coverage that airplanes certificated prior to September 1977 were required to meet. The Safety Board was unable to determine whether the installation of an anticollision light on N683AV applicable to the current standards would have altered the outcome of the accident. The Safety Board believes, however, that it is reasonable to conclude that any increase in the external lighting of the Metroliner would have enhanced the possibility of detection by the flightcrew of USAir 1493. Consequently, the Safety Board believes that the FAA should encourage operators of airplanes certificated prior to September 1, 1977, to enhance the nighttime conspicuity of their airplanes by upgrading to the current standard for anticollision light installations.

2.4 Flightcrew Situational Awareness and Vigilance

Inherent in the "see and avoid" concept to avoid collision is a need for pilots to be alert and vigilant in monitoring air traffic communications for situations that may lead to conflicts with other aircraft. The Safety Board believes that the importance of such attentiveness should be reemphasized within the aviation community.

As in some previous accidents investigated by the Safety Board, both the USAir and Skywest flightcrews were operating their aircraft in accordance with their respective ATC clearances. The clearance for SKW5569 to taxi into position and hold on runway 24 left and the clearance for USA1493 to land on runway 24 left were communicated by the local controller.

The Safety Board is concerned that the relatively low number of runway incursions may lead to a relaxed vigilance and a decrease in the high

state of situational awareness of pilots that is so critical to their performance. A NASA study on near midair collisions[14] found that erroneous beliefs about shared responsibility may occur when flightcrews are operating under ATC control. In such circumstances, a pilot may relegate a part of his or her responsibility for situational awareness to the controller. In the radar environment of an approach and after having received specific landing clearance, pilots may relax their vigilance in listening to communications that are not specifically directed to their aircraft. In addition, they may reduce efforts to visually scan for aircraft between their position and the intended landing runway. Pilots must not only be vigilant for ATC communications directed to their call signs, but also for other communications on the air traffic radio frequency that could provide notice of a developing traffic conflict situation involving their aircraft. Pilots of an aircraft on an active runway or on final approach to landing should be especially vigilant in listening for information about the runway they currently occupy or expect to occupy.

The FAA report entitled "Reducing Runway Incursions," published in April 1990, disclosed that "insufficient awareness of surface and landing traffic" was a principal pilot-related causal factor of runway incursions. Increasing levels of air traffic are placing more demands upon controllers and pilots. It is therefore essential that pilots monitor the ATC system to the fullest extent possible to detect unsafe practices or conditions that may affect their flight and to take action to protect themselves from dangerous practices or conditions before they result in accidents.

The Safety Board recognizes the challenging, inherent difficulties in monitoring the flow of information that is intrinsic to high-density environments of the NAS and the fundamental limits on the human ability to receive and process such information. These limits are affected by workload, experience, and processing strategies. The Safety Board recognizes that more than 60 ATC communications took place in the 3 minutes and 43 seconds from the time USA1493 came on the LC2 frequency until the accident. The Safety Board also recognizes that the LC2 missed some key transmissions. Nevertheless, the Safety Board believes that effective training, planning, and resource management can diminish the effects of limitations on the ability of pilots to detect time-critical information and that all NAS users will benefit.

The Airman's Information Manual (AIM) is the U.S. official guide to basic flight information and ATC procedures for operating in the NAS. The Safety Board believes that appropriate language should be added to the AIM that reinforces the need for pilots to maintain vigilance in listening to ATC frequencies for information that may jeopardize the safety of their aircraft. The Safety Board also believes that the general aviation and commercial air carrier community should take steps to ensure that their respective training programs, including cockpit resource management training

---

[14] Billings, C., Greyson, R., Hecht, W., and Curry, R., "A Study of Near Midair Collisions in US Terminal Airspace," NASA Technical Memorandum 81225, 1980.

and flight operating procedures, place sufficient emphasis on the need for pilots to maintain vigilance in the monitoring of ATC communications for potential traffic conflicts with their aircraft, especially when on active runways and during final approach/landing segments. The enhancement of situational awareness of flightcrews can be attained through the application by pilots of the concepts of cockpit resource management (CRM) training. Improved flightcrew performance, such as the reduction of selective listening and other practices, can increase opportunities to receive helpful information that may prevent accidents. Nevertheless, the FAA does not require CRM training programs for flight personnel. Based on its accident investigation experience, the Safety Board has frequently advocated more widespread use of CRM training concepts by air carriers.

In January 1990, and again in November 1990, the Safety Board issued recommendations to the FAA following investigations of two accidents that occurred as a result of poor flightcrew coordination and situational awareness. The first recommendation, A-89-124, urged the FAA to require 14 CFR 121 operators to develop and use CRM programs. It was issued following the crash of Delta Air Lines flight 1141, a Boeing 727, at Dallas-Fort Worth International Airport, on August 31, 1988. In that accident, 14 persons were fatally injured and 26 other people aboard were seriously injured. The second recommendation, A-90-135, urged the FAA to require scheduled 14 CFR 135 operators to develop and use CRM training programs. This recommendation was issued following the crash of Aloha IslandAir flight 1712, a deHavilland DHC-6, at Molokai, Hawaii, on October 28, 1989, which killed all 20 persons aboard. The FAA responded on February 8, 1991 to both recommendations that it was considering amending the training requirements for these operators and, if so amended, all such certificate holders would be required to include CRM in their flight crewmember training programs. The Safety Board regards these two recommendations as "Open--Acceptable Response" based on the above reply.

The Safety Board believes that the circumstances of this accident underscore the need for both requirements and therefore it reiterates these recommendations to the FAA.

2.5 Communications Phraseology

The Safety Board believes that pilots and air traffic personnel should adopt clear and concise standard phraseology regarding intersection takeoffs and "position-and-hold" clearances. In all likelihood, such action would contribute significantly to a reduction in the number of runway incursions.

A review of the air traffic local control frequency recording covering the period 9 minutes before and 5 minutes after the accident at LAX disclosed several occasions where the phraseology used by pilots was inappropriate. Examples include the use of such words and phrases as, "We'll take forty seven," "Okay," "We'd like to go from here," "For the left side two four left." These words do not convey the extent of specificity that is required in the NAS. Specifically, the LC2 stated that she did not hear the flightcrew of SKW5569 state that they were at taxiway 45. If the flightcrew

of SKW5569 had stated, "we are at the taxiway 45 intersection, ready for takeoff," it is possible that the misidentification might not have occurred. The use of nonstandard words and conversational phraseology precipitates misunderstanding between pilots and controllers.

The Safety Board's Special Investigative Report entitled "Runway Incursions at Controlled Airports in the United States" (NTSB/SIR-86/01) disclosed that many runway incursions were attributable to the improper use of phraseology that resulted in miscommunications by controllers and pilots. The joint FAA/industry partnership to improve pilot/controller communication that produced the document "Call to Action," published in 1988, provided further evidence that the most common and troublesome problem evident in the ATC system was the improper use of established and recommended phraseology by pilots and controllers.

Neither the AIM nor the Air Traffic Control Handbook (7110.65F) contain specific phraseology to be used by pilots when requesting an intersection departure and by ATC personnel when issuing a position-and-hold clearance for an intersection departure. The Los Angeles accident provides vivid evidence that position-and-hold operations at intersecting points along runways continue to play a significant role in the runway incursion problem.

The Safety Board believes that a solution to reducing misunderstandings and/or loss of situational awareness by pilots and controllers concerning intersection takeoffs is to establish clear and concise standard terminology for pilots and controllers. For example, pilot request: "Cessna N12345 request intersection takeoff from runway 24 Left at taxiway 45;" controller reply: "Cessna N12345, taxi into position and hold runway 24 Left at intersection 45." Recommended communication phraseology regarding the request for intersection departures should be incorporated into the appropriate section of the AIM. In addition, standard air traffic phraseology and procedures regarding position and hold at intersections should be incorporated into the Air Traffic Control Handbook (7110.65F).

Moreover, the Safety Board believes that all pilots, general aviation and commercial, should be made aware of the events leading up to this accident through operations bulletins and safety seminars, such as the "Wings Pilot Proficiency Program."

2.6 Survival Factors

The emergency response for this accident was timely and effective. The close proximity of Fire Station 80 to the accident site, coupled with the rapid response of ARFF units, facilitated personnel efforts to apply extinguishing agent to the external fires and to assist some of the passengers in egressing from the B-737. The Safety Board believes that these factors reduced injuries and saved lives. The Safety Board also found that the rapid availability of adequate numbers of ARFF-trained fire fighters, from both Fire Station 80 and off-airport structural fire companies, allowed ARFF personnel to implement an interior fire attack immediately. Sufficient personnel also allowed the extrication of the first officer, while protecting him from fire.

During the emergency evacuation, the R-1 exit, the left and right overwing exits, and the R-2 exit were used. Many of the passengers stated that the cabin filled with thick black smoke within seconds of the impact with the building. It is possible that some of the passengers, who perished in the aisle waiting to exit through the row 10 exits, could have made their way aft to the R-2 door. However, based on survivors' reports of the rapid infusion of thick smoke, it is more probable that the aft portion of the cabin became obscured by smoke early, limiting the use of the R-2 exit.

The delay in opening the right overwing exit prompted by the passenger who "froze" and the subsequent altercation involving two other passengers significantly hampered the evacuation to the extent that additional passengers who may have been able to escape did not. The outboard seatback adjacent to the overwing exit, which folded forward and blocked part of the opening, also slowed the evacuation of passengers. However, it was not possible to determine the cumulative effect of these events. A deceased flight attendant and 10 deceased passengers were found lined up in the aisle from 4 1/2 to 8 feet from the overwing exits. They most likely collapsed while waiting to climb out the overwing exit. They perished as a result of smoke and particulate inhalation, strongly suggesting that they were able to make their way, possibly guided by the floor path emergency lights, to the overwing area from as far away as the forward cabin.

2.6.1 Flight Attendant Training and Performance

The investigation included a review of USAir's emergency procedures training methods and the use of cabin mockups for training. During initial emergency evacuation training, student flight attendants are required to evacuate a cabin filled with simulated smoke. The Safety Board determined that the "hands on" training was realistic and replicated (as much as possible in training) what could be expected in an actual emergency.

However, based on the circumstances of this evacuation, three potential training issues warrant discussion. The airplane was equipped with personal breathing equipment (PBE). However, flight attendants are trained in accordance with FAA standards to use the PBE for fighting in-flight fires rather than as a supplemental breathing source in emergency evacuations. The deceased flight attendant, who found the L-1 exit inoperable, made her way down the center aisle to reach the overwing exit to facilitate passenger evacuation and to try to escape herself. The Safety Board considered that if the PBE had been used by the flight attendant, it would have provided protection from the smoke and she may have survived. However, the Safety Board also recognizes that the time required to reach and don a PBE could extend time in a smoke-filled cabin and thereby reduce the chances of survivability. Therefore, the Safety Board does not consider it appropriate to suggest a change to the current policy on the use of PBEs for in-flight fires.

The USAir policy for the B-737 assigns flight attendants' "2nd choice" exits at the overwing (Type III) location. The Safety Board believes that air carriers that have a second choice exit assignment should emphasize in flight attendant training the need to evaluate personal risk in a decision

to go to a second choice exit as opposed to chosing a closer escape path. For example, another door or any opening in the fuselage may be acceptable and more appropriate. Therefore, the Safety Board believes that the Emergency Evacuation Subcommittee of the FAA Aviation Rulemaking Advisory Committee should examine air carrier flight attendant emergency procedures regarding the second choice exit assignments to ensure that such assignments provide for use of the nearest appropriate exit point.

The Safety Board also notes that both the L-2 and R-2 flight attendants released their restraint systems after the collision with the Metroliner but before the B-737 impacted the abandoned fire station. Additionally, the L-2 flight attendant partially opened the L-2 door, allowing the slide pack to fall free, and then reclosed the exit as the airplane slid from the runway.

During testimony given at the Safety Board's public hearing and during the postaccident interviews, both flight attendants stated that they were trained not to release their restraints until the airplane came to a complete stop and that, in retrospect, they understood the wisdom in that procedure. Their rationale for their premature restraint release was that they saw fire outside the airplane and released their restraints based on their limited knowledge of the hazards that existed. Nonetheless, on final impact with the building, both of them were thrown forward into the galley bulkhead, action that could have incapacitated them. Except for minor contusions, both of them were able to respond and facilitate the evacuation from the R-2 exit. Although releasing their restraints was intended to speed up the evacuation, the possible consequences of serious injury could have prevented either or both of them from assisting in the evacuation. The Safety Board believes that the potential for flight attendant survival can be significantly increased by providing flight attendants with supplemental training to underscore the importance of remaining in their jump seats with their restraints fastened until the airplane has come to a complete stop.

2.6.2 Source and Migration of the Cabin Fire

When the B-737 overrode the Metroliner, the cockpit and forward lower cargo bay areas were extensively damaged. As the B-737 and Metroliner continued to slide, the fuselage and lower cargo bay of the B-737 were involved with fuel from the Metroliner's ruptured fuel cells and hydraulic fluid from the B-737's damaged nose gear. The initial impact with the Metroliner also damaged the avionics bay located below the cockpit in front of the lower forward cargo bay. The front portion of the cargo bay collapsed rearward and upward. The location of the crew oxygen cylinder on the forward right side of the cargo compartment shows fuselage skin penetrations originating from outside of the airplane. The regulator for the crew oxygen cylinder was most probably damaged during the initial impact sequence which resulted in the escape of gaseous oxygen. Fuel from the Metroliner and hydraulic fluid from the B-737 provided a fuel source for the fire, and oxygen from the crew oxygen cylinder accelerated it.

After the initial impact, the R-1 flight attendant, who was seated in the jump seat located directly above the cargo bay, remembered hearing

metal scrape just before the cabin lights went out and the emergency lights came on. He remembered the floor directly in front of his jump seat moving up and down about knee high as heat and smoke entered the forward cabin area. When the B-737 impacted the abandoned fire station and the airplane stopped, he recalled that the smoke coming through the floor near him became more dense and that it became more difficult to breath. He also noted that the first-class cabin filled with smoke very quickly.

The significant fire damage in the forward cargo bay and the vertical burnthrough in the forward cabin area strongly suggest that the area was subjected to prolonged exposure to a high-temperature fire. That factor, as well as the relatively uniform burn pattern throughout the cabin and the fact that the B-737's fuel did not contribute to the fire, indicates that the origin of the fire was in the forward cargo bay area.

The extent to which the release of oxygen from the crew emergency cylinder accelerated the fire is unknown. However, assuming fuel from the Metroliner had penetrated the lower cargo area, oxygen released from the bottle would have enriched the burn environment and thereby accelerated the generation of heat and smoke. The presence of a melted and burned through area on the right outboard side of the fuselage, approximately where the crew oxygen bottle was secured to the right sidewall, is a further indication that a gaseous oxygen release served to accelerate the fire from the lower cargo bay area up into the cabin.

Comments by survivors regarding the appearance within the cabin of thick black smoke very early in the accident sequence are consistent with observations in other airplane accidents involving gaseous oxygen and fire. The Safety Board believes that the propagation of the fire in the cabin of USA1493 was accelerated by the release of oxygen from the flightcrew oxygen system that was damaged in the initial collision sequence on the runway and that the accelerated fire significantly reduced the time available for emergency evacuation. The Safety Board recognizes that gaseous oxygen systems are not required to meet specific crashworthiness standards and that there were unique impact forces resulting from this runway collision.

The technical data surrounding this accident and the historical data regarding gaseous oxygen fires do not appear to be sufficient to support the need for specific airplane structural or systems modifications. The Safety Board is aware of and encourages ongoing FAA research on the potential for gaseous oxygen involvement in aircraft fires. The Safety Board supports this effort and urges the FAA to continue the research with a view toward system modification.

2.6.3 Adequacy of FAA Regulations Relative to Fire Retardant Cabin Furnishings

The need for fire retardant cabin furnishings on transport aircraft was first addressed by the FAA in 1947. By 1972, FAA regulations required carpets, seats, and interior panels, to undergo Bunsen burner flammability tests. Subsequently, the FAA conducted additional research and proposed upgrading these standards by adding toxicity, smoke, and improved

flammability criteria. By 1977, in the absence of full-scale burn tests to support the rule and proposed standards, the rule was withdrawn. As a result, the FAA formed the Committee on Special Aviation Fire and Explosion Reduction (SAFER), which conducted full-scale tests and research and made recommendations for fire safety improvements. The technical information developed as a result of these tests provided a standardized method of evaluating the suitability of cabin materials. On April 16, 1985, the FAA issued a Notice of Proposed Rulemaking (NPRM) entitled "Improved Flammability Standards for Materials Used in the Interiors of Transport Category Airplane Cabins," which became a regulation in 1985. The regulation established new fire test criteria for type certification, required that the cabin interiors of airplanes manufactured after 1985, and used in air carrier service, comply with these new criteria, and required that cabin interiors of all other airplanes type certified after January 1, 1958, and used in air carrier service, comply with these new criteria upon the first replacement of the cabin interior.

The accident B-737 was manufactured before the effective date of the regulation and therefore any retrofit of fire retardant cabin furnishings was required only in the event of a "general retrofit" by the carrier. Piecemeal replacements of cabin furnishings, except for fire-blocked seat covers, are not required to meet the new flammability standards. The FAA's rationale for this policy was the adverse economic effect on the airline industry. Thus, it is reasonable to expect that if an air carrier applied this regulation, as written, an airplane in service for 20 or more years might never be subjected to a "general retrofit," which requires an upgrade to the fire retardant materials.

In this accident, all of the cabin furnishings burned except for the carpeting and seats. The overhead bins melted and ignited and then fell on the passengers and the cabin floor. If cabin furnishings of the type specified for newly manufactured aircraft had been installed in the accident airplane, fire and toxic smoke might not have spread so quickly through the cabin. The Safety Board believes that after a specified date air carriers should be required to use fire retardant materials in all transport category airplane interiors that meet the provisions of 14 CFR 25.853.

2.6.4 FAA Exit Row Regulations

On April 5, 1990, the FAA enacted the final rule for "exit row seating," which required all Part 121 and 135 operators to screen and brief passengers who are assigned seats in exit rows. The rule became effective on October 5, 1990. The Notice of Proposed Rulemaking, which was published on March 13, 1989, and the final rule provided only general guidance on how operators could comply with the rule by stating, "Airlines must take steps to inform passengers sitting in exit rows about what may be required of them in an emergency evacuation." Although this general guidance did not specify how operators were to comply with the rule, operators were required to have FAA-approved programs for procedures to screen and brief passengers. At the time of the accident, and almost 4 months after the final rule became effective, the FAA had not completed its review, approval or rejection of any of the programs submitted by USAir and 12 other operators. FAA required that

the program be subject to successive approval by the principal operations inspector (POI), the FAA Regional Office, and the FAA Flight Standards Service, in Washington, D.C.

During the Safety Board's public hearing, the FAA's Deputy Director of Aircraft Certification acknowledged that there were "initial problems" with programs submitted by air carriers that would have to bear the burden of any subsequent changes required by the FAA. Consequently, the FAA issued a checklist to operators and established a special team of evaluators to review each proposed program. On May 22, 1991, the FAA's POI assigned to USAir approved the airline's exit screening and evacuation briefing program.

USAir believed that its proposed program met the intent of the rule by providing passenger screenings by ticket and gate agents, affixing placards to exit row seatbacks, similar to the placard on the accident airplane that described passenger duties and responsibilities, and by offering flight attendant briefings for exit row passengers. The USAir screening and briefing program probably resulted in more passengers escaping through the overwing exits than otherwise would have.

The FAA's method of implementing this important safety rule has resulted in a great deal of confusion among air carriers and, more importantly, delayed its implementation. This delay by the FAA has not been in the public interest.

2.6.5 Improved Access to Type III Exits

The issue of adequate access to Type III (overwing) emergency exits has been of concern for many years. This concern intensified after the August 22, 1985, accident involving a B-737, operated by British Airtours, which was destroyed on the ground by fire in Manchester, England. The accident resulted from an engine malfunction that occurred before takeoff. Of the 137 occupants, 57 were unable to evacuate the airplane and were fatally injured. In 1986, the United Kingdom Civil Aviation Authority (CAA) commissioned Cranfield Institute to conduct a human factors research program to investigate the influence of certain cabin configurational factors on the behavior of passengers in situations where the evacuation process had become disorderly. The objective of the research was to assess the effect on passenger behavior and flow rates during simulated emergency evacuations. Subsequently, the British Civil Aviation Administration (CAA) issued an Airworthiness Notice (AN-79), requiring increased access to Type III exits of airplanes registered in the United Kingdom.

The circumstances of this accident are similar to those in the Manchester accident in that many passengers attempted to exit from an overwing exit in a very limited period of time. The 10 USAir passengers and L-1 flight attendant successfully made their way to the exit; however, they succumbed to smoke and toxic fumes while awaiting their turns to exit. The size of the Type III exit is a limiting factor during an evacuation. In addition, some occupants lost valuable time because of the delay in opening the exit, the altercation at the exit, and a possible obstruction created by a broken outboard seatback.

In response to concerns expressed by the public after the Manchester accident, the FAA convened a Public Technical Conference (PTC) in September 1985 for the purpose of examining emergency evacuation from transport airplanes. Access to Type III exits was a topic of particular concern. Subsequent to the PTC, tests were conducted by CAMI to examine the relationship between passageway width and evacuation flow rate. The tests showed that the flow rate increased by 14 percent after the following improvements were made: "A configuration which had a minimum of 20 inches of unobstructed passageway to the exit, with the leading edge of the seat bottom cushion of the row of seats aft of the exit protruding 5 inches forward of the projected aft vertical edge of the exit opening; and a configuration which provided two passageways to the exit by centering a seat row on the exit, but with the outboard seat deleted and with the seat rows forward and aft of this seat row spaced at 32 inches (providing two, approximately 6 inch unobstructed passageways)."

No further action was taken by the FAA to address or resolve the problem of access to Type III emergency exits until the issuance of an NPRM entitled "Improved Access to Type III Exits," on April 9, 1991, 2 months after the accident at LAX.

The NPRM addressed the salient issues pointed out after the Manchester accident and the preliminary information gathered during the on-scene phase of the LAX investigation. The NPRM solicited comments on the need to remove seats next to Type III exits, to increase the space between seat rows on each side of the exits, or a combination of the two options. The Safety Board believes that a continuous access path of no less than 20 inches, as demonstrated by tests, is preferable to removing the seat adjacent to the exit or removing the seat and having a 20-inch or less access path. Furthermore, the Safety Board believes that the proposed compliance requirement of 6 months is necessary and reasonable because operators have had ample time to prepare for this proposed regulation. The Safety Board supports this rule and encourages the FAA to develop and issue a final rule at the earliest possible date.

2.7 Efforts to Reduce Runway Incursions

The Safety Board has long been concerned about the runway incursion/ground collision issue. Based on that concern, the Board included this issue when it adopted the "Most Wanted" Safety Recommendations program in 1990. The issue continues to be a part of the "Most Wanted" list. This concern was heightened by two recent fatal accidents that preceded this accident. These previous accidents were the collision in Detroit, Michigan, on December 3, 1990, between Northwest Airlines flights 299 and 1482[15] and

[15] "Northwest Airlines, Inc., Flights 1482 and 299, Runway Incursion and Collision, Detroit Metropolitan/Wayne County Airport, Romulus, Michigan, December 3, 1990" (NTSB/AAR-91/05)

the collision in Atlanta, Georgia, on January 18, 1990, between Eastern Airlines flight 111 and an Epps Air Service King Air A100.[16]

The runway collision of USA1493 and SKW5569 involved controller-related factors identified in previous Safety Board reports. These factors are related to human performance and are being addressed in a number of different actions, including FAA and industry efforts to increase awareness of the nature and magnitude of the human performance problem, improved training and technological solutions that may reduce the workload, and a fail-safe redundancy for the human performance of air traffic controllers.

The Safety Board is aware of several advanced concepts in airport surface traffic detection and automation that, when perfected and coupled with the correct match of hardware and location-specific software, could provide warnings to preclude accidents similar to the collision of USA1493 and SKW5569. For example, the FAA is currently testing an Airport Movement Area Safety System (AMASS). The AMASS system will use the data available in Airport Surface Detection Equipment (ASDE-3) and the Automated Radar Terminal System (ARTS) to identify potential incursions and will alert the controller so that timely corrective actions can be taken. The Safety Board fully supports the early development and installation of such systems at appropriate airports with high volume and complex traffic flow.

On a broader scale, the Safety Board encourages the FAA to continue the research effort in Airport Surface Traffic Automation (ASTA), which is intended to develop automation tools and more complete automation for controlling the flow of aircraft on the airport surface. In addition to reducing the frequency of runway incursions, design goals of the program should include a reduction in taxiway incursions and improvements in ATC operational efficiency. This automation, including Departure Flow Management (DFM) and Terminal Air Traffic Control Automation (TATCA), is intended to support interactions among the various aircraft on the airport surface and on the approach path.

Although the Safety Board fully supports and encourages these efforts, it nevertheless recognizes that these programs are intended for a limited number of high-density air carrier airports, and that the operational benefits will not be available until the late 1990s or later. The Safety Board commends the FAA's efforts to fund, support, and implement an operational system analogous to the airborne conflict alert system to prevent runway incursions at all U.S. certificated airports that are served by air carriers.

2.8 Pilot Self-Medication

The results of the examination of the toxicological specimens taken from the captain of USA1493 were positive for phenobarbital, a medication

---

[16] "Runway Collision of Eastern Airlines, Boeing 727, Flight 111 and Epps Air Service, Beechcraft King Air A100, Atlanta Hartsfield International Airport, Atlanta, Georgia, January 18, 1990" (NTSB/AAR-91/03)

prescribed by his personal physician for the treatment of a gastrointestinal disorder. Phenobarbital tablets were also discovered in the captain's flight bag in the wreckage. The investigation established that the captain had, for several years prior to the accident, periodically used the medication. The presence of the medication in the captain at the time of the accident indicates that he had used it shortly before flying, contrary to the instructions of his physician and FAA requirements. However, since the quantity detected was below established therapeutic levels and the first officer reported that the captain functioned normally throughout the flight, the Safety Board concludes that the medication did not adversely affect his performance.

During this period, the captain maintained a first-class medical certificate and underwent semiannual physical examinations. When examined by his FAA Aviation Medical Examiner, he failed to report his use of any medications when he completed the medical history portion of applications for the certificates. Thus, he concealed the use of phenobarbital from the FAA and his employer.

Specimens taken from the first officer of SKW5569 revealed the presence of substances found in typical over-the-counter medications. Although the Safety Board believes that the performance of the first officer was not a central factor in the accident, the presence of these substances again raises the question concerning the frequency with which pilots self-medicate shortly before flying.

Various FAA programs have made pilots well aware of the consequences of the abuse of illicit drugs in aviation. However, the circumstances revealed by this accident indicate that all pilots may not fully appreciate the potential dangers of many medications and, as a result, may use them inappropriately.

Therefore, the Safety Board believes that the circumstances involving the pilots in this accident demonstrate the need for the FAA to undertake a special educational program about the use of these types of drugs to reach all active pilots. Literature about the issue provided to pilots by their FAA Aviation Medical Examiners may also be helpful. Such a program must describe, illustrate, and alert pilots to the potential consequences of the misuse of legitimately prescribed medications and over-the-counter preparations. It must also stress that pilots must seek and heed the advice of their physicians and FAA Aviation Medical Examiners concerning the use of all medications they take and the effect that each may have on the safety of their flight operations.

2.9 Analysis of FAA Post-Accident Toxicological Testing

The Safety Board believes that, as a minimum, FAA air traffic management personnel should have required that the ground controllers and the clearance delivery controller be tested under the FAA's drug testing program. Three controllers were handling the accident airplanes, and the clearance delivery controller committed an error with a misplaced flight strip.

The Safety Board recognizes that all the facts and circumstances regarding an accident cannot be known immediately after an accident. Therefore, it cannot then be established with certainty who should be subjected to the drug testing program. Under the circumstances, the Safety Board believes that the FAA should test all individuals who may be reasonably associated with the circumstances of an accident, such as all controllers who have had communications with an aircraft shortly before an accident and their supervisors. The specimens can be retained until the investigation has established who might have been associated with the accident. Then, only those specimens that are relevant to the investigation should be submitted for analysis. Those that are not submitted for analysis can be returned to the individual who submitted them.

The Safety Board was encouraged that USAir Inc., had implemented a drug testing program that exceeded the FAA's postaccident drug testing regulation. The airlines' program, which included a random testing element, included testing for additional drugs (both licit and illicit) in urine, as well as blood sampling to test for ethyl alcohol. The airlines' postaccident testing program, in which urine and blood are collected and screened for additional drugs, including alcohol, is consistent with Safety Board Recommendations I-89-4 through -12, which were addressed to the Secretary of the Department of Transportation (DOT) on December 5, 1989. The Secretary and staff responded to these recommendations in a letter with attachments on August 3, 1990, and again on November 5, 1990.

Safety Board staff has met with the Secretary's Special Assistant for Drug Enforcement and Program Compliance and DOT staff to discuss DOT postaccident drug testing programs and the need to collect blood and urine specimens, as well as to increase the number of drugs (including alcohol) in the program. The Secretary's Special Assistant indicated to the Safety Board staff that the DOT was currently evaluating the merits of establishing a separate program for drug/alcohol testing following accidents. The DOT has yet to notify the Safety Board of its planned action. Appendix J includes all correspondence between the DOT and the Safety Board related to the safety recommendations mentioned above.

2.10 Cockpit Voice Recorder Reliability

The Safety Board concludes that the tape supplied with the CVR aboard USA1493 by Sundstrand was defective when it was installed. The maintenance performed by USAir on the CVR does not appear to have introduced defects into the tape. Sundstrand provided data that demonstrates that this type of recording tape is approved by the FAA and is appropriate for installation in this CVR. The CVR had been in service for 1,000 to 1,500 hours, while the recommended overhaul interval (and thus the expected service life of the tape) is 12,000 hours. Consequently, the tape was relatively new and not expected to have degraded substantially from normal use. The Safety Board believes that the FAA should perform a directed safety investigation of the Sunstrand Model AV-557 CVR to determine what modifications need to be made to ensure that the switching mechanism in the unit is able to withstand recording tape anomalies and variation in tape opacity that are expected to appear during normal service life of the tape.

3. CONCLUSIONS

3.1 Findings

1. The flightcrews of both airplanes were properly trained and qualified for the flights except for the self-medication practices of two pilots.

2. The flight attendants aboard USA1493 were properly trained and qualified for the flight; however, contrary to their training, the two flight attendants located in the rear of the airplane began to initiate the emergency evacuation after the initial impact and before the airplane had come to a stop.

3. Both airplanes were properly maintained and equipped for the flights.

4. Air traffic volume and traffic control workload at the Los Angeles International Airport was moderate at the time of the accident.

5. Weather conditions did not contribute to the cause of the accident.

6. The ability of the Los Angeles Air Traffic Control tower personnel to distinguish aircraft on the runways and other airport traffic movement areas, including the accident site, was complicated by some of the terminal II apron lights which produced glare.

7. Operating procedures at the Los Angeles Air Traffic Control tower did not provide redundancy comparable to the FAA's National Operational Position Standards, which require that flight progress strips, used to monitor the progress of flights between controller positions, be processed through the ground control position.

8. FAA evaluations, as administered by the Air Traffic Service staff, did not identify that essential redundancy was absent at the Los Angeles Air Traffic Control tower. This lack of redundancy contributed to and compounded errors by the local controller.

9. The local controller forgot that she had placed SKW5569 into position for takeoff on runway 24 left at the intersection of taxiway 45 because of her preoccupation with another airplane.

10. The local controller's incorrect perception of the traffic situation went undetected because she had an apparent match between her view of the traffic situation on the airport and the flight progress strip at her operating position

11. A flight progress strip for WW5072 was earlier misplaced by the clearance delivery controller. If local procedures had required that strips be processed through the ground control position, misplacement would have been detected and corrected. Because this strip was not present at the local controller's operating position, she misidentified an airplane and issued a landing clearance that led to the runway collision.

12. Current communications procedures for pilots and controllers regarding intersection takeoffs do not require that a specific point of departure be identified.

13. The Technical Appraisal Program for air traffic controllers is not being fully utilized because of a lack of understanding by supervisors and the unavailability of appraisal histories.

14. The local controller did not have the Airport Surface Detection Equipment radar available to assist her; however, under the circumstances and procedures in effect, it probably would not have prevented the accident.

15. Aircraft external lighting systems required for certification are intended primarily for in-flight conspicuity, rather than for conspicuity on airport surfaces; consequently, the external lighting of SKW5569 tended to be indistinguishable from the runway lights when viewed from the cockpit of USA1493.

16. The postmortem presence of phenobarbital in the captain of USA1493 and over-the-counter medications in the first officer of SKW5569 did not contribute to the accident. However, it indicates a less than complete appreciation of the potential dangers that the unauthorized use of such medications may pose.

17. The emergency response of the Los Angeles Department of Airports for this accident was timely and effective.

18. The exit row briefing provided by USAir increased the preparedness of passengers for the evacuation; however, the delay in opening the right overwing exit, the partially blocked exit opening and other reaction to stress caused delays in the egress of some passengers.

19. The propagation of the fire in the cabin of USA1493 was accelerated by the release of oxygen from the flightcrew oxygen system that was damaged in the initial collision sequence on the runway. The accelerated fire significantly reduced the time available for a successful emergency evacuation.

20. Many of the deceased passengers on USA1493 were found near the overwing exit. They did not proceed to another available exit in the rear of the airplane, perhaps because of smoke and limited visibility, and were overcome when the cabin fire intensified.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the failure of the Los Angeles Air Traffic Facility Management to implement procedures that provided redundancy comparable to the requirements contained in the National Operational Position Standards and the failure of the FAA Air Traffic Service to provide adequate policy direction and oversight to its air traffic control facility managers. These failures created an environment in the Los Angeles Air Traffic Control tower that ultimately led to the failure of the local controller 2 (LC2) to maintain an awareness of the traffic situation, culminating in the inappropriate clearances and the subsequent collision of the USAir and Skywest aircraft. Contributing to the cause of the accident was the failure of the FAA to provide effective quality assurance of the ATC system.

4. RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board makes the following recommendations to the Federal Aviation Administration:

Modify Air Traffic Control procedures at the Los Angeles International Airport to:

a.) segregate arrivals and departures to specific runways;

b.) provide redundancies as intended in the National Operational Position Standards in the control tower. (Class II, Priority Action) (A-91-104)

Undertake a thorough risk-based evaluation of air traffic control procedures at the Los Angeles International Airport, evaluate whether changes are required, and implement necessary changes. The evaluation should consider at least the following issues:

a.) runway intersection takeoffs;

b.) position-and-hold clearances;

c.) displaced runway thresholds;

d.) hazards associated with runway crossing traffic;

e.) local assist controller;

f.) Airport Surface Detection Equipment use and maintenance.

(Class II, Priority Action) (A-91-105)

Include in the Office of Safety Quality Assurance the authority and resources to: (1) independently evaluate air traffic control facility compliance with FAA directives and; (2) audit facility evaluations performed by the Office of Air Traffic System Effectiveness to determine that noted deficiencies are corrected. (Class II, Priority Action) (A-91-106)

Retain the National Operational Position Standards as a separate, independent order and:

a.) direct the FAA's Human Factors and Air Traffic Service staffs to perform a combined review of the order to determine the adequacy of redundancies and incorporate any resultant recommendations into the National Order;

b.) expedite the development of Chapters 5 through 10 of the National Order. (Class II, Priority Action) (A-91-107)

Provide Air Traffic Control Supervisors with formal training to improve their understanding of the intent, objectives and administration of the Technical Appraisal Program. (Class II, Priority Action) (A-91-108)

Require that interim evaluations of controller performance, such as those of the Technical Appraisal Program, be retained for 2 years and utilized in conjunction with other performance appraisals to track the performance and training needs of air traffic controllers. (Class II, Priority Action) (A-91-109)

Conduct a one-time examination of the airport lighting at all U.S. tower-controlled airports to eliminate or reduce restrictions to visibility from the control tower to the runways and other traffic movement areas. (Class II, Priority Action) (A-91-110)

Redefine the airplane certification coverage compliance standards for anticollision light installations to ensure that the anticollision light(s) of an aircraft in position on a runway are clearly visible to the pilot of another aircraft preparing to land or take off on that runway. (Class II, Priority Action) (A-91-111)

Evaluate and implement, as appropriate, suitable means for enhancing the conspicuity of aircraft on airport surfaces during night or periods of reduced visibility. Include in this effort, measures such as the displacement of an aircraft away from the runway centerline, where applicable, and the use of conspicuity enhancements, such as high-intensity strobe lighting and logo lighting by aircraft on active runways, and encourage operators of airplanes certificated prior to September 1, 1977, to upgrade their airplanes to the present higher intensity standards for anticollision light installations. (Class II, Priority Action) (A-91-112)

Direct the general aviation community and the airlines to take steps to ensure that pilot training programs, including cockpit resource management training and flight operations procedures, place sufficient emphasis on the need for pilots to maintain vigilance in monitoring air traffic control radio communication frequencies for potential traffic conflicts with their aircraft, especially when on active runways and/or when conducting a final approach to a landing. (Class II, Priority Action) (A-91-113)

Incorporate into the Airman's Information Manual language that will alert pilots to the need for vigilance in monitoring air traffic frequencies for traffic conflict situations which may affect the safety of their flight. (Class II, Priority Action) (A-91-114)

Develop for inclusion in the Airman's Information Manual and the Air Traffic Control Handbook, (7110.65F) specific phraseology to be used by pilots when requesting an intersection departure and specific phraseology to be used by controllers when issuing a position-and-hold clearance for an intersection departure. (Class II, Priority Action) (A-91-115)

Prohibit the use, after a specified date, of cabin materials in all transport category airplanes that do not comply with the improved fire safety standards contained in 14 CFR 25.853. (Class II, Priority Action) (A-91-116)

Direct the Emergency Evacuation Subcommittee of the Aviation Rulemaking Advisory Committee to examine flight attendant emergency procedures regarding the "2nd choice" exit assignments to ensure that such assignments provide for use of the nearest appropriate exit point. (Class II, Priority Action) (A-91-117)

Issue an Air Carrier Operations Bulletin directing Principal Operations Inspectors to emphasize that during a crash sequence flight attendants must remain properly restrained and seated in their crew seats until the airplane has come to a complete stop. (Class II, Priority Action) (A-91-118)

Establish a comprehensive educational program to alert pilots to the potential adverse effects on flightcrew performance that may arise from the misuse of prescribed and over-the-counter medication. (Class II, Priority Action) (A-91-119)

Conduct a directed safety investigation of the Sunstrand Model AV-557 CVR to determine the necessary modifications to ensure that the switching mechanism in the unit is able to withstand recording tape anomalies and variations in tape opacity that can be expected to appear during the normal service life of the tape. (Class II, Priority Action) (A-91-120)

Disseminate information regarding the circumstances of this accident and the findings of the Safety Board's investigation to the pilot community through operations bulletins and safety seminars, such as the "Wings Pilot Proficiency Program." (Class II, Priority Action) A-91-121)

Also as a result of this accident, the National Transportation Safety Board reiterates the following recommendations to the Federal Aviation Administration:

A-89-124

Require 14 CFR Part 121 operators to develop and use Cockpit Resource Management programs in their training methodology by a specified date. (Class II, Priority Action)

A-90-135

Require that scheduled 14 CFR Part 135 operators develop and use Cockpit Resource Management programs in their training methodology by a specified date. (Class II, Priority Action)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ James L. Kolstad
Chairman

/s/ Susan Coughlin
Vice Chairman

/s/ John K. Lauber
Member

/s/ Christopher A. Hart
Member

/s/ John Hammerschmidt
Member

October 22, 1991

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Washington Headquarters of the National Transportation Safety Board was notified of a runway collision accident involving USAir flight 1493 and Skywest flight 5569 at Los Angeles International Airport by the FAA Command Center within minutes of its occurrence. Staff members from the NTSB Southwest Region Office (LAX) were on-scene within one hour. A full investigation team departed Washington, D.C., the following morning at 0400 in order to arrive in Los Angeles at first daylight. The team consisted of the following investigative group leaders: Operations, Human Performance, Air Traffic Control, Powerplants, Systems, Structures, Aircraft Performance, and Survival Factors. Specialists' reports were also prepared to summarize CVR and FDR information.

Parties to the field investigation were the FAA, USAir, Skywest Airlines, Boeing Commercial Airplanes, Fairchild Aircraft Corporation, General Electric Aircraft Engines, the Air Line Pilots Association, the International Association of Machinists, the Association of Flight Attendants, the National Air Traffic Controller's Association and the City of Los Angeles Department of Airports.

2. Public Hearing

A 3 1/2 day public hearing was held in Los Angeles beginning on May 6, 1991. Parties represented at the hearing were the FAA, USAir, Skywest Airlines, Boeing Commercial Airplanes, Fairchild Aircraft Corporation, the Air Line Pilots Association, the Association of Flight Attendants, and the National Air Traffic Controllers Association.

APPENDIX B

PERSONNEL INFORMATION

USAir Crewmembers

Captain Colin F. Shaw

Captain Shaw, age 48, held Airline Transport Pilot Certificate No. 001678605 and was type rated in fixed wing BA-111 and B-737 aircraft. He possessed a current FAA Class I Medical Certificate issued in October 1990 with the limitation that the holder must wear corrective lenses. There were no waivers affixed to his medical certification. He was hired by Mohawk Airline, a forerunner of USAir, in August 1968 and had remained employed by the airline for the past 22 years. Captain Shaw accumulated approximately 16,300 hours of total flight time, of which 4,300 hours were in the B-737 aircraft. He upgraded to captain in the B-737 in September 1985. His last proficiency check in the B-737 was accomplished in January 1991. Captain Shaw accrued approximately 43 hours and 83 hours, respectively, of combined flight and duty time during the 30-day and 60-day period preceding the accident. FAA records do not show Captain Shaw having any previous accidents, incidents, or violations.

First Officer David T. Kelly

First Officer Kelly, age 32, is the nolder of Airline Transport Pilot Certificate No. 217726609 with type ratings in the Lear Jet and L-382. His FAA Class I Medical Certificate, issued in April 1990, contained no limitations or waivers. He was hired by USAir in October 1988. First Officer Kelly has approximately 4,316 hours of flight time, of which 982 hours are in the B-737 aircraft. His most recent simulator/proficiency check was accomplished in December 1990. First Officer Kelly accrued approximately 61 hours and 101 hours, respectively, of combined flight and duty time during the 30 day and 60 day period preceding the accident. FAA records do not show First Officer Kelly having any previous accidents, incidents, or violations.

Lead Flight Attendant Deanne Bethea

Lead Flight Attendant Deanne Bethea was employed by USAir Inc., on January 6, 1989. Her most recent recurrent emergency procedures training was performed in August 1990.

Flight Attendant "B," Patricia Hodges

Flight Attendant Patricia Hodges was employed by USAir Inc., on August 11, 1989. Her most recent recurrent emergency procedures training was performed in August, 1990.

Flight Attendant "C," William Ibarra

Flight Attendant William Ibarra was employed by USAir Inc., on January 6, 1989. His most recent recurrent emergency procedures training was performed in June, 1990.

Flight Attendant "D," Vance Spurgeon

Flight Attendant Vance Spurgeon was employed by USAir Inc., on August 11, 1989. His most recent recurrent emergency procedures training was performed in August, 1990.

Skywest Airlines Flightcrew

Captain Andrew J. Lucas

Captain Lucas, age 32, was the holder of Airline Transport Pilot Certificate No. 002311520 with a type rating in the SA-227. He also held a current FAA Class I Medical Certificate issued in November 1990 with no limitations or waivers noted. He was hired by Skywest Airlines in May 1985 and had remained employed by the airline for the past 5 years. Captain Lucas accumulated approximately 8,808 hours of total flight time, of which 2,107 hours (all pilot-in-command) were in the SA-227 aircraft. He completed initial upgrade training in the SA-227 in May 1986. The latest recurrent pilot testing and instrument proficiency checks required by 14 CFR Part 293 and 297 were completed by him in December 1990. Captain Lucas accrued approximately 89 hours and 137 hours, respectively, of combined flight and duty time during the 30-day and 60-day period preceding the accident. FAA records do not show Captain Lucas having any previous accidents, incidents, or violations.

First Officer Frank C. Prentice

First Officer Prentice, age 45, was the holder of Airline Transport Pilot Certificate No. 545666095. He also held a FAA Class I Medical Certificate issued in February 1990 with the limitation that the holder must wear lenses that correct for distant vision and possess glasses that correct for near vision while exercising the privileges of his airman certificate. There were no waivers affixed to his medical certification. He was hired by Skywest Airlines in July 1989. First Officer Prentice accumulated approximately 8,000 hours of total flight time, of which 1,363 hours (all second-in-command) were in the SA-227. His most recent proficiency flight check was completed in July 1990. First Officer Prentice accrued approximately 87 hours and 177 hours, respectively, of combined flight and duty time during the 30-day and 60-day period preceding the accident. FAA records do not show First Officer Prentice having previous accidents, incidents, or violations.

Los Angeles ATC Tower Personnel

Local Controller 2 (LC2) Robin Wascher

Ms. Wascher was the local controller 2 at the time of the accident. She held FAA CTO certificate number 549925086 dated February 3, 1977, and a Temporary Airman Certificate with an endorsement for LAX ATCT dated December 2, 1990. She also held an FAA/National Weather Service Tower Visibility Observations Certificate issued on August 8, 1986. Her most recent prior medical examination occurred on October 19, 1990. She was required to wear corrective lenses.

Prior to being hired by the FAA, Ms. Wascher was an ATC specialist with the U.S. Air Force from 1975 to July 27, 1977. Ms. Wascher was employed by the FAA as an ATC specialist on March 28, 1982. Her first assignment was at the Gulfport, Mississippi, ATCT, a Level III facility. She transferred to Greenville, Mississippi, on April 4, 1984, and to Aspen, Colorado, on June 6, 1986. Greenville was a Level I and Aspen was a Level II ATC facility at the times Ms. Wascher was employed at those facilities. On September 18, 1989, Ms. Wascher transferred to LAX ATCT, where she became a full performance-level (FPL) controller on December 12, 1990.

Area Supervisor (AS), Francita Vandiver

Ms. Vandiver was the AS at the time of the accident. She held FAA Control Tower Operator certificate number 512627564, issued June 26, 1976. She also held an FAA Temporary Airman Certificate with an endorsement for LAX Tower, dated May 25, 1988, and an FAA/National Weather Service Tower Visibility Observation Certificate issued July 28, 1988. Her last medical examination was performed on October 22, 1990, with no limitations or waivers noted.

Ms. Vandiver was first employed by the FAA on November 8, 1982. Prior to her employment by the FAA she was an ATC specialist with the U.S. Navy for approximately 6 years.

APPENDIX C

EXTRACT FROM COCKPIT VOICE RECORDER TRANSCRIPT

INTRA-COCKPIT TIME & SOURCE	CONTENT	AIR GROUND COMMUNICATIONS TIME & SOURCE	CONTENT
1756:54 PA-3	ladies and gentlemen in preparation for landing in 'os angeles-		
		1757:01 LAXCNTR	usa 1493 two five zero knots approach one two four point niner good day.
		1757:05 RDO-1	ok usa 1493 two hundred fifty and ah twenty four nine?
		1757:10 LAXAPR	twenty four nine that's correct.
		1757:24 RDO-1	usa 1493 out of eleven for ten on the profile.
		1757:27 LAXAPR	usa 1493 los angeles approach. intercept the runway two four right localizer maintain one zero thousand
		1757:34 RDO-1	intercept maintain ten
1757:38 CAM-2	here we go. when he says intercept the localizer * * * *.		

INTRA-COCKPIT

TIME & SOURCE	CONTENT
1757:55 CAM-2	slowing at ten.
1758:04 CAM-2	* * turn right heading * * * [sound of laughter].
1758:20 CAM-?	* *.
1759:16 CAM	[sound similar to that of an autopilot disconnect]
1759:26 CAM-2	(point five).
1759:28 CAM-1	alright.
1759:41 CAM-2	cleared to visual for two four left.

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
1759:00 LAXAPR	usa 1493 do you have the airport in sight?
1759:04 RDO-1	usa 1493 affirmative.
1759:06 LAXAPR	(cleared visual approach) two four left usa 1493, cross denay at or above eight thousand.
1759:11 RDO-1	ok denay at eight or above and ah cleared visual two four left usa 1493.

INTRA-COCKPIT		AIR GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1759:42 CAM-1	left.		
1759:46 CAM-2	correct?		
1759:49 CAM-1	I'll confirm that.		
		1759:57 RDO-1	ah just confirm the visual for usa 1493 is to ah two four left.
		1800:02 LAXAPR	that's correct usa 1493.
		1800:04 RDO-1	thank-you.
1800:08 CAM	[sound similar to that of an altitude alert horn *** [tape section "E" begins - slow tape speed] ***		
1800:11 CAM-?	* * the only conditions.		
1800:16 CAM-?	* * *.		
1800:21 CAM-1	I hope you don't mind me * * (the cabin).		
1800:24 CAM-2	oh no no no no negative * * * * * (right out there) * *		

INTRA-COCKPIT

TIME & SOURCE	CONTENT
1800:58 CAM-1	(you got 'em) down.
1801:00 CAM	[sound similiar to that of an altitude alert horn]
1801:15 CAM	[sound of whistling]
1801:35 CAM	[unidentified beep possibly originating from the radio]
1802:48 CAM-1	you got the left side in sight * ?
1802:51 CAM-2	yeah.
1803:00 CAM-?	* we're out of four...
1803:01 CAM-?	right.

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
1802:01 LAXAPR	usa 1493 expedite ah your descent through four thousand as much as practical if you would. there will be traffic pass above you to land on the south side.
1802:08 RDO-1	ok I'll expedite through four usa 1493.

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1803:02 CAM-?	(message)		
1803:03 CAM-?	*		
		1803:05 LAXAPR	usa 1493 thanks for your help. Contact los angeles tower one three three point niner at romen. good night.
		1803:10 RDO-1	thirty three nine good night.
		1803:17 LAXTWR	usa 23 fly heading two five zero maintain two thousand wind two five zero at six runway two four left cleared for take-off.
1803:20 CAM-2	gear down.		
1803:21 CAM-1	alright you gave the three bells.		
1803:23 CAM-2	yes I did.		
1803:23 CAM	[sound similar to that of landing gear being extended]		
		1803:24 USA23	ok two thousand two fifty cleared to go usa 23.

INTRA-COCKPIT

TIME & SOURCE	CONTENT
1803:29 CAM-1	ok ah start switches are continuous, recall both checked.
1803:37 CAM-1	speed brakes still working (for a living).
1803:39 CAM-2	alright.
1803:42 CAM-1	gear checked?
1803:43 CAM-1&2	down..

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
1803:30 LAXTWR	* 246. You still holding short of forty seven?
1803:33 *246	two forty six affirmative.
1803:35 LAXTWR	you're next.
1803:36 *246	thank you.
1803:37 SKW569	skw 569 at forty five we'd like to go from (this point).
1803:41 LAXTWR	skw 569 taxi up to and hold short two four left.

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1803:44 SKW569	roger hold short.
1803:44 CAM-1	..three green.		
1803:45 CAM-?	alright.		
1803:48 CAM-2	flaps (goin') one.		
1803:49 CAM	[sound similar to that of a flap lever actuation]		
1803:52 CAM-1	* flaps *.		
		1803:54 *725	* 725 ready in sequence.
		1803:56 LAXTWR	skw246 taxi across runway two four left runway two four right parallel and turn right heading two seven zero, maintain two thousand two four zero at six cleared for take-off.
1803:59 CAM	[sound similar to that of a flap lever actuation]		
1804:00 CAM-2	five.		
1804:02 CAM	[sound similar to that of flap lever actuation]		

IBERIA COCKPIT

TIME & SOURCE	CONTENT
1804:12 CAM	[continuous clicks through approach similar to stabilizer trim actuations]

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
1804:05 SKW246	ok two (seventy) to two thousand two forty six cleared takeoff.
1804:08 LAXTWR	runway two four right.
1804:10 SKW246	affirmative.
1804:11 LAXTWR	(wings) five thousand six taxi across runway two four left. contact ground point six five when off the runway. good day.
1804:17 PHIL102	is that for phillipine one zero two ma'am?
1804:19 LAXTWR	no sir hold short. (wings) 5006 taxi across runway two four left. contact ground point six five when off the runway.
1804:30 LAXTWR	usa 23 contact los angeles departure now.
1804:33 USA23	good night.

INTRA-COCKPIT

TIME & SOURCE	CONTENT
1805:09 CAM-2	thirty green light detent.

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
1804:35 RDO-1	usa 1493 (inside of) Romeo.
1804:38 LAXTWR	wings 5006 ground ah tower.
1804:44 LAXTWR	skw569 taxi in position and hold runway two four left traffic crossing down field.
1804:49 SKW569	ok two four left position and hold skw569.
1804:52 LAXTWR	wings 5006 tower.
1805:00 SWA725	tower swa725 ready in sequence.
1805:02 LAXTWR	swa725 roger taxi up to and hold short two four left.
1805:05 SWA725	up to hold short swa725.
1805:06 LAXTWR	you'll follow the metro liner.
1805:08 SWA725	ok.

INTRA-COCKPIT

TIME & SOURCE	CONTENT
1805:11 CAM-1	alright. gear, flaps, landing clearance remains.

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
1805:09 *5006	[unintelligible transmission to tower].
1805:12 LAXTWR	5006 you back with me?
1805:14 *5006	yeah (we switched radios now).
1805:16 LAXTWR	ok, I thought I lost you. taxi across runway two four left. contact ground point six five when off the runway. traffic will hold in position.
1805:21 *5006	sorry we thought we lost you, we apologize.
1805:23 LAXTWR	no problem. sundance 518 taxi across runway two four left. contact ground point six five when off the runway. good night.
1805:29 RDO-1	usa 1493 for the left side two four left.
1805:33 LAXTWR	* 246 heading two seven zero. contact los angeles departure. good night.

INTRA-COCKPIT

TIME & SOURCE	CONTENT
1805:41 CAM-1	out of a thousand feet *.

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
1805:37 @246	246 good night .
1805:39 @2858	[unintelligible transmission from tower]
1805:44 LAXTWR	swa725 tower.
1805:47 SWA725	swa725 go ahead.
1805:48 LAXTWR	yes sir. you're holding short, is that correct?
1805:50 SWA725	yes ma'am, we're holding short.
1805:51 LAXTWR	thank-you. usa 1493 cleared to land runway two four left.
1805:55 RDO-1	cleared to land two four left 1493.
1805:58 *2858	2858 to the right five miles.
1806:00 LAXTWR	usa2858 winds two three zero at eight. cleared to land runway two four right.

INTRA-COCKPIT

TIME & SOURCE	CONTENT
1806:07 CAM-2	* looks real good *.
1806:09 CAM-1	ahhh, you're coming outta five hundred feet bug plus twelve, sink is seven.
1806:16 CAM	[sound of click]
1806:19 CAM-1	lights (on).

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
1806:04 USA2858	clear to land.
1806:08 WNGW5072	tower wings west 5072 is ready for take-off.
1806:13 LAXTWR	wings 5072?
1806:15 WNGW5072	affirmative.
1806:18 LAXTWR	wings 5072, are you at forty seven or full length?
1806:20 WNGW5072	we're at full length.
1806:21 LAXTWR	ok.

INTRA-COCKPIT

TIME & SOURCE	CONTENT
1806:30 CAM-?	* *.
1806:57 CAM-?	[unintelligible remark]
1806:59 CAM	[sound of impact]

AIR-GROUND COMMUNICATIONS

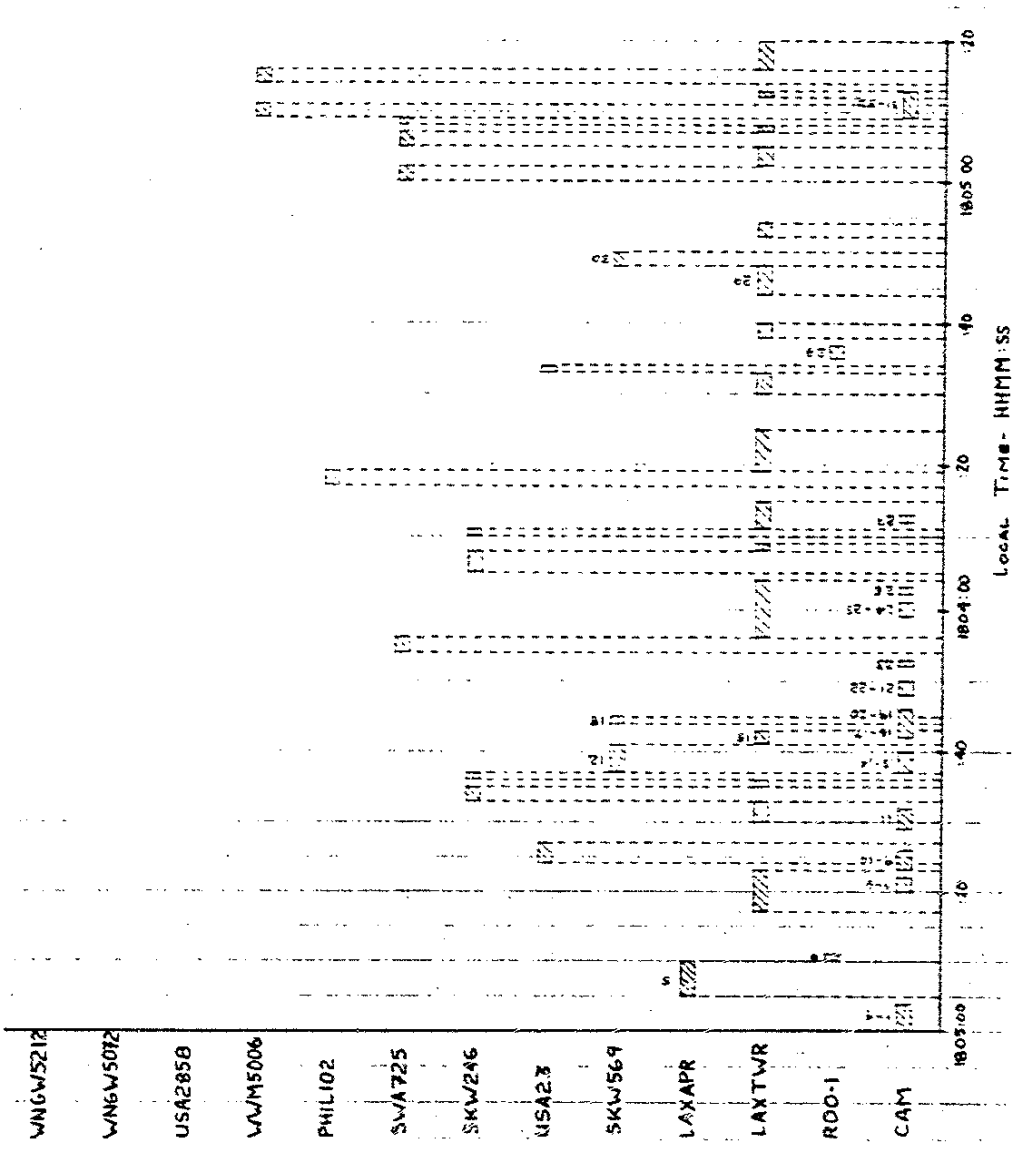
TIME & SOURCE	CONTENT
1806:26 LAXTWR	hold short.
1806:27 WNGW5072	roger, holding short.
1806:30 LAXTWR	wings 5072 say your squawk.
1806:33 WNGW5072	forty six fifty three.
1806:46 WNGW5212	los angeles tower wings west 5212 with you on a visual for two four right.
1806:55 LAXTWR	swa725 taxi in to position and hold runway two four left.
1806:58 SWA725	725 position and hold two four left.

APPENDIX D

CVR/ATC RECORDED DATA CORRELATION

PERTINENT CVR TIMELINE TRANSMISSIONS, 1803:00 - 1805:20

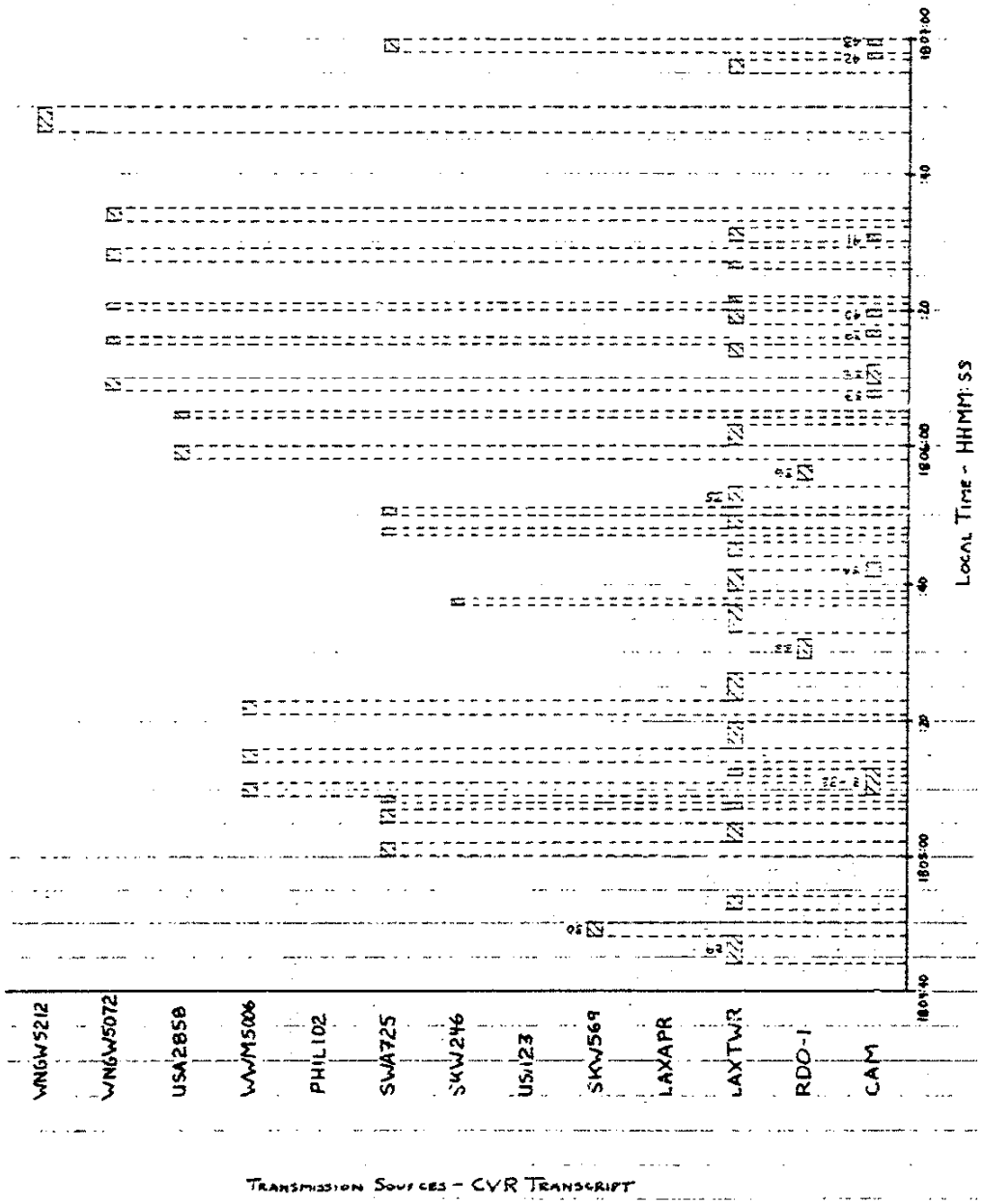
1.	18,03,00,	CAM-?	* we're out of four...
2.	18,03,01,	CAM-?	right.
3.	18,03,02,	CAM-?	(message)
4.	18,03,03,	CAM-?	*
5.	18,03,05,	LAXAPR	usa 1493 thanks for your help. Contact los angeles tower one three three point niner at romen. good night.
6.	18,03,10,	RDO-1	thirty three nine good night.
7.	18,03,20,	CAM-2	gear down.
8.	18,03,21,	CAM-1	alright you gave the three bells.
9.	18,03,23,	CAM-2	yes I did.
10.	18,03,23,	CAM	[sound similar to that of landing gear being extended]
11.	18,03,29,	CAM-1	ok ah start switches are continuous, recall both checked.
12.	18,03,37,	SKW569	skw 569 at forty five we'd like to go from (this point).
13.	18,03,37,	CAM-1	speed brakes still working (for a living).
14.	18,03,39,	CAM-2	alright.
15.	18,03,41,	LAXTWR	skw 569 taxi up to and hold short two four left.
16.	18,03,42,	CAM-1	gear checked?
17.	18,03,43,	CAM-1&2	down..
18.	18,03,44,	SKW569	roger hold short.
19.	18,03,44,	CAM-1	..three green.
20.	18,03,45,	CAM-?	alright.
21.	18,03,48,	CAM-2	flaps (goin') one.
22.	18,03,49,	CAM	[sound similar to that of a flap lever actuation]
23.	18,03,52,	CAM-1	* flaps *.
24.	18,03,59,	CAM	[sound similar to that of a flap lever actuation]
25.	18,04,00,	CAM-2	five.
26.	18,04,02,	CAM	[sound similar to that of flap lever actuation]
27.	18,04,12,	CAM	[continuous clicks through approach similar to stabilizer trim actuations]
28.	18,04,35,	RDO-1	usa 1493 (inside of) Romen.
29.	18,04,44,	LAXTWR	skw569 taxi in position and hold runway two four left traffic crossing down field.
30.	18,04,49,	SKW569	ok two four left position and hold skw569.
31.	18,05,09,	CAM-2	thirty green light detent.
32.	18,05,11,	CAM-1	alright. gear, flaps, landing clearance remains.



TRANSMISSION SOURCES - CVR TRANSCRIPT

PERTINENT CVR TIMELINE TRANSMISSIONS, 1804:40 - 1807:00

29.	18,04,44,	LAXTWR	skw569 taxi in position and hold runway two four left traffic crossing down field.
30.	18.04,49,	SKW569	ok two four left position and hold skw569.
31.	18,05,09,	CAM-2	thirty green light detent.
32.	18,05,11,	CAM-1	alright. gear, flaps, landing clearance remains.
33.	18.05,29,	RDO-1	usa 1493 for the left side two four left.
34.	18,05,41,	CAM-1	out of a thousand feet *.
35.	18,05,51,	LAXTWR	thank-you. usa 1493 cleared to land runway two four left.
36.	18,05,55.	RDO-1	cleared to land two four left 1493.
37.	18,06,07,	CAM-2	* looks real good *.
38.	18,06,09.	CAM-1	ahhh, you're coming outta five hundred feet bug plus twelve, sink is seven.
39.	18,06,16.	CAM	[sound of click]
40.	18.06,19,	CAM-1	lights (on).
41.	18,06,30,	CAM-?	* *.
42.	18,06,57,	CAM-?	[unintelligible remark]
43.	18,06,59,	CAM	[sound of impact]



TRANSMISSION SOURCES - CVR TRANSCRIPT

APPENDIX E

ASDE EQUIPMENT OUTAGES

Information regarding LAX ASDE equipment outages was obtained from a review of AF Facility Maintenance Logs, FAA Form 6030-1, for the period between February 1, 1989, and February 8, 1991.

The acronym OTS denotes that a particular piece of equipment is out of service. The acronym RTS denotes that the equipment has returned to service.

DATE	TIMES	OUTAGE
02-05-89	2110-2115,	Ch B OTS
02-07-89	0830-0945,	OTS
02-20-89	1950-1958,	Ch B OTS
03-05-89	0900-	OTS
03-06-89	-1815	RTS
03-24-89	1925-1930,	Ch B OTS
	1930-2005,	North ASDE out of alignment
04-11-89	1730-	Ch B OTS
04-12-89	-1500,	Ch B RTS
04-26-89	1950-2005,	Ch B OTS
05-03-89	1350-	OTS, Antenna gearbox failure
05-10-89	-1341,	RTS
05-13-89	2016-2045,	OTS
05-14-89	0200-1630,	OTS TWR CAB Control Panel
05-16-89	0800-0918,	Ch B OTS
05-22-89	2000-2130,	OTS
05-25-89	0900-1040,	Ch A OTS
05-30-89	2010-	Ch A OTS
05-31-89	-1340	Ch A RTS
06-02-89	1025-2205,	Ch A OTS
06-11-89	2050-	OTS
06-12-89	-2135,	RTS
06-13-89	0722-	OTS
06-22-89	-1548,	RTS
06-27-89	1338-1455,	OTS
07-09-89	0235-	OTS
07-10-89	-2025,	RTS
07-23-89	1530-	Ch B OTS
07-24-89	-2130,	Ch B RTS
07-25-89	2122-2207,	OTS

DATE	TIMES	OUTAGE
02-05-89	2110-2115,	Ch B OTS
02-07-89	0830-0945,	OTS
02-20-89	1950-1958,	Ch B OTS
03-05-89	0900-	OTS
03-06-89	-1815	RTS
03-24-89	1925-1930,	Ch B OTS
	1930-2005,	North ASDE out of alignment
04-11-89	1730-	Ch B OTS
04-12-89	-1500,	Ch B RTS
04-26-89	1950-2005,	Ch B OTS
05-03-89	1350-	OTS, Antenna gearbox failure
05-10-89	-1341,	RTS
05-13-89	2018-2045,	OTS
05-14-89	0200-1630,	OTS TWR CAB Control Panel
05-16-89	0800-0918,	Ch B OTS
05-22-89	2000-2130,	OTS
05-25-89	0900-1040,	Ch A OTS
05-30-89	2010-	Ch A OTS
05-31-89	-1340	Ch A RTS
06-02-89	1025-2205,	Ch A OTS
06-11-89	2050-	OTS
06-12-89	-2135,	RTS
06-13-89	0722-	OTS
06-22-89	-1548,	RTS
06-27-89	1338-1455,	OTS
07-09-89	0235-	OTS
07-10-89	-2025,	RTS
07-23-89	1530-	Ch B OTS
07-24-89	-2130,	Ch B RTS
07-25-89	2122-2207,	OTS

08-15-89	2000-	Ch B OTS
08-16-89	-1105,	Ch B RTS
08-17-89	0710-0730,	OTS
09-10-89	1945-2010,	OTS
10-23-89	2020-2030,	Ch B OTS
11-26-89	1723-1742,	Ch B OTS
12-03-89	1800-2218,	OTS (Ch A)
	1800-	[unable to determine when Ch B RTS] possible RTS on, or as late as, 01-02-90 @ 1220.
12-10-89	2050-	OTS
12-28-89	-1006,	RTS
01-03-90	1921-1630,	OTS
01-04-90	-0830,	RTS
01-11-90	0850-	OTS
01-26-90	-0900,	RTS
01-30-90	0640-1255,	OTS
01-31-90	1045-	OTS
02-01-90	-0841,	RTS
02-05-90	1210-	OTS
02-06-90	-0725,	RTS
02-12-90	0540-0600,	Ch B OTS
02-14-90	2143-	OTS
02-15-90	-0811,	RTS
02-19-90	1845-1850,	OTS
	2100-2154,	OTS
02-24-90	1900-	OTS
02-25-90	-1406,	RTS
12-26-90	1145-1222,	OTS
03-01-90	1345-	Ch B OTS
03-05-90	-1110,	Ch B RTS
03-06-90	1300-1333,	OTS
03-18-90	1800-	Ch A OTS
03-19-90	-0125,	Ch A RTS
03-21-90	1709-1717,	Ch A OTS
03-23-90	0600-1740,	Ch A OTS
	0200-	Ch A OTS
03-24-90	-0730,	Ch A RTS
	2120-2156,	Ch A OTS
03-30-90	1850-	Ch A OTS
03-31-90	-1230,	Ch A RTS
	1850-	North Display OTS
04-01-90	-1100,	North Display RTS
04-02-90	2120-2140,	North Display OTS
04-21-90	2315-2400,	Ch A OTS
04-23-90	1530-1545,	ASDE Control Box in Cab-stuck button
	1740-1853,	OTS
04-28-90	2050-1621,	OTS
04-29-90	-0921,	RTS
	2018-	OTS
05-01-90	-1545,	RTS
05-22-90	1500-1519,	Ch A OTS
05-24-90	2020-2050,	OTS

05-25-90 2240-2308, Ch A OTS
06-04-90 2018-2127, Ch B OTS
06-11-90 2030-2050, OTS
06-23-90 2030-2045, Ch B OTS
06-26-90 2050-2116, Ch A OTS
08-11-90 1234-1240, Ch A OTS
08-11-90 1942- Ch A OTS
08-13-90 1751- Ch B OTS, ASDE OTS
-0950, Ch A RTS
08-20-90 -1400, Ch B RTS
08-21-90 1938-1935, OTS
09-03-90 1952- OTS
09-04-90 -1740, Ch B RTS
09-10-90 -1125, Ch A RTS
1850-1947, OTS
09-24-90 2045-2115, OTS
10-05-90 0640-0740, OTS (Map Alignment)
11-05-90 0015- Ch A OTS
11-29-90 -1542, Ch A RTS
11-30-90 1602- OTS
01-16-91 -1719, RTS
01-18-91 1825-[11]->(FAA Form 7230-4) ASDE channel A OTS on south side indicator. Due to this, DEU will not operate either side (North & South). Channel B ASDE OTS on south side, targets too weak to be useable.
01-19-91 0001--->(FAA Form 7230-4) ASDE Channel A OTS on south side indicator, DEU will not operate either side, channel B ASDE OTS on south side, targets too weak to be useable.
0923--->(FAA Form 7230-4) Radar (maintenance) reminded of ASDE problems.
1515--->(FAA Form 7230-4) ASDE north side RTS, channel A north side weak but useable.
-1515, Ch A&B/North Display RTS/South Display OTS.
1630--->(FAA Form 7230-4) ASDE OTS, maintenance advised.
01-20-91 0001--->(FAA Form 7230-4) ASDE OTS.

0650--->(FAA Form 7230-4) ASDE channel A and B RTS. Display on both scopes remains OTS.
1443--->(FAA Form 7230-4) Radar technician has worked on ASDE today, however it remains OTS.
2305--->(FAA Form 7230-4) ASDE RTS.
01-21-91 1700--->(FAA Form 7230-4) ASDE OTS.
01-22-91 0001--->(FAA Form 7230-4) ASDE south side OTS.
1255--->(FAA Form 7230-4) ASDE OTS.
1710--->(FAA Form 7230-4) ASDE north side RTS, both channels work.

---

[11] Dates and times shown underlined indicate information obtained from LAX ATCT Daily Record of Facility Operations, FAA Form 7230-4.

1734--->(FAA Form 7230-4) ASDE north side OTS.
1756--->(FAA Form 7230-4) ASDE north side RTS.
2230--->(FAA Form 7230-4) ASDE north side OTS.
01-23-91 0001--->(FAA Form 7230-4) ASDE OTS.
0050--->(FAA Form 7230-4) ASDE north side RTS.
1135--->(FAA Form 7230-4) ASDE RTS, south side indicator OTS, maintenance advised.
1750-1758, OTS
2230-2400, OTS
01-24-91 0001--->(FAA Form 7230-4) ASDE OTS, unusable because north ASDE map misalignment and south ASDE is OTS.
01-25-91 0001--->(FAA Form 7230-4) ASDE OTS, radar (maintenance) aware.
1351--->(FAA Form 7230-4) South ASDE RTS, both channels RTS.
01-26-91 0001--->(FAA Form 7230-4) ASDE on north complex OTS.
01-27-91 0001--->(FAA Form 7230-4) ASDE on north complex OTS.
1713--->(FAA Form 7230-4) ASDE OTS.
1730--->(FAA Form 7230-4) ASDE south RTS.
01-28-91 0001--->(FAA Form 7230-4) ASDE north complex OTS.
0600--->(FAA Form 7230-4) Losing targets intermittently ASDE channel B.
1357--->(FAA Form 7230-4) ASDE channel B RTS (south side).
01-29-91 0001--->(FAA Form 7230-4) ASDE north complex OTS. ASDE B channel OTS.
01-30-91 0001--->(FAA Form 7230-4) ASDE north complex OTS. ASDE B channel OTS.
0900--->(FAA Form 7230-4) ASDE OTS for schedule maintenance (Change Gearbox).
1510--->(FAA Form 7230-4) South ASDE complex ASDE RTS, north complex OTS, channel B RTS.
01-31-91 0001--->(FAA Form 7230-4) ASDE north complex OTS.
0630--->(FAA Form 7230-4) ASDE Ch B OTS.
0757--->(FAA Form 7230-4) ASDE Ch B RTS.
02-01-91 0001--->(FAA Form 7230-4) ASDE north complex OTS.
2300- Checked operation of ASDE, operation normal.
2320- AF Radar Technician checked with ATCT ATM to see if he wanted any assistance from radar regarding the accident (certification of ASDE). ATM replied negative.
02-02-91 0001--->(FAA Form 7230-4) ASDE north complex OTS.
1010-1040, Commenced and completed certification of ASDE after talking with and at the request of the ATM and the AF Sector Chief.
02-03-91 0001--->(FAA Form 7230-4) ASDE north complex OTS.
1845- Working on north ASDE display.
-2300, North ASDE display RTS.

02-05-91	-1015, ASDE OTS/due to antenna gearbox leaking. (Replaced gearbox).
	-1023, It was determined the ASDE antenna rotation is slower than normal (72 RPM versus normal 144 RPM).
02-06-91	-0935, In reference to 05/1023 entry, AFS manager, Western Pacific Region and Headquarters personnel state that is okay to certify the ASDE with a slower antenna speed of 73 RPM.
	-1033, ASDE RTS.
	-1816, Ch B OTS.
	-1852, Ch B RTS.
02-07-91	-0859, Advised by air traffic of map linearity problem on north ASDE display. After discussion with tower, they agreed that display was useable and air traffic would like to continue using it at this time due to weather. Display will require downtime to check.
	-1058, ASDE OTS. Released for maintenance on tower displays.
	-1235, ASDE RTS.

APPENDIX F

SUMMARY OF MEDICAL HISTORY OF COLIN F. SHAW

NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
WASHINGTON, DC 20594
APRIL 10, 1991

SUMMARY OF MEDICAL HISTORY OF COLIN F. SHAW, JR./1

July, 1984
Captain Shaw reported the use of phenobarbital and probanthine during the previous six to eight years for peptic ulcer disease, to his personal physician. Phenobarbital had been prescribed by another unknown physician for gastrointestinal problems. Physician's notes state: "The patient does admit to drinking 4-5 cans of beer daily."

June, 1985
The personal physician prescribed phenobarbital (unknown quantity of 15 mg tablets) to Captain Shaw for a condition later described by the physician as "spastic colon", secondary to a feeling of apprehension. The physician's notes state: "going to training for new airplane".

February, 1989
A prescription was issued by the personal physician and filled for phenobarbital (40 15 mg tablets) for the same condition. (This prescription vial was discovered in the Captain's flight bag following the accident.)

August, 1990
A prescription was issued by the personal physician and filled for phenobarbital (30 15mg tablets) for the same condition.

An examination of Captain Shaw's applications for FAA medical certificates from 1973 to the date of the accident (24 applications) revealed that Captain Shaw never reported a gastrointestinal illness or the use of phenobarbital to his Aviation Medical Examiner on the applications.

An examination of the records of the medical insurance carrier under which Captain Shaw was covered revealed that Captain Shaw had submitted no claims for prescription benefits for phenobarbital prescriptions he had received.

1/ With respect to the use of phenobarbital

APPENDIX G

FACTUAL SUMMARY OF AIR TRAFFIC CONTROLLER MEDICAL RECORDS

NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
Washington, D.C. 20594

April 22, 1991

FACTUAL SUMMARY OF AIR TRAFFIC CONTROLLER MEDICAL RECORDS

A. ACCIDENT

LOCATION: Los Angeles International Airport
Los Angeles, California

DATE/TIME: February 1, 1991, 1807 PST

AIRCRAFT: USAir Flight 1493, B-737-300
OPERATOR: USAir, Inc.

AIRCRAFT: Skywest Flight 5569, Fairchild SA-227
OPERATOR: Skywest Airlines, Inc.

B. REVIEWER

James W. Danaher, Chief, Operational Factors and Human Performance Division, NTSB

C. SUMMARY

On April 12, 1991 at FAA Headquarters in Washington, D.C., the undersigned reviewed FAA medical records of four ATCS personnel who were on duty in the control tower at Los Angeles International Airport at the time of the subject accident. The individuals whose records were reviewed, and their duty positions in the tower at the time of the accident, were as follows:

Francita Vandiver	Area Supervisor (AS)
Sheri Arslanian	Ground Control Two (GC2)
Elliot Brann	Clearance Delivery One (CD1)
Robin Wascher	Local Control Two (LC2)

FAA medical records of the above-mentioned Vandiver, Arslanian and Brann contained no entries to indicate any abnormal physical, physiological, or psychological conditions. All three of these individuals reportedly had visual acuity of 20/20 uncorrected — both near and distant vision — on their most recent aviation medical examinations.

FAA medical records of Robin Wascher contained a copy of her military medical records covering her service with the U.S. Air Force for the period April 12, 1971 to July 27, 1977. She served initially (until April 1975) as a dental specialist and thereafter as an air traffic control specialist.

Her military medical records indicate that on July 11, 1977, Ms. Wascher consulted an Air Force flight surgeon and reported that, as a result of her reaction to the recent death of her parents in an airplane accident, she was incapable of controlling traffic safely. Following this meeting the flight surgeon recorded a diagnosis of "Situational Reaction, Acute, Adult," and "grounded" her, thus prohibiting her from performing her ATC duties. The records show that, on July 18, 1977, she consulted with a second military flight surgeon who recommended: "Psychiatry Consult." Then on July 26, 1977, Ms. Wascher was seen in a military mental health clinic by its Chief of Clinical Social Work. The record shows that a report of the consult was prepared. On the next day, July 27, 1977, she was given a separation physical examination. The examination record indicated she was qualified for "world wide duty and separation." The records also indicated she was given an Honorable Discharge from the Air Force on July 27, 1977. At this time she had completed approximately 17 months of a six-year enlistment.

Ms. Wascher's FAA medical records indicate she entered on duty with the FAA on February 28, 1982 as an air traffic control specialist. The FAA's subsequent receipt and review of her military medical records prompted its Office of Aviation Medicine to request Ms. Wascher to undergo psychological and psychiatric evaluations as a condition of continued employment. Following these evaluations, psychiatrist Bart Pakull, M.D., of FAA's Office of Aviation Medicine reported in a memorandum dated April 7, 1983 to the flight surgeon of Ms. Wascher's parent FAA organization that there was "... no evidence of sufficient psychopathology to come to any determination that this applicant would be medically unqualified for air traffic control work."

Ms. Wascher's FAA medical records contained no further entries on this matter or other information to indicate any inability to meet applicable FAA medical standards. Her medical records indicate that she has worn glasses since 1966 to correct for defective distant vision. Her latest aviation medical examination form indicated she requires corrective lenses for distant vision. Her corrected distant vision was reported as 20/15.

On April 12, 1991, the FAA's Acting Federal Air Surgeon, Jon Jordan, M.D. was asked by the undersigned about the FAA's current policy regarding their review of prior military medical records of ATCS applicants." He indicated that FAA changed its policy about two years ago and began requiring the review of any such records prior to a person's employment as an ATC specialist. He said this policy remains in effect at this time.

James W. Danaher

James W. Danaher

APPENDIX H

EXTRACT OF FAA ORDER 7220.2A, OPERATIONAL POSITION STANDARDS

U.S. Department of Transportation
Federal Aviation Administration

7220.2A
Operational Position Standards

September 21, 1989

Prepared By: Air Traffic

Chapter 1. GENERAL

1-1 PURPOSE

This order establishes the procedures that are to be used for operating the positions within Air Traffic (AT) facilities. The procedures contained within this order document how the positions are to be operated and, in conjunction with FAA Orders 7110.10, 7110.65, and 7210.3, will be the basis for performance evaluation, training, and certification. All personnel operating positions in AT facilities shall use the Facility-level Operational Position Standards (OPS) written as instructed in this order. The Air Traffic Manager is responsible for providing current Facility-level OPS to the personnel operating the positions within the AT facility.

This order contains National OPS that apply to all facilities and instructions that shall be used to write the Facility-level OPS. The instructions specify how to include in the National OPS those details applicable to the operation of each sector or position within an AT facility. In this way, OPS are applicable to positions differing with respect to local or specific configurations and interposition relations.

The implementation and continued use of the procedures contained in this and other orders will standardize the operation of the positions in AT facilities and provide the user with a constant, predictable level of service.

1-1 Note.— If any procedures in this order are found to conflict with the requirements of Orders 7110.10, 7110.65, or 7210.3, the requirements of these other orders shall take precedence and the Air Traffic Manager shall be notified of the conflict. The Air Traffic Manager shall notify Air Traffic's Procedures Division (ATO-300) of the details of the conflict.

1-2 DISTRIBUTION

This order is distributed to all Air Traffic facilities, to selected offices in Washington Headquarters, Regional Headquarters, the FAA Technical Center, and the Aeronautical Center, and to all International Aviation Field Offices. Also, copies are sent to General Aviation, Air Carrier, and Flight Standards District Offices and to the interested aviation public.

1-3 CANCELLATION

Order 7220.2, Operational Position Standards, dated 6/23/88, with its subsequent changes, is canceled.

1-4 EFFECTIVE DATE

The effective date of this order is September 21, 1989, for those facilities completing implementation of OPS for the first time. For those facilities having already implemented OPS, the changes specified in this order become effective on January 11, 1990.

1-5 BACKGROUND

Operational Position Standards have been developed to define the operation of positions in AT facilities in enough detail that what is to be done to operate the positions is clear. The use of this order to operate the positions will result in the standardization of position operation (each person will operate the position in a similar manner), consistent training (all instructors will teach the same procedures), and objective performance evaluations (the standards will be defined). Prior procedures used for position operation, training, and performance evaluation were not consistent and caused service to the user to vary with the person operating the position.

1-6 EXPLANATION OF CHANGES

Some of the requirements for combining the National OPS with Facility-level Details to form Facility-level OPS have been relaxed, in order to make it easier for facilities to print and distribute the OPS materials. The major changes are as follows:

a. PARAGRAPH 3-8 FORMAT FOR FACILITY-LEVEL OPS. Note (3-8a Note.—) permits printing the Facility-level OPS document so that the text of the National OPS appears only on the left-hand pages and the required Facility-level Details appear on the facing, right-hand pages.

b. Paragraphs have been renumbered and paragraphs reserved at the end of each section, in order to permit additions to the sections, if required either at the facility or national level.

c. Page numbering has been changed to identify both chapter and section.

d. The required Facility-level Details include some which may be made attachments to the Facility-level OPS document. These specific cases are identified in the National OPS. This change does not apply to any other required Facility-level Details.

e. Other changes to this handbook include editorial changes in Chapter 4, Table of Contents; Chapter 11, paragraph 45; Chapter 29, paragraph 1; and Chapter 30, paragraph 39. Major changes were made in Chapter 11, paragraph 47; Chapter 14, paragraph 137; and Chapter 30, paragraphs 43 and 60.

1-7 DEFINITIONS

a. Operational Position Standards (OPS) are the uniform methods of position operation which require standardization of instruction, certification, performance, and evaluation.

b. OPS Elements are the tasks required to operate the positions.

c. OPS Functions are identifiable parts of an Element that describe what is to be done.

d. OPS Procedures describe how to do the Functions in an ordered series of steps and are the actions specified for accomplishing the Functions.

e. Prerequisite Knowledge is the knowledge a person requires in order to perform the OPS Procedures.

f. National OPS specify the OPS Procedures that shall be used to perform the Elements for operating the positions in all facilities, and they list the Prerequisite Knowledge that applies to all facilities.

g. Facility-level OPS are OPS produced by the facility for operating a particular sector or position in that facility.

h. As used in this handbook and in the OPS:

1. "Shall" or an action verb in the imperative sense means a procedure is mandatory.
2. "Should" means a procedure is recommended.
3. "May" or "need not" means a procedure is optional.
4. "Will" indicates futurity, not a requirement for application of a procedure.
5. Singular words include the plural and plural words include the singular.

For further definition of terms, consult the Glossary in FAA Orders 7110.10, 7110.65, 7210.3, or the Airman's Information Manual.

1-8 REQUESTS FOR INFORMATION

Questions pertaining to this order should be directed to Air Traffic's Procedures Division (AT0-300).

1-9 AUTHORITY TO CHANGE THIS ORDER

Changes to this order must be approved by Air Traffic's Procedures Division (AT0-300).

1-10 thru 999 RESERVED.

Chapter 2. OPERATIONAL POSITION STANDARDS

2-1 POLICY

Operational Position Standards (OPS) specify in detail how the tasks assigned to a position shall be performed in order to comply with related FAA orders. For example, the OPS for the Local Control position specifies how the specialist shall perform in order to ensure that the provisions of FAA Order 7110.65 are met. Therefore, the OPS for each position are the basis for:

a. Developmental and proficiency training.

b. Position certification with accompanying proficiency levels.

c. Over-the-shoulder, annual, and other performance evaluations.

d. Supervisory actions and support.

2-2 SCOPE

OPS are provided for tasks or duties directly related to position responsibilities.

2-3 FACILITY RESPONSIBILITIES

a. The Air Traffic Manager shall be responsible for ensuring that the requirements of this handbook are met in the facility. In the facility directives conveying the facility-level OPS to the personnel who operate the positions, the Air Traffic Manager shall ensure that all employees are aware that the OPS are directive.

b. Each supervisor shall be responsible for ensuring that the operation of sectors or positions under supervision is in accordance with the facility-level OPS applicable to those sectors or positions.

c. Training on the Prerequisite Knowledge included in a facility-level OPS shall be completed satisfactorily before commencement of on-the-job training (OJT) involving that OPS.

1. Evidence during OJT that the requirements for Prerequisite Knowledge have not been met shall require additional training on the Prerequisite Knowledge and may result in suspension of OJT until the additional training has been completed satisfactorily.

2. If the Prerequisite Knowledge changes while OJT is in progress, training on the changed Prerequisite Knowledge shall be completed satisfactorily before continuing OJT.

2-4 RECOMMENDATIONS FOR CHANGES

Recommendations for changes to this handbook shall be prepared and processed in accordance with the following procedure.

a. Recommendations for changes to the OPS are to be submitted in writing to the appropriate employee participation group (EPG).

b. The EPG shall review the recommended OPS changes and submit the changes to the Air Traffic Manager for review.

c. The Air Traffic Manager may comment on and then shall submit the recommended OPS changes to the Regional Procedures Branch for review.

d. The Region may comment on and then shall submit the recommended OPS changes to Air Traffic's Procedures Division (ATP-100) for review.

e. Air Traffic's Procedures Division (ATP-100) shall inform the Air Traffic Manager of the response to the recommended OPS changes.

2-5 OPS ELEMENTS

The Elements of the OPS are the tasks required to operate the positions.

a. In this handbook, the Elements that apply to all positions in all facilities are given as section headings in Chapter 4.

b. Beginning with Chapter 5 in this handbook, the National OPS group the Elements according to positions, identifying the Elements usually performed at these positions. The Elements are given as section headings in chapters, where each chapter heading is the name of the position.

2-5b Note. — In some facilities, certain Elements may be performed at positions other than the ones named in this handbook. See 3-3.

2-6 OPS FUNCTIONS

a. The Functions of the OPS are identifiable parts of an Element that describe what is to be done.

b. In this handbook, the Functions are given as numbered paragraphs in sections, where each section heading is an Element.

2-6b Note. — In some facilities, certain Functions may be performed at positions other than the ones named in this handbook. See 3-3.

2-7 OPS PROCEDURES OR PROCEDURAL STEPS

a. The OPS Procedures describe how to do the Functions in an ordered series of steps. These procedural steps are the actions specified for accomplishing the Functions.

b. In this handbook, the OPS Procedures are the details given in the numbered paragraphs beginning with Chapter 4.

2-7b Note. — The facilities provide some of the procedural steps in the OPS used to operate the actual positions in the field facilities. See Chapter 3.

2-8 PREREQUISITE KNOWLEDGE

Prerequisite Knowledge is the knowledge a person requires in order to perform the procedural steps in the OPS. It is specific for each position, and it consists of knowledge that applies to all facilities and that which applies to the facility and to the specific position.

a. In this handbook, the Prerequisite Knowledge is listed at the beginning of each chapter, beginning with Chapter 4.

b. Prerequisite Knowledge includes, but is not limited to, the following information:

1. Separation minima.
2. Airspace and airport layout details.
3. Strip marking.
4. Phraseology for opening and closing interphone conversations.
5. Phraseology for conducting radio communications, including correct pronunciation of letters and numbers.
6. Operation of the controls on equipment.
7. Aircraft characteristics and recognition.
8. Relevant sections and paragraphs in national, regional, and facility directives and in Letters of Agreement.
9. References given in the OPS Procedures, as specified in **2-9** and **3-8d**.

c. Prerequisite Knowledge does not include the details for performing a single Function; such details shall be provided as OPS Procedures consisting of sequential procedural steps for performing the Function.

2-9 REFERENCES

a. References are aids for remembering sections or paragraphs in this or other directives that describe actions critical to the safety of flight, where these actions are not applied under normal circumstances at the sector or position.

b. In this handbook, a Reference is given immediately following the procedural step to which it applies.

2-10 NATIONAL OPS

a. The National OPS are the OPS as given in this handbook, beginning with Chapter 4. These National OPS specify the OPS Procedures that shall be used to perform the Elements for operating the positions in all facilities, and they list the Prerequisite Knowledge that applies to all facilities.

b. The National OPS include requirements for adding the details to produce the Facility-level OPS for operating specific positions in the facility.

2-11 FACILITY-LEVEL OPS

Facility-level OPS are OPS produced by the facility for operating a particular sector or position in that facility. These Facility-level OPS specify the OPS Procedures that shall be used to perform the Elements for operating a particular sector or position in the facility, and they list the Prerequisite Knowledge that applies to that sector or position.

2-12 thru 999 RESERVED.

Chapter 3. FACILITY-LEVEL OPS

3-1 REQUIRED FACILITY-LEVEL OPS

For each sector or position in the facility that performs any Element or Function described in the National-level OPS, a Facility-level OPS narrative shall be written. This Facility-level narrative shall include the procedure/s for each Element or Function and a list of the Prerequisite Knowledge for performing the procedural steps. The Facility-level OPS shall also define the vertical and the lateral boundaries of each operational sector.

a. If two or more sectors are operated as a combined sector, the Facility-level OPS for the combined sector shall be the combination of the Facility-level OPS for the individual sectors.

b. If two or more individual positions are operated as a combined position, the Facility-level OPS for the combined position shall be the combination of the Facility-level OPS for the individual positions.

c. If a position named in the National OPS is operated as two positions in the facility, each position shall have its Facility-level OPS clearly stating which Elements or Functions in the National OPS are to be performed by which position in the facility. For example, if the facility has an Assistant Local Control position, the facility shall provide a Facility-level OPS for the Local Control position and a separate Facility-level OPS for the Assistant Local Control position, both together including all the Elements and Functions given in the National OPS for the Local Control position.

3-2 REQUIRED ELEMENTS AND FUNCTIONS

Any Element or Function in the National OPS that refers to equipment used in the facility or to a service provided by the facility shall be included in the Facility-level OPS.

3-3 DESIGNATION OF ELEMENTS AND FUNCTIONS TO SECTORS OR POSITIONS

a. The OPS Elements in Chapter 4 of this handbook shall be included as the opening Elements in each Facility-level OPS to which they apply. For example, the Elements for Air Traffic Principles and Transfer of Position Responsibility shall be included as the first two Elements in the OPS for all of the positions providing air traffic services, including the first-level and second-level supervisory positions.

b. The OPS Elements and Functions for a position named in the National OPS, beginning with Chapter 5 of this handbook, shall be included in the Facility-level OPS for the positions with the same name in the facility, unless the layout of the equipment makes this impossible or the Element or Function applies to a service that is never provided by the facility.

1. The Air Traffic Manager shall be responsible for ensuring the rearrangement of the equipment, at the earliest opportunity, to allow the Elements and Functions in the Facility-level OPS to be the same as those in the National OPS for each correspondingly named position.

2. The only OPS Procedures to be deleted from the National OPS when producing the Facility-level OPS shall be those given in Elements or Functions that apply to services never provided by the facility. In these cases only, the Element or Function name shall be included in the Facility-level OPS, followed by the abbreviation "N/A," for "not applicable."

3. The only OPS procedural steps that may be deleted are those steps that are not accomplished at the facility because the equipment is not installed. In those cases only, the step number or letter shall be included, followed by the abbreviation N/A for not applicable.

c. If an Element or Function for a given position in the National OPS is performed at a position with a different name in the facility because of the equipment layout, then the Element or Function shall be included in the Facility-level OPS for the differently named position in the facility, except as specified in **3-3d** below. The Prerequisite Knowledge applicable to the Element or Function shall be included in the list of Prerequisite Knowledge for the differently named position.

d. Elements that include the need to make decisions for controlling air traffic shall not be assigned to the Flight Data positions in centers and terminals.

3-4 FACILITY-LEVEL DETAILS REQUIRED

In writing Facility-level OPS, details applicable to the sector or position shall be added, as specified, wherever the phrase "Facility-level Details Required" appears in the required Elements or Functions.

a. The required Facility-level Details are specified following each notation for "Facility-level Details Required." All of the details required to complete the step in the OPS Procedure when working the position shall be included. For example, "Call (facility) via (method); use (method) as a backup" requires inserting the name of each facility that would be called in the step, the usual methods of communicating with each facility, and the methods to be used when the usual methods are not available; the step in the Facility-level OPS would appear as a list similar to the following:

"Call Los Angeles TRACON via GP376 voice line; use GP404 line as a backup.

"Call Southern Approach, Flight Data position, via GP3401 line; use GP1607 line as a backup."

b. The procedural steps for the Functions in the National OPS apply to operations with the usual equipment operating normally. When adding the Facility-level Details, instructions shall be included on what to do when the equipment malfunctions. If a backup is available, the alternative equipment or the alternative method to use when the usual equipment malfunctions shall be written out in detail. For example, a backup method shall be provided for outages of the Flight Data Entry and Printout (FDEP) equipment or outages of the interphones. If no backup is available, this shall be stated.

3-5 OPERATIONAL DETAILS NOT COVERED IN OPS

Some emergency situations and unusual situations are not covered in the National OPS; procedures for some of the commonly occurring emergencies are included. The Air Traffic Manager may include procedures for handling some of the other emergency or unusual situations in the Facility-level OPS. The Air Traffic Manager shall direct that, for situations not covered in the Facility-level OPS or other directives, the person operating the sector or position shall take whatever actions that person judges appropriate. First priority shall be given to the preservation of life. The person taking these actions shall inform the Air Traffic Manager at the earliest opportunity.

3-6 ADDITIONAL FACILITY-LEVEL DETAILS ALLOWED

Provided that the National OPS are not modified or deleted, except as specified in **3-3b2** and **3-3b3**, the Air Traffic Manager may authorize additional Elements or Functions, or procedural steps for existing Functions, for any Facility-level OPS.

a. The Elements on operating equipment in the National OPS specify the minimum procedural steps required for AT services. Additional tasks may be done by the person operating the position or by maintenance personnel, at the option of the Air Traffic Manager. If the Air Traffic Manager requires the person operating the position to perform these tasks, then the details for performing these tasks shall be included in the Facility-level OPS as additional procedural steps in appropriately named Functions.

b. The Elements in the National OPS for the positions that are not staff, supervisory, or managerial positions, but are operational positions in centers, terminals, or Flight Service Stations, do not include statistical data-collection tasks (such as the hourly traffic count) or administrative duties. Such tasks or duties may be assigned to one or more positions at the option of the Air Traffic Manager. If the Air Traffic Manager requires the person operating a specified position to perform these tasks, then the details for performing these tasks shall be included as additional procedural steps in appropriately named Functions in the Facility-level OPS for the specified position.

3-7 MODIFICATIONS TO NATIONAL OPS PROHIBITED

a. Except as specified in **3-3b2**, **3-3b3** and **3-3c**, the National OPS shall not be modified when including the details to produce the Facility-level OPS.

3-7a Note. — In making the transition to operating according to the required OPS, operating methods previously used in the facility shall be changed as needed to conform exactly with the National OPS.

b. Facility-level Details shall not contradict or negate any of the required procedural steps given in the National OPS.

3-8 FORMAT FOR FACILITY-LEVEL OPS

a. The Facility-level OPS shall be exact reproductions of the required Elements, Functions, and procedural steps in the National OPS, with the required Facility-level Details inserted into the sequences of procedural steps at the places indicated by the notation "Facility-level Details Required." A description of what details to insert follows each notation.

3-8a Note.— Until further notice, the following method may be used to produce the Facility-level OPS if limited resources preclude printing the OPS with the Facility-level Details inserted into the text of the National OPS.

1. Place the text of the National OPS only on the left-hand pages of the Facility-level OPS document (as seen when looking at the open document).

2. Print only one section of the National OPS on a single page. If a section is longer than one page, print the succeeding pages as the next left-hand pages. If the section is shorter than one page, leave the remainder of the page blank.

3. Place the Facility-level Details to start on the right-hand page facing the page in the National OPS that specifies these details are required (except where the National OPS states that the details may be made appendices to the document). If a page in the National OPS contains more than one step requiring Facility-level Details, place the details in the same sequence as called for in the National OPS.

b. The required Facility-level Details shall be added, where so instructed in the National OPS, such that the sequences of procedural steps given in the National OPS are not altered by the additions. The required Facility-level Details shall not be given as attachments to the National OPS, unless instructed to do so in the National OPS, nor as references to other documents or handbooks.

c. The required Facility-level Details, where added, shall be preceded by the facility's three letter identifier, followed by a hyphen, followed by letters to identify the position. The position identifiers for the tower cab positions, for example, should be LC for Local Control, GC for Ground Control, CD for Clearance Delivery, GH for Gate hold, and FD for Flight Data. For centers, the sector identification should be used. For the terminal radar positions, AP may be used for Approach and DP for Departure. If more than one Approach or Departure position is used, a number or letter may be used to designate these positions.

d. If the Air Traffic Manager authorizes additions to the Facility-level OPS, the additions shall be made in such a way that the Elements, Functions, and procedural steps required by the National OPS are not modified or deleted, and the required sequences of procedural steps are not altered.

e. Additions to the Facility-level OPS shall be made using the same format as in the National OPS, with Elements, Functions, and procedural steps as defined in Chapter 2.

f. The Prerequisite Knowledge required for performing the procedural steps shall be listed at the beginning of each Facility-level OPS. The Prerequisite Knowledge shall include that listed in the National OPS and that required by the addition of the Facility-level Details.

g. References shall not be included in the OPS Procedures of the Facility-level OPS, except for the following:

1. References already included in the National OPS for the position.

2. Sections or paragraphs in other facility directives that describe actions critical to the safety of flight, where these actions are not applied under normal circumstances at the sector or position.

h. The format for numbering paragraphs in the National OPS shall be used for numbering paragraphs in the Facility-level OPS. For example, the Facility-level OPS for the Flight Data positions in Flight Service Stations shall start with paragraph number **4-1** and run consecutively through **4-2, 4-3,** etc. for the Elements from Chapter 4 of this handbook, then continue with paragraph number **11-1** and run consecutively through **11-2, 11-3,** etc. for the Elements from Chapter 11 of this handbook. The Facility-level OPS for positions other than the Flight Data positions in Flight Service Stations shall not use the **11-** paragraph numbers.

i. *Similarly, the format for numbering pages in the National OPS shall be used for numbering pages in* the Facility-level OPS. The page numbers have three parts, showing the chapter, the section (with Prerequisite Knowledge counted as Section 0), and the page within the section. For example, the Facility-level OPS for the Flight Data positions in Flight Service Stations shall start with page number **4-0-1** and run consecutively through **4-1-1, 4-2-1,** etc., for the Elements from Chapter 4 of this handbook, then continue with page number **11-0-1** and run consecutively through **11-1-1, 11-2-1,** etc. for the Elements from Chapter 11 of this handbook. The Facility-level Details will be inserted in the National OPS to form the Facility-level OPS, the last digits of the page numbers in the Facility-level OPS may not correspond exactly with the last digits of the page numbers for the same Functions and procedural steps in the National OPS.

3-8! Note.— If the optional method described in 3-8 a Note is used for producing the Facility-level OPS, then the page sequences for the Facility-level Details (on the right-hand pages) shall be shown by adding a period and a number to the last digit of the page numbers in the National OPS. For example, the Facility-level Details required for paragraph 11-15a3 on page 11-4-1 of the National OPS shall start on page 11-4-1.1 and continue (if needed) on page 11-4-1.2.

3-9 CROSS CHECKING OF FACILITY-LEVEL DETAILS

a. The Air Traffic Managers of facilities that have sectors or positions with interfacility interactions shall coordinate with each other to ensure that the Facility-level OPS are compatible among the facilities for the procedural steps involved in each interfacility interaction. These facilities would include centers, terminals, tower cabs, TRACONS, Flight Service Stations, and military air traffic facilities.

b. For sectors and positions within a facility, the Facility-level OPS shall be compatible for the procedural steps involved in each intrafacility interaction. For example, if coordination is required between two positions, the procedural steps for both sides of the coordination shall be given so that the two Facility-level OPS, taken together, cover the required coordination completely.

3-10 METHODS FOR PRODUCING FACILITY-LEVEL OPS

a. Any method suitable for producing the master documents for the Facility-level OPS may be used, providing that the copies made from the masters for distribution to the operating personnel are legible and easily readable. For example, printed materials may be cut and pasted, or materials may be retyped.

b. The Facility-level OPS shall be complete documents with the Prerequisite Knowledge listed at the beginning and the Functions and procedural steps in the correct sequences within the Elements, as given in the National OPS. The required Facility-level Details shall not be added out of sequence as attachments or abbreviated as references to other documents, unless so instructed in the National OPS.

3-11 CHANGES TO FACILITY-LEVEL OPS

Authorized changes to the OPS Procedures or Prerequisite Knowledge shall be made by producing new pages for insertion in the Facility-level OPS.

a. The new pages shall be dated and labeled as a numbered change, with consecutive changes numbered consecutively for each Facility-level OPS.

b. The changed material shall be marked as indicated in Chapter 8 of FAA Order 1320.1, FAA Directives System.

3-12 DISTRIBUTION OF FACILITY-LEVEL OPS

a. Copies of the current Facility-level OPS shall be available to each person who operates the sectors or positions. A copy of the current Facility-level OPS shall be available for ready reference and easily accessible by the personnel operating the sectors or positions.

b. Each change to a Facility-level OPS, except for editorial changes, shall be briefed to each person who operates the relevant sectors or positions.

3-13 thru 999 RESERVED.

Chapter 22. CLEARANCE DELIVERY

22-1 PREREQUISITE KNOWLEDGE

The Prerequisite Knowledge requirements for performing the Clearance Delivery functions in tower cabs shall be satisfied as follows:

a. The specialist shall have met one or more of the following qualifications:

1. FAA Academy Terminal graduate.

2. Previous qualification to perform Clearance Delivery functions in a tower cab.

3. Successful completion of Section 1 of Terminal Self-Study Course 55027 (or Air Traffic Assistant (ATA) Course 55037), Clearance Delivery, as required by Terminal Instructional Program Guide TP 12-0-1.

b. In addition, the specialist shall have successfully completed the training program developed by the facility in accordance with Section 2 of Terminal Self-Study Course 55027 (or Air Traffic Assistant (ATA) Course 55037), Clearance Delivery, as required by Terminal Instructional Program Guide TP 12-0-1. This program shall be completed at the facility where the specialist will be performing the Clearance Delivery functions.

Section 2. RECEIVE, FORMULATE, AND ISSUE CLEARANCES/ INSTRUCTIONS

22-10 RECEIVE CLEARANCE REQUESTS

a. Upon receiving a clearance request, scan strips to determine if flight plan is available.

b. If the flight plan is not available:

1. Request the flight plan from Flight Data, or
2. Request the necessary information from the pilot.
3. If 1. or 2. cannot be accomplished, instruct the pilot to file/refile the flight plan.

c. Ensure clearance/information has been entered into the Automated Radar Terminal System (ARTS).

22-11 FORMULATE CLEARANCES/INSTRUCTIONS

a. Ensure that the following items are included in an IFR/VFR-on-top/SVFR/TCA clearance:

1. Aircraft identification.
2. Clearance limit.
3. Departure procedure/Standard Instrument Departure (SID).
4. Route of flight.
5. Altitude.
6. Departure frequency.

22-11a6 Facility-level Details Required. — List departure frequencies.

7. Transponder code when required.

b. When issuing instructions, include the following:

1. Departure frequency.
2. Transponder code when required.

22-12 ISSUE CLEARANCES/AMENDMENTS/INSTRUCTIONS

a. When issuing a clearance/amendment/instruction:

1. Speak at a rate that is consistent with copying the information.
2. Issue the clearance/amendment/instruction in the proper format using prescribed phraseology.
3. Issue departure restrictions, clearance void times, or release times as necessary.

b. After issuing a clearance/amendment/instruction:

1. Ensure clearance/amendment/instruction has been received by either a pilot acknowledgement or a correct readback.
2. Mark the flight progress strip to indicate the clearance/amendment/instruction has been issued.
3. Forward the flight progress strip to the appropriate position.

22-12b3 Facility-level Details Required. — Insert the appropriate facility positions to which flight progress strips shall be forwarded.

22-13 thru 17 RESERVED.

Section 4. ISSUE GROUND MOVEMENT INSTRUCTIONS

23-28 ISSUE GROUND MOVEMENT INSTRUCTIONS

Issue ground movement instructions using proper radio message format in concise and easy-to-understand terms.

a. Issue unrestricted taxi instructions when the aircraft will proceed without restrictions to an assigned takeoff runway.

Phraseology:

TAXI TO RUNWAY (runway number).

TAXI TO RUNWAY (runway number) VIA (taxiway or detailed route, if necessary).

b. Issue unrestricted ground movement instructions when the aircraft/vehicle will proceed without restrictions to a destination point other than an assigned takeoff runway.

Phraseology:

TAXI/PROCEED TO (destination).

APPROVED AS REQUESTED.

CONTINUE TAXIING ACROSS/VIA/ON (runway/taxiway).

c. Issue restricted taxi instructions when it is necessary to hold the aircraft short of the assigned takeoff runway:

1. First specify the assigned takeoff runway, followed by taxi instructions if necessary, and then state the hold short instructions.

Phraseology:

RUNWAY (number), TAXI/PROCEED VIA (route if necessary), HOLD SHORT OF (runway number).

RUNWAY (number), TAXI/PROCEED VIA (route if necessary), HOLD SHORT OF (location).

RUNWAY (number), TAXI/PROCEED VIA (route if necessary), HOLD ON (taxiway, runup pad, location).

2. Add the reason for the hold short instructions if necessary.

Phraseology:

TRAFFIC (traffic information).

FOR (reason).

d. Issue restricted ground movement instructions when it is necessary to hold or restrict the aircraft/vehicle at any point due to traffic or other operational considerations.

Phraseology:

HOLD FOR (reason).

HOLD POSITION.

HOLD SHORT OF (position).

FOLLOW (traffic) (restrictions as necessary).

TAXI/PROCEED BEHIND (traffic).

TAXI/PROCEED LEFT/RIGHT OF (traffic/runway/taxiway).

e. When a specific route is required, specify the route in clear and concise terms.

Phraseology:

TAXI/PROCEED TO (destination) VIA (route).

TAXI/PROCEED (direction) ON (taxiway/runway/movement area).

TAXI/PROCEED ACROSS (runway/taxiway/ramp).

TAXI/PROCEED ON (taxiway/runway/ramp).

TURN (right/left).

EXIT AT (location).

f. Issue instructions for expeditious compliance when traffic or other operational considerations are a factor.

Phraseology:

TAXI/PROCEED WITHOUT DELAY (reason, time permitting).

EXIT/CROSS (runway/taxiway) WITHOUT DELAY. (To be used when prompt compliance is required to avoid an interruption of traffic movement.)

g. Denial of request. When a specialist cannot approve a ground movement request due to traffic or operational consideration, use the following phraseology:

Phraseology:

UNABLE (reason, time permitting).

23-29 ISSUE TRAFFIC INFORMATION

a. Exchange traffic information between conflicting traffic by specifying position and intentions of each.

Phraseology:

TRAFFIC (location and intentions).

b. Issue traffic information when the information will provide assistance to pilot/operator.

Phraseology:

TRAFFIC (location and intentions).

23-30 USE OF NON-PRESCRIBED PHRASEOLOGY

a. When phraseology is needed for unusual situations that are not covered in 7110.65 or this order, issue instructions that are clear and concise. AVOID phraseology that lends itself to misinterpretation, e.g., "Yield," "Give way," or "Shoot the gap."

b. Issue instructions that state what to do rather than what not to do, e.g., "HOLD SHORT OF RUNWAY" instead of "Do not taxi onto the runway."

23-31 ISSUE PROGRESSIVE GROUND MOVEMENT INSTRUCTIONS

Progressive ground movement instructions are detailed routes issued to the pilot/operator. Occasionally, it may be necessary to issue these instructions step by step as the aircraft/vehicle proceeds along a route.

a. Issue progressive ground movement instructions when:

1. Pilot/operator requests.
2. Pilot/operator is unfamiliar with route issued.
3. The specialist deems it necessary due to traffic or field conditions, e.g., construction or closed taxiways.

b. Progressive ground movement instructions include step-by-step routing directions.

23-32 CONFIRM LOCATION

When an aircraft/vehicle is not visible from the tower, confirm the location by one of the following methods:

a. Reports of progress by pilot/operator via the radio.

b. ASDE to confirm pilot/operator-reported position.

c. Reports by other pilots/operators.

23-33 REPORT AIRPORT CONDITIONS

Issue information on airport conditions in time for it to be useful to the pilot/operator.

23-34 thru 38 RESERVED.

Section 5. PROCESS FLIGHT PROGRESS STRIPS

23-39 PREPARE/OBTAIN FLIGHT PROGRESS STRIP

a. Prepare or obtain a flight progress strip.

23-39a Facility-level Details Required. — Specify which aircraft operations require a flight progress strip at the Ground Control position.

b. Ensure the flight progress strip contains the following minimum information:

1. Aircraft identification.
2. Type.
3. Pilot intentions.
4. Additional information, as required by the facility.

23-39b4 Facility-level Details Required. — List any facility-required additional information.

23-40 REVIEW FLIGHT PROGRESS STRIP

Review the flight progress strip to ensure that required information is displayed and conforms with appropriate directives.

23-41 REVISE FLIGHT PROGRESS INFORMATION

If discrepancies are detected:

a. Return the flight progress strip to Flight Data/Clearance Delivery for correction, or

b. Revise the flight progress strip and inform the affected position.

23-42 ISSUE REVISED/AMENDED FLIGHT PROGRESS INFORMATION

a. Issue amended clearance information to the pilot, or

b. Instruct the pilot to contact Clearance Delivery for amended clearance.

23-43 MARK FLIGHT PROGRESS STRIP

Mark the flight progress strip as follows:

a. A symbol indicating that the pilot has received the required current departure information. Use one of the following symbols:

1. The current ATIS code when the pilot has received the current ATIS information.
2. "WX" when the pilot has received the current weather information in the place of the ATIS or where there is no ATIS.

b. The runway the aircraft is assigned.

c. The designator for the departure point on the runway when an aircraft will depart from a point other than that designated as the standard operating procedure for that runway. Use one of the following designators:

1. The intersection designator.

23-43c1 Example. — 22/G (for runway/intersection).

2. A designator for another portion of the runway when the standard operating procedure designates a specific intersection for departures.

23-43c Facility-level Details Required. — List the designated departure point for the standard operating procedure for each runway.

d. Additional facility markings.

23-43d Facility-level Details Required. — List facility-required markings.

23-44 FORWARD FLIGHT PROGRESS STRIP

Forward the flight progress strip to the appropriate position.

APPENDIX I

TRANSCRIPT OF LAX ATCT LC2 POSITION

DOCKET NO. SA-505

EXHIBIT NO. 3B

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

Certified Transcript of Communications
LAX ATCT LC2 Operating Position
1758:06 through 1812:39 PST
February 1, 1991

US Department of Transportation
Federal Aviation Administration

Memorandum

Subject: INFORMATION: Transcription concerning the accident involving US Air 1493 and Skywest 569 on February 2, 1991

Date: February 6, 1991

From: Quality Assurance Specialist
Los Angeles Tower

Reply to Attn of:

To:

This transcription covers the time period from February 2, 1991, 0158 UTC to February 2, 1991, 0212 UTC.

Agencies Making Transmissions	Abbreviation
Mexicana 906	MXA906
Los Angeles ATCT Local Control Two	LC2
Phillipine 102	PAL102
America West 37	AWE37
Skywest 246	SKW246
Canadian 505	CDN505
Los Angeles TRACON Departure Control One	DR1
America West 429	AWE429
Wings West 5006	WWM5006
Sundance 518	SDC518
Los Angeles ATCT Local Control One	LC1
US Air 23	USA23
Los Angeles TRACON Departure Control Two	DR2
Skywest 569	SKW569
Southwest 725	SWA725
US Air 1493	USA1493
US Air 2852	USA2858
Wings West 5072	WWM5072
Wings West 5212	WWM5212
Police Department 80	PD80
Helicopter 5NR	5NR
Helicopter N5212	N5212
Los Angeles City Operations	City Ops
Los Angeles City Operations 38	City Ops 38

I hereby certify that the following is a true transcription of the recorded conversations pertaining to the subject aircraft incident.

James R. Morris
Quality Assurance Specialist

(0158)		no pertinent transmissions
0158:06	MXA906	mexicana nine oh six five miles from runway
0158:10	LC2	mexicana nine zero six roger traffic short final cleared to land runway two four left (unintelligible)
0158:20	LC2	flipr after short final
0158:22	LC1	ah follow the flipr going in the slot
0158:22	PAL102	ah los angeles ah phillipine one zero two heavy is on ah finals two four right
0158:28	LC2	phillipine one zero two heavy los angeles tower wind two four zero at six cleared to land runway two four right
0158:33	PAL102	one zero two
0158:34	LC2	cactus thirty seven if able turn left first available high speed contact ground point six five when off the runway traffic on a mile and half final behind you
0158:40	AWE37	thirty seven wilco
0158:50	SKW246	tower skywest two forty six will take forty seven

0158:54	LC2	skywest two forty six hold there
0158:57	SKW246	two forty six
(0159)		no pertinent transmissions
0159:02	CDN505	canadian five zero five on a ah turning final for two four left
0159:06	LC2	canadian five zero five los angeles tower wind two five zero at seven cleared to land runway two four left caution wake turbulence preceding heavy boeing seven forty seven
0159:14	CDN505	cleared to land two four left canadian five zero five three green
0159:17	LC2	crossover cactus four fifty nine w w
	DR1	santa barbara c r
0159:32	LC2	cactus four twenty nine taxi into position and hold runway two four left
0159:35	AWE429	to hold two four left cactus four twenty nine
0159:52	LC2	mexicana nine zero six turn left first available high speed contact ground point six five when off the runway good night
(0200)		no pertinent transmissions

0200:01	LC2	wings west five thousand six turn left at your reverse high speed or the forward high speed hold short of runway two four left remain this frequency
0200:06	WWM5006	okay
0200:07	SDU518	tower sundance five eighteen turned to final for two four right
0200:12	LC2	sundance five eighteen los angeles tower wind two five zero at two cleared to land runway two four right caution wake turbulence preceding heavy boeing seven forty seven
0200:19	SDU518	ah cleared to land two four right understand he is two four left sundance five eighteen
0200:23	LC2	he's two four right also
0200:26	SDU518	okay we're slowin
0200:28	LC2	cactus four twenty nine fly heading two five zero maintain two thousand wind two five zero at six runway two four left cleared for takeoff
0200:34	AWE429	cactus four twenty nine cleared for takeoff two four left two thousand feet heading two five zero
0200:39	LC2	sundance five eighteen you got two five right in sight

0200.42	SDU518	we got two five right in sight and the other guy for two four lefts in sight
0200:44	LC2	sundance five eighteen understand you have the (unintelligible) canadian seven thirty seven just ah be eleven o'clock and a half a mile
0200:52	SDU518	we have him in sight we can step over him for two five right
0200:56	LC2	sundance five eighteen change to runway two five right wind two five zero at six cleared to land runway two five right contact tower one two zero point niner five
(0201)		no pertinent transmissions
0201:03	SDU518	thank you steppin over to two five right over to the other tower sundance five eighteen thanks for the help
0201:08	LC1	alaska twenty z z
0201:31	LC2	cactus four twenty nine contact los angeles departure good night
0201:34	AWE429	cactus four twenty nine good night
0201:44	LC2	rundown u s air twenty three (unintelligible) crossover
0201:46	DR1	roger

0201:50	Unknown	lights on uniform
0201:53	LC2	calling ground say a eh tower say again
0201:56	Unknown	landing lights on uniform
(0202)		no pertinent transmissions
0202:02	LC2	affirmative
0202:04	LC2	phillipine one zero two heavy turn left when able hold short of runway two four left remain this frequency
0202:12	PAL102	ah roger (unintelligible)
0202:14	LC2	thank you
0202:18	Unknown	(unintelligible)
0202:21	LC1	i gotta heavy ventura
0202:22	LC2	ah follow the gorman (unintelligible)
0202:25	LC1	z z (unintelligible)
0202:26	LC1	z z
0202:28	LC2	u s air twenty three taxi into position and hold runway two four left

0202:30	USA23	position and hold ah two four left u s air twenty three
0202:34	Unknown	one three point six five one niner tango
0202:39	DR2	say again local two
0202:39	LC2	request ah two seventy skywest
0202:42	DR2	on who skywest who
0202.43	LC2	two forty six
0202:44	DR2	approved
0202:48	LC1	canadian
0202:49	LC1	call ya back on the heavy ventura
0202:50	LC1	canadian five zero five turn left when able contact ground point six five when off the runway good night
0203:00	PAL102	one zero two is ah only to hold ma'am
0203:02	LC2	one zero two heavy affirmative hold short of runway two four left
0203:06	PAL102	hold short
0203:09	WWM5006	can th wings fifty oh six cross two four left

0203:12	LC2	fifty oh six hold short
0203:13	WWM5006	hold short
0203:18	LC2	u s air twenty three fly heading two five zero maintain two thousand wind two five zero at six runway two four left cleared for takeoff
0203:24	USA23	okay two thousand two fifty cleared to go u s air twenty three
0203:30	LC2	skywest two forty six you still holding short of forty seven
0203:33	SKW246	two forty six affirmative
0203:35	LC2	you're next
0203:36	SKW246	roger
0203:38	SKW569	skywest ah five sixty nine at forty five we'd like to go from here if we can
0203:40	LC2	skywest five sixty nine taxi up to and hold short of two four left
0203:44	SKW569	roger hold short
0203:53	SWA725	southwest ah seven twenty fives ready in sequence

0203:56	LC2	skywest two forty six taxi across runway two four left runway two four right shoreline turn right heading two seven zero maintain two thousand wind two four zero at six cleared for takeoff
(0204)		no pertinent transmissions
0204:05	SKW246	kay two seventy to two thousand two forty six cleared for takeoff
0204:09	LC2	runway two four right
0204:10	SKW246	affirmative
0204:11	LC2	wings five thousand six taxi across runway two four left contact point six five when off the runway good night
0204:17	PAL102	was that for phillipine one zero two ma'am
0204:19	LC2	no sir hold short wings five thousand and six taxi across runway two four left contact ground point six five when off the runway
0204:30	LC2	u s air twenty three contact los angeles departure good night
0204:32	USA23	good night
0204:33	USA1493	u s air fourteen ninety three inside of roman

0204:38	LC2	wings five thousand and six ground eh tower
0204:44	LC2	skywest five sixty nine taxi into position and hold runway two four left traffic will cross downfield
0204:49	SKW569	kay two four left position and hold skywest five sixty nine
0204:52	LC2	wings west five thousand and six tower
0204:59	SWA725	tower southwest seven twenty fives ready in sequence
(0205)		no pertinent transmissions
0205:02	LC2	southwest seven twenty five roger taxi up to and hold short of two four left
0205:05	SWA725	up to hold short southwest seven twenty five
0205:06	LC2	you'll follow the metroliner
0205:09	WWM5006	(unintelligible) on frequency again changed radios sorry bout that
0205:12	LC2	five thousand six you're back with me
0205:14	WWM5006	yeah and we didnt mean to switch radios we're now on

0205:16	LC2	okay i thought i lost you taxi (unintelligible) runway two four contact ground point six five when off the runway traffic will hold in position
0205:21	WWM5006	great and we thought we lost you we apologize
0205:23	LC2	no problem sundance five eighteen taxi across runway two four left contact ground point six five when off the runway good night
0205:29	USA1493	u s air fourteen ninety three for the left side two four left
0205:33	LC2	skywest two forty six heading two seven zero contact los angeles departure good night
0205:38	SKW246	two forty six good night
0205:39	LC2	southwest seven twenty five you're holding short of two four left correct
0205:44	LC2	southwest seven twenty five tower
0205:47	SWA725	ah seven twenty five go ahead
0205:48	LC2	yes sir you're holding short is that correct
0205:50	SWA725	yes ma'am we're holding short
0205:51	LC2	thank you

0205:53	LC2	u s air fourteen ninety three cleared to land runway two four left
0205:55	USA1493	cleared to land two four left fourteen ninety three
0205:58	USA2858	twenty eight fifty eights for the right five miles
0205:59	LC2	u s air twenty eight fifty eight wind two three zero at eight cleared to land runway two four right
(0206)		no pertinent transmissions
0206:04	USA2858	cleared to land
0206:08	WWM5072	tower wings west fifty seventy two is ready for takeoff
0206:13	LC2	wings fifty seventy two
0206:15	WWM5072	affirmative
0206:17	LC2	wings fifty seventy two you at forty seven or full length
0206:20	WWM5072	we're full length
0206:21	LC2	okay
0206:26	LC2	hold short

0206:28	WWM5072	roger holding short
0206:30	LC2	wings fifty seventy two say you're squawk
0206:33	WWM5072	forty six fifty three
0206:46	WWM5212	los angeles tower wings west fifty two twelve with you on the visual two four right
0206:51	LC1	of runway two five right
0206:51	LC2	flipper
0206:54	Unknown	cross the left hold short of the right alpha air one zero
0206:55	LC1	flipper approved inside
0206:55	LC2	southwest seven twenty five taxi into position and hold runway two four left
0206:58	SWA725	southwest seven twenty five position and hold two four left
(0207)		no pertinent transmissions
0217:04	Unknown	what the hell
0207:23	Unknown	helicopters
0207:23	LC2	southwest seven twenty five just remain off the runway at this time

0207:25	Unknown	helicopters
0207:28	SWA725	southwest seven twenty five remain off the runway
0207:30	PD80	helicopters p d eighty you need any help over there
0207:32	LC2	right now we dont know
0207:33	PD80	okay
0207:35	WWM5212	wing fifty two twelve ah we're on a visual two four right
0207:36	Unknown	we'd like to work just a at or below (unintelligible)
0207:39	LC2	wings fifty two twelve wind two four zero at eight cleared to land runway two four right ah use caution we just had an aircraft go off the runway in flame
0207:46	WWM5212	okay ah yeah we see that and ah we're cleared to land on two four right
(0208)		no pertinent transmissions
0208:02	PD80	helicopters police eighty
0208:09	LC2	and u s air twenty eight fifty eight turn left when able hold short of runway two four left till we find out what happened

0208:16	USA2858	roger understand do you want us to go down to the far end
0208:19	LC2	twenty eight fifty eight ah turn left at seventy five if you can no delay off the runway traffic on a mile final
0208:24	USA2858	kay will take the high speed and hold
0208:28	Unknown	you can take the wings west to the north if you want
0208:31	LC2	okay we just had a deal did she tell you want happened on final
0208:35	LC2	okay we just had a seven thirty seven land and blow up he went up in flame he's off the runway now two four left is closed
0208:41	Unknown	is the right still open
0208:42	LC2	yeah the rights still open
0208:44	Unknown	okay
0208:47	5NR	copter control helicopter five november romeo inbound from santa monica sepulveda arrival to the f a a
(0209)		no pertinent transmissions
0209:12	5NR	los angeles helicopters five november romeo

0209:15	LC2	calling los angeles helicopters say again
0209:17	5NR	yes ma'am november five november romeo approaching bolona creek four oh five sepulveda arrival to the f a a
0209:22	LC2	helicopter five nr report the old wang build or wang building wind altimeter three zero one one
0209:28	5NR	three zero one one five november romeo
0209:30	LC2	wings fifty two twelve use caution there i dont believe theres any debris on the right but i dont know what (unintelligible)
0209:35	N5212	okay we're using a lot of caution
0209:41	Unknown	what happened over there
(0210)		no pertinent transmissions
0210:09	5NR	helicopter control five november romeo is the ah wang building
0210:12	LC2	helicopter five nr cross the two fours and the two fives at or above one thousand feet landing at the f a a will be at your own risk wind two five zero at seven
0210:20	5NR	five november romeo roger

0210:26	WWM5212	and tower wings fifty two twelve ah you want us just to continue on down here a ways or ah (unintelligible)
0210:28	LC1	heavy ventura
0210:30	LC2	approved
0210:30	LC2	wings fifty two twelve turn left at seventy five i believe theres a u s air seven thirty seven bac jet holding there ill try and get you down the ah taxiway as soon as i can
0210:41	WWM5212	okay is that the next one here
0210:43	WWM5212	you want us to go way to the end then
0210:47	LC2	yes sir
0210:48	WWM5212	okay thats what we'll do
(0211)		no pertinent transmissions
0211:35	City Ops	tower city ops
0211:42	City Ops	tower city ops
0211:44	LC2	city ops tower
0211:45	City Ops	is two four left closed

0211:48	LC2	city ops affirmative
0211:56	LC1	heavy ventura rolling
(0212)		no pertinent transmissions
0212:13	LC2	city ops tower
0212:17	Ops 38	tower thirty eight go ahead
0212:18	LC2	ops thirty eight has anybody checked runway two four right for debris yet
0212:22	Ops 38	ah negative uh we're trying to get some injured people help
0212:28	LC2	okay thank you
0212:39	Unknown	hey did you guys lose one (unintelligible.

END OF TRANSCRIPT

APPENDIX J

NTSB CORRESPONDENCE WITH THE SECRETARY OF TRANSPORTATION IN REGARD TO DRUG AND ALCOHOL TESTING

National Transportation Safety Board
Washington, D.C. 20594
Safety Recommendation

Date: December 5, 1989
In reply to: I-89-4 through -12

Honorable Samuel K. Skinner
Secretary
U.S. Department of Transportation
400 Seventh Street, S.W.
Washington D.C. 20590

Investigations of transportation accidents conducted by the National Transportation Safety Board provide concern about the prevalence of drug and alcohol use and its effect on the safety of the traveling public. Substance abuse has been particularly evident in rail and highway accidents and, to a lesser extent, has also been evident in aviation and marine accidents. The Safety Board believes that the problems of drug and alcohol use in transportation should receive the highest level of attention by the U.S. Department of Transportation (DOT), specifically in regard to DOT's drug and alcohol testing regulations. The Safety Board commends the efforts by DOT to develop regulations to eliminate drug and alcohol use in transportation.

The Safety Board does, however, take exception to the inconsistent approach taken by the DOT in the formulation of those regulations that pertain to the drug and alcohol testing of persons involved in accidents or incidents. Substantial differences exist among the postaccident/incident sampling and testing requirements for the transportation modes and between the drug testing policies for DOT employees in safety sensitive positions and private sector employees. Furthermore, the testing requirements of many pertinent regulations are not sufficient to permit the Safety Board or the modal agencies to identify the extent to which drug and alcohol abuse contributes to transportation accidents.

Under the Federal Aviation Administration's (FAA) regulations for postaccident/incident testing of aviation personnel, Safety Board investigators may not be able to determine whether surviving air carrier crewmembers or FAA air traffic controllers caused or contributed to an accident because of drug or alcohol impairment. The DOT regulations for postaccident testing incorporate the guidelines developed by the Department of Health and Human Services (DHHS). The Safety Board has several concerns regarding the incorporation of these guidelines in postaccident/incident testing regulations. First, the guidelines specify the collection of urine only. Second, the guidelines specify the analysis for only five drugs or drug classes. These five drugs do not include alcohol, the substance of most frequent abuse, prescription medications, and other illicit drugs. Third, the presence of drugs or alcohol (if tests were required) cannot be related to a

level of performance impairment without the analysis on a blood sample; such a test is not required. Fourth, the drug level in the urine may be below the measurement threshold cutoffs specified in the DHHS guidelines due to the high thresholds in these guidelines and due to delays in collection of urine following an accident. Even though drugs may have been present at a level sufficient to cause performance impairment when an accident occurred, the level could decline below the high measurement threshold cutoff by the time of sampling; the presence of a drug and its contribution to an accident would thus go undetected. Finally, the DHHS guidelines were never intended to be used for forensic purposes--that is, to determine the causal relationship of drugs (or alcohol) to a transportation accident--yet the guidelines are being made to serve that purpose by their incorporation in postaccident/incident testing regulations.

In contrast to FAA requirements, the Federal Railroad Administration (FRA) requires the collection of both blood and urine as soon as practical after an accident involving railroad employees. The investigations of railroad accidents have shown the benefits of the FRA regulations. The extent of substance use and abuse includes illicit drugs, prescription medications, and alcohol, all of which can cause sufficient performance impairment to produce a serious or catastrophic accident. The Safety Board has advocated adoption of common rules similar to those used by the FRA in the Board's comments on notices of proposed rulemaking for drug testing regulations by various DOT agencies, even though the Safety Board considers the drugs identified in the FRA program as being minimal requirements. The Safety Board's comments were unheeded.

Investigation of the grounding of the EXXON VALDEZ in Prince William Sound on March 24, 1989, disclosed that the captain of the vessel had alcohol in his blood and urine some 10 hours after the grounding. However, because of the delay in obtaining specimens, there is an increased uncertainty regarding his condition at the time of the accident. In addition, a U.S. Coast Guard Vessel Traffic Service (VTS) employee (a DOT civilian in a safety sensitive position) on duty at the time of the grounding had gone off duty before being asked to provide blood and urine specimens for drug and alcohol testing. His blood and urine specimens were positive for alcohol, which he claimed was due to drinking after going off duty. The DOT determined that the VTS employee was not sampled and tested according to the DOT employee testing procedures, which call for urine testing only and do not provide for alcohol analysis. In addition, a Coast Guard employee collected the specimen, which was not in accordance with policy. The DOT employee testing policy calls for a contractor to collect the specimen; because the contractor could not get to Alaska within a reasonable time, a second urine sample of the VTS employee was obtained about 90 hours after the qualifying accident. The DOT policy establishes a guideline of 32 hours in which to collect a specimen from an employee after an accident or incident has occurred; this length of time is unreasonable. Certainly 90 hours far exceeds any reasonable time period for collection of specimens.

The manner in which DOT regulations do not address alcohol are of concern to the Safety Board. In addition to the regulatory confusion regarding whether or not alcohol determinations are to be made and in what body fluid, a number of the modal agencies (FAA, FHWA, FRA, and the Coast Guard) within DOT have set a threshold limit for blood alcohol (0.04 percent and above is prohibited) within the regulations even though a test for alcohol may or may not be required. Other agencies (UMTA, and Research and Special Programs Administration) have not defined a limit. The Safety Board addressed the concern of what blood alcohol content (BAC) constitutes impairment in Safety Recommendation A-84-45 in 1984 to the Federal Aviation Administration when the FAA first used the 0.04-percent BAC cutoff. The Safety Board classified this recommendation as "Closed--Unacceptable Action" on September 16, 1985, when the FAA established the 0.04-percent BAC as the impairment level.

On December 10, 1987, the Safety Board wrote to Secretary Burnley, encouraging him to reconsider the Department's position on the BAC definition of "under the influence" and to implement rules that would penalize any BAC greater than zero. On February 3, 1988, Assistant Secretary Matthew V. Scocozza responded to the Safety Board:

> I agree that we should reevaluate our position on what, if any, blood alcohol level is acceptable for those commercial operators within our purview.
>
> I have directed my staff to work with the modal administrations to develop a department wide definition of "under the influence." You may be assured that I place a high priority on this issue and we will move expeditiously.

The Safety Board has not heard further from the Secretary's office regarding this issue. On October 4, 1988, the Federal Highway Administration (FHWA) published its final rule on permissible blood alcohol levels for operators of commercial motor vehicles. Drivers having any positive alcohol concentration are subject to 24-hour out-of-service sanctions; however, 0.04 percent was again established as the level at or above which a person operating a commercial motor vehicle would be subject to commercial driver license disqualification. This level was established in spite of a National Academy of Science conclusion that at any BAC level above zero, the driving performance of most commercial drivers would be degraded sufficiently to increase the risk of a crash.

In addition to the FAA and FHWA, the FRA and the Coast Guard have previously adopted policies prohibiting the operation of vehicles at a BAC of 0.04 percent and above. Other agencies, such as the Research and Special Programs Administration and the Urban Mass Transportation Administration (UMTA), have no policy at all. Defining "under the influence" as having a BAC of 0.04 percent or greater leaves the impression among transportation workers and the public that drinking is allowable so long as the BAC tests below 0.04 percent. The Safety Board does not believe this is the message the DOT wishes to send. It should be absolutely clear that no alcohol is acceptable in commercial transportation because research has demonstrated that low blood alcohol levels can produce impairment.

The recent drug and alcohol regulations of the various DOT administrations treat Federal employees and employees in the private sector differently. According to Public Law 101-71 (101 Stat. 471, July 11, 1987), disclosure of toxicological results obtained on Federal employees pursuant to Executive Order 12564 (September 15, 1989) can be released only (1) to the employee's medical review official, (2) the administrator of any employee assistance program in which the employee is receiving counseling, or (3) to any supervisory or management official within the employee's agency having authority to take adverse personnel action against such employee, or (4) pursuant to the order of a court of competent jurisdiction where required by the United States Government to defend against any challenge against any adverse action. Release of test results to anyone else requires the written consent from the employee. Thus, during an accident investigation, information on drug abuse by a government employee in a safety sensitive position will not be made available to the investigators unless the employee gives written authorization. In contrast, drug and alcohol testing results from individuals in the private sector is released without written consent.

One of the most (if not the most) important objectives of postaccident drug and alcohol testing is to determine whether such substances caused or contributed to the cause of an accident. The use of the results of such testing by the Safety Board has led and will continue to lead to the development and implementation of recommendations and procedures to prevent accidents. If DOT employees in safety sensitive positions are free to withhold the results of postaccident toxicological test results from the Safety Board, crucial factual information pertaining to the accident will be kept secret, and the Safety Board's mandate to determine the facts, circumstances, and probable cause of the accident and to develop safety recommendations will be defeated. Therefore, DOT must eliminate the double standard between the disclosure of toxicological test results on private persons who have a direct responsibility for transportation safety and DOT employees who occupy safety sensitive positions.

At the present time, blood and urine specimens collected during investigation of rail accidents and incidents are under the control of the FRA. The FRA contracts with and pays for a private laboratory to carry out the drug analysis of blood and urine specimens. Similarly, the FAA has an interagency agreement with the Armed Forces Institute of Pathology (AFIP) for testing fatally injured crewmembers in aviation accidents. In selected cases, a surviving pilot or crewmember has been tested under this program. However, postaccident testing under new regulations for the modal agencies (except the FRA) places the responsibility for analysis of urine specimens for drugs with the employer. Furthermore, the reporting of toxicological testing (including postaccident testing) results to the appropriate DOT regulatory agency--such as the FAA, FHWA, and the Coast Guard--is done on a 6-month basis. Thus, a DOT agency may not know the results of postaccident testing until months after an accident investigation has been completed.

With the exception of railroad and perhaps marine employees, alcohol- and drug-impaired persons involved in accidents may not be identified as a result of the current modal regulations and DOT's Drug-Free Departmental Workplace Drug Testing Guide for DOT employees in safety sensitive positions. The drug and alcohol regulations for the various transportation modes are inconsistent, confusing, and, in some modes, inappropriate.

Therefore, the National Transportation Safety Board recommends that the U.S. Department of Transportation:

Develop postaccident and postincident testing regulations that are separate from the pre-employment, random, and reasonable suspicion testing regulations in all modal agencies. (Class II, Priority Action) (I-89-4)

Adopt uniform regulations for all drug and alcohol testing, other than postaccident and postincident testing, in all transportation modes, including U.S. Department of Transportation employees who are in safety sensitive positions. (Class II, Priority Action) (I-89-5)

Adopt uniform regulations on postaccident and postincident testing of private sector employees for alcohol and drugs in all transportation modes. Use the Federal Railroad Administration's (FRA) current regulation as a model regulation for all transportation modes except for the permissible blood alcohol level of less that 0.04 percent. Using the FRA regulation as a model for other transportation modes refers only to the collection of blood and urine and the screening and confirmation of positives in blood. As a minimum, the drugs identified in FRA screen should be used in the other modes. Reference to the FRA model does not refer to the administration or implementation of the regulation. The Safety Board recognizes that the implementation of the regulation may be different in the various transportation modes. The regulations for all modes should provide:

- for the collection of blood and urine within 4 hours following a qualifying incident or accident. When collection within 4 hours is not accomplished, blood and urine specimens should be collected as soon as possible and an explanation for such delay shall be submitted in writing to the administrator. (Class II, Priority Action) (I-89-6);

- testing requirements that include alcohol and drugs beyond the five drugs or classes specified in the Department of Health and Human Services (DHHS) guidelines and that are not limited to the cutoff thresholds specified in the DHHS guidelines. Provisions should be made to test for illicit and licit drugs as information becomes available during an accident investigation (Class II, Priority Action) (I-89-7).

Adopt uniform regulations in postaccident and postincident testing of U.S. Department of Transportation employees in safety sensitive positions. The regulations should provide:

- for the collection of blood and urine within 4 hours following a qualifying incident or accident. When collection within 4 hours is not accomplished, blood and urine should be collected as soon as possible and an explanation for such delay shall be submitted in writing to the administrator by the local official making the decision to test. (Class II, Priority Action) (I-89-8);

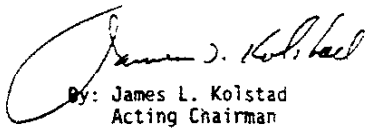
- testing requirements that include alcohol and drugs beyond the five drugs or classes specified in the Department of Health and Human Services (DHHS) guidelines and that are not limited to the cutoff thresholds specified in the DHHS guidelines. Provisions should be made to test for illicit and licit drugs as information becomes available during an accident investigation (Class II, Priority Action) I-89-9);

- that toxicological results from Federal employees be made available to investigators of the National Transportation Safety Board (Class II, Priority Action) (I-89-10);

- procedures by which Federal employees are sent to the nearest hospital or medical facility for obtaining blood and urine specimens for toxicological testing following a qualifying incident or accident (Class II, Priority Action) (I-89-11);

Issue rules specifying zero (no alcohol) as the blood alcohol concentration for private sector employees in safety sensitive positions in all transportation modes and for Federal employees in safety sensitive positions. (Class II, Priority Action) (I-89-12)

KOLSTAD, Acting Chairman, BURNETT, LAUBER, NALL, and DICKINSON, Members, concurred in these recommendations.



By: James L. Kolstad
Acting Chairman

THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

August 3, 1990

The Honorable James L. Kolstad
Chairman
National Transportation
Safety Board
Washington, D.C. 20594

Dear Mr. Chairman:

I am responding to your letter that transmitted nine National Transportation Safety Board (NTSB) recommendations (I-89-004 through 012) concerning the Department's drug and alcohol regulations, particularly with respect to post-accident testing. I share your concern about the problem of alcohol and drug use in the transportation industry. That concern prompted the comprehensive drug regulations that are now in effect, as well as the pending rulemaking concerning alcohol abuse, and drives my continued personal involvement in these issues.

Your recommendations, and the issues they raise, are discussed in greater detail in the enclosure to this letter. The primary purpose of the Department's program is to prevent such abuse by deterring improper conduct by employees performing sensitive safety and security-related functions. While we recognize that results of Department of Transportation (DOT) mandated testing may have relevance to accident investigations in some situations, the DOT program is not primarily intended as an accident investigation tool.

The overall thrust of your recommendations appears to be to ask the Department to create an additional program -- distinct in scope, purpose, methods, and procedures from the Department's existing drug and alcohol abuse prevention program -- to determine the role of substance abuse in the causation of transportation accidents. We do, however, understand your concern and are willing to discuss the need for such an additional program with the NTSB, as well as the implications in terms of resources, costs, benefits and the respective transportation safety roles of the Department and the NTSB. Terrance Gainer, my Special Assistant for Drug Enforcement and Program Compliance, will be in contact with you to initiate discussions on this subject.

I look forward to working with you in assuring that we have the safest possible transportation system.

Sincerely,

Samuel K. Skinner

Samuel K. Skinner

Enclosure

Enclosure to DOT letter dated August 3, 1990

RESPONSE TO NTSB DRUG AND ALCOHOL TESTING RECOMMENDATIONS

NTSB recommendations I-89-4 -- I-89-12 touch a number of major issues involved in the Department's programs regarding substance abuse. This enclosure addresses the relationship of the recommendations to these issues.

General:

At the outset, we want to correct an apparent misunderstanding about the drug testing rules issued by the Department in November 1988. While the Department recognizes that post-accident drug tests may be useful, in some situations, as part of the overall process of determining the causation of transportation accidents, the Department's drug testing rules, including their post-accident components, were not primarily intended for accident/incident investigation purposes. The primary purpose of the rules is deterrence and, if transportation employees persist in the use of drugs, the removal of such people from sensitive safety or security-related positions. Accidents were intended as a triggering event for testing for these purposes.

We would also point out that the Department did not deem the drug testing rulemakings an appropriate vehicle for responding to concerns about alcohol. Approximately one month prior to your letter, we did publish an advance notice of proposed rulemaking (ANPRM) on this subject, raising many of the issues in your letter. We will use this rulemaking proceeding as a vehicle for responding to alcohol-related concerns, including those raised by the NTSB.

It is also important to keep in mind that, while there are obvious similarities, the DOT drug testing programs for DOT employees and industry, respectively, have different bases. The Department's role in each is significantly different. As an employer, the Department has a different perspective and more control over certain aspects of its program than when it acts as a regulator of industry safety. It is necessary to guard against any tendency to treat the two programs as interchangeable.

Drug Testing and Cause:

One of your major concerns with the testing methodology adopted by DOT is that it prevents investigators from determining whether the drugs 'caused or contributed' to an accident and from determining the 'level of performance impairment.' You also note that the DHHS Guidelines on which our procedures were based were not intended for forensic purposes. The Board's statements on this point appear to assert only the obvious: that a testing program designed for one purpose may not fully serve a second, quite different, purpose.

It is generally agreed that, at any level, drugs can adversely affect performance (whether the person may be said to be "impaired" or not, in a legal sense analogous to alcohol impairment at a given BAC level*) and can have an adverse effect on performance after they can no longer be readily measured by testing of urine or blood. Therefore, since the drugs for which we are requiring testing are illegal, we have simply decided that detecting the presence of these drugs above a specified level serves an important purpose, in the context of our preventive program, in promoting transportation safety.

We agree that there may be some accident investigation situations in which post-accident toxicological workups of blood samples may provide useful information in the larger context of determining accident causation.** There may be, for example, concentrations of a given drug which are sufficiently high as to involve a substantial likelihood of impairing effects. This information, of course, would need to be viewed alongside documented performance failures, the appearance or demeanor of the employee, and other factors to form a reasonable basis for a determination of the cause of an accident.

The point is that a program focusing on accident causation and using a full forensic, toxicological workup of the fluids of employees involved in accidents is a very different program, with a different purpose, from what the Department has established. The Department would need to consider carefully whether it makes sense, in light of all relevant factors, to establish such a new, additional program. Such a program would raise issues that go far beyond the existing DOT preventive program (e.g., the overall role of the Department in investigating and determining the causes of particular transportation accidents, since substance abuse factors could not be viewed in isolation from other potentially causative factors). Other alternatives may need to be considered (e.g., authority for the NTSB to conduct its own toxicological tests as part of accident investigations). The Department is willing to

---

* - We would caution against any attempt to establish a body fluid concentration level, analogous to a BAC level for alcohol, at which impairment by a drug can be presumed to exist. Most experts do not believe it would be meaningful to do so, given the great number of chemical and individual human factors involved in responses to drugs. In any event, setting such a level would probably aid in establishing causation in only a small fraction of cases, at best.

** - At the same time, we should recognize that toxicological workups of blood samples are not a panacea. Given that finding evidence of a drug in a blood sample generally indicates only the recent use of a drug, such a workup may not yield probative information for establishing accident causation beyond what would be obtained through urine testing, and perhaps less in some cases.

explore various alternatives with the NTSB in the discussions that Mr. Gainer will offer to initiate.

Alcohol:

The Department has long recognized that alcohol abuse poses a serious problem to transportation; indeed, several of the Department's modal administrations already have in place strict regulations and programs that address the use and abuse of alcohol by transportation workers.

The Department did not include alcohol among the substances to be tested in its drug testing rules, because, for numerous reasons, it became clear that the alcohol problem raises complicated issues that may require a different approach from other drugs, such as cocaine or marijuana.

For example, alcohol is a legal substance (for persons over 21), with legally and socially acceptable uses, not a controlled substance. Unlike illegal drugs, for which we target any use by employees, alcohol use or impairment, to be legally relevant, must occur in the context of job performance. We note that even your letter is not clear on this issue. You state that "no alcohol is acceptable in commercial transportation." You also note that a BAC level of 0.04 "leaves the impression ... that drinking is allowable so long as the BAC tests below 0.04 percent." In fact, some DOT rules prohibit drinking alcohol a certain number of hours before going on duty. In the case of FHWA's commercial vehicle driver rules, a driver who shows any detectable level of BAC will be taken out of service for 24 hours. It is also far from clear why DOT insistence on a 0.00 BAC level, without concommitant prohibitions of other activities that may cause demonstrable psychomotor deficits that are substantially similar to those that may be observed at BAC levels below 0.04 (e.g., minor illnesses, stress in family relationships), would result in significant safety benefits.

There are also complex questions such as what use of alcohol to prohibit and, if a testing requirement is promulgated, what types of testing and what timing of that testing would be appropriate and would best identify alcohol users. Preemployment testing for alcohol, for example, may not have any relevance since any detected use would not be on the job.

Methodological questions also exist. The preferred methods for alcohol testing, and related requirements and costs, are sufficiently different from drug testing to warrant separate treatment. For example, medical personnel are needed to take a blood sample for alcohol testing, but trained, non-medical personnel are sufficient to obtain a urine sample for drug testing. Urine testing to determine the presence of alcohol is more complex and uncertain, requiring the willingness and ability of the donor to provide two appropriately timed samples.

Alcohol abuse may warrant different action than drug use, according to some experts. Alcohol abusers may be more likely to respond to education efforts than drug users, who, simply by unauthorized use of a controlled substance, have crossed over the line into illegal activity.

Consequently, we chose to address alcohol as a separate problem. In June 1989, in testimony before the Senate Committee on Commerce, Science and Technology, Secretary Skinner committed the Department to further review the alcohol problem. On November 2, 1989, the Department issued an advance notice of proposed rulemaking (ANPRM) to seek public comment on the scope of the alcohol problem in the transportation industry, whether its existing rules are sufficient to respond to the problem, and the feasibility and scope of several possible options, if further action is deemed necessary.

The ANPRM sought comment on a variety of issues related to alcohol abuse, including whether testing should be required, what kinds of tests would be appropriate, what testing methodologies should be used, and what BAC level should be used as a criterion for intoxication. The issues on which the ANPRM sought comment encompass the points made in your recommendations concerning alcohol testing. Your letter has been placed in the ANPRM docket, and your recommendations will be fully considered as the Department determines the appropriate next action.

BAC level:

As you know, several DOT agencies have conducted rulemaking proceedings on the issue of what BAC level should be established as a criterion for intoxication. As a result of these rulemakings, all have established 0.04 BAC as their positive threshold for commercial transportation industry personnel. (In addition, some agencies, like the FAA and FHWA, also require that personnel not consume alcohol a certain number of hours before going on duty.)

As your letter mentioned, a National Academy of Sciences (NAS) study, commissioned by the Federal Highway Administration during its BAC rulemaking proceeding and referred to in your letter, concluded that, at any BAC level above zero, most commercial drivers would experience a degradation in skill that would increase the risk of crash involvement. However, a three-fourths majority of the NAS panel members recommended that penalties (e.g., driver disqualification) be required only for violations of 0.04 BAC or higher.

As noted above, this issue has been raised again in the Department's alcohol rulemaking proceeding. We will reconsider whether to propose changing the 0.04 level in response to comments on the ANPRM.

Additional Drugs:

We have deferred to the expertise of DHHS on testing protocols and procedures. Their Guidelines are intended to safeguard the accuracy and integrity of test results and the individual's privacy. These Guidelines reflect the current state of the art in drug testing. In directing DHHS to develop such Guidelines, Congress specifically directed the agency to "establish comprehensive standards for all aspects of laboratory drug testing and laboratory procedures...including standards which require the use of the best available technology for ensuring the full reliability and accuracy of drug tests...." Pub. L. 100-71, §503(a)(1)(A)(ii)(I)(101 Stat. 391, 769).

DHHS-approved testing protocols and positive thresholds for drugs beyond the five for which testing is now required do not exist. Also, DHHS certification of laboratories does not extend to testing of any additional drugs. We do not have the uniform standards for additional drugs crucial to the accuracy and integrity of the testing process, which courts have relied upon in upholding Federally-required drug testing. This absence of uniform standards could make defense of the DOT regulations in court more difficult. Testing for additional drugs may increase the privacy intrusion of testing, and could in some situations raise additional fourth amendment issues, making it more difficult to persuade the courts to approve DOT-required testing. It should also be noted that the five drugs for which we require testing are the most used drugs and the costs of testing increase with each additional drug added to the list.

The Medical Review Officer's task in determining whether drug use indicated by the test is legitimate would be significantly more difficult in dealing with legal prescription drugs. Privacy concerns also exist. The use of DOT-mandated tests to discover the presence of legal prescription drugs, and therefore permit employer inferences about otherwise confidential medical conditions, could not easily be prevented.

However, the Department is aware that the concerns of those who want to test employees for other drugs that may impair safety are legitimate, whether in the context of post-accident testing or otherwise. The Department is considering additional rulemaking to explore how to respond to these concerns, including the identification of appropriate additional drugs for which testing is warranted and the establishment of appropriate testing protocols for those drugs.

We intend to continue working with DHHS to resolve this issue. The issue of testing for additional drugs was considered at the DHHS "Consensus Conference" held November 29-December 1, 1989, as reflected in the report of that conference. The Department will work closely with DHHS as DHHS responds to conference recommendations, some of which are likely to address means of testing for additional drugs while still preserving the integrity/accuracy safeguards of the DHHS procedures.

If it were decided to create a new, additional post-accident toxicology program, the Department could consider, as part of rulemaking to establish the program, whether differences between this program and the existing preventive program warranted taking a different approach with respect to the drugs for which testing was done. Hopefully, DHHS would be of assistance in such an effort.

Cutoff Levels:

The cutoff levels used both in the Department's internal drug testing program and in our regulations for private industry were established by DHHS, based on their expertise concerning the testing process. These cutoffs were designed by DHHS to achieve a reasonable balance between the objectives of treating as positive significant amounts of drug metabolites in an employee's system while treating as negative smaller quantities of metabolites that could result from such sources as passive inhalation, cross-reactivity, or ingestion of food products.

Like the issue of additional drugs, the issue of cutoff levels was discussed extensively at the DHHS Consensus Conference. There appeared to be considerable sentiment at the conference for tightening cutoff levels, at least for some drugs (e.g., marijuana), which is reflected in the report of the conference. If, following further DHHS consideration of recommendations from the conference, DHHS determines that changes are warranted, the Department will revisit the issue of cutoff levels. It is our intent that DOT regulations remain consistent with the DHHS drug testing guidelines on this issue.

Cutoff levels are needed to help establish when, as part of a preventive drug testing program, the consequences assigned to a positive test should follow. A testing program intended simply to help establish accident causation, not bearing these consequences, arguably may not need cutoff levels. It could be possible, if it were decided to create a new, additional post-accident toxicological testing program to determine accident causation, for DOT, through rulemaking, to permit information to be transmitted to the accident investigation process concerning the levels of drugs present in fluid samples, regardless of "cutoff levels." DOT could also consider the gathering of other data concerning drug use as part of such a process.

Timing of Collection:

The Department is well aware that extended delays in sample collection and testing after an accident may result in deterioration or elimination of a drug or drug metabolite from a person's system. As your letter suggests, taking post-accident samples within four hours or less is highly desirable. The Department's regulations support collecting such samples as soon as possible.

There is substantial doubt, however, whether a regulatory requirement to collect post-accident samples within four hours would be

meaningful. This particularly is a problem at remote accident sites; it may be very difficult, as a practical matter, to effect a collection even within the 32-hour time limit set forth in DOT rules. Often there are no medical facilities available, which is a particular problem if blood as well as urine is to be taken. Our own experience in our internal testing program has made it clear to us that requirements to test no later than four hours after an accident could prove extremely costly, and may be impossible in some circumstances.

We would also point out that the recommended four-hour collection limit is premised on the time-sensitive nature of toxicological testing of blood samples. Urinalysis testing does not involve the analogous time-critical considerations associated with collection and testing of blood samples. We believe that the time frame for post-accident urinalysis testing is generally sufficient to indicate whether an individual has used drugs within a range of time in the past, and that this time frame is appropriate to the purpose of using accidents as triggering a test which has an important deterrent value.

Requiring a written report to a modal administrator if a post-accident test does not happen within a certain period of time is an information collection requirement of dubious worth. It is not clear from your recommendation what use the administrator would make of this information or what safety benefit would be gained by the writer or receiver of the report. As part of normal record inspections or as a result of reviews of reports, the modal administrations can determine whether there are violations of the "test as soon as possible" requirement and, if appropriate, take enforcement action.

Sending Federal employees to a hospital or other facility as a collection site could be considered by the Department, should at some future time the Department decide to institute blood testing for these employees. Urinalysis can proceed in collection sites that are not medical facilities, of course.

Regulatory Approaches:

The advantage to be gained from combining regulations requiring drug testing in private industry and DOT procedures and orders requiring drug testing for DOT employees is not apparent. They are based on different legal authorities and apply in very different organizational contexts. It is very likely that rulemaking action to combine these requirements would be far more trouble than it is worth.

As you know, there is substantial uniformity among the modal drug testing regulations. This uniformity pertains to the key building blocks of the rules, such as the use of DHHS-approved laboratories, use of 49 CFR Part 40 testing procedures, types of testing, and consequences of test results. As the Department developed these regulations, it was a clear Departmental policy to

ensure the maximum practicable degree of DOT-wide consistency. Where the rules differ, it was because the Department concluded that differences among the operating administrations, or the industries they regulate, required those differences. Further regulatory revision for the sake of uniformity would not be productive.

It is also unclear why separating post-accident testing regulations from other drug testing requirements would be useful in achieving the objectives of the Department's drug testing program. Obviously, the Department can consider the Board's recommendations for post-accident testing without undertaking a rulemaking simply to reorganize existing post-accident testing provisions into separate parts of the Code of Federal Regulations.

As you are aware, the FRA rule and the DOT employee drug testing program were already in existence when the Department formulated its remaining drug testing rules. A number of differences between the FRA rule and other DOT rules simply result from the Department's decision to let the FRA's existing rule stand. This decision did not represent a policy decision to cast all other DOT rules in the FRA mold; indeed, the Department decided to the contrary.

As your letter notes, the Board commented on a number of regulatory issues touched on in the current series of recommendations in its comments to the Department's rulemakings on drug testing. These comments were fully considered, as were those of other interested persons. While the Department, as noted above, will work with DHHS to consider revisions to some portions of its testing procedures as the results of the Consensus Conference become available, we believe that we have already adequately responded to your comments during our rulemaking. When factors are raised that we did not consider or when experience illustrates a problem, we will consider appropriate changes.

Blood Testing:

Because the primary purposes of the rule are deterrence and identification of drug users, the Department has determined urine testing to be an appropriate approach for DOT's program to prevent drug abuse. For our purposes, it provides fully reliable testing in a much less expensive and perhaps less intrusive manner than does blood testing. Legal authority to require blood testing of Federal employees in a non-medical context is unclear.

Provision of Toxicological Results for DOT Employees:

As your letter points out, section 503(e) of Public Law 101-71 (101 Stat. 391, 471, July 11, 1987) authorizes disclosure of Federal employees' test results obtained pursuant to Executive Order 12564 (September 15, 1986) only 1) to the employee's medical review official; 2) to the administrator of any employee assistance program in which the employee is receiving counseling;

3) to any supervisory or management official within the employee's agency having authority to take adverse personnel action against such employee; or 4) pursuant to the order of a court of competent jurisdiction where required by the U.S. Government to defend against any challenge against any adverse action. As a result, if the employee does not consent, accident investigators, including the NTSB's, would not have access to the drug testing results.

While we are sympathetic to the NTSB's interest in obtaining drug test results involving DOT employees involved in accidents, the limitation on our providing them to you results, as you acknowledge, from a statutory requirement. Since, as you know, a regulation cannot amend or contradict a statute, we are not in a legal position to implement your recommendation that test results for Federal employees be made available to NTSB investigators, unless the employee consents. We understand that the NTSB is seeking legislative authority from Congress to obtain post-accident drug test results of Federal employees. A bill to this effect has been introduced in this session of Congress.

MAY 31 1990

Honorable Samuel K. Skinner
Secretary
U.S. Department of Transportation
400 Seventh Street, S.W.
Washington, D.C. 20590

Dear Mr. Skinner:

Thank you for the Department of Transportation's (DOT) response to Safety Recommendations I-89-4 through -12. The National Transportation Safety Board appreciates and supports your commitment to improve transportation safety by deterring drug and alcohol use in the transportation industry. The Safety Board had been encouraged by your desire to continue discussions with us on the need to develop a more comprehensive drug testing program for postaccident, postincident, and reasonable cause that meets the needs of both agencies. Safety Board staff had met with your previous special assistant, Terrance Gainer, to discuss progress toward this goal. However, based on the responses set forth in your letter of August 3, 1990, and on our concern that there does not appear to have been any real progress on the development of the more comprehensive postaccident drug testing program requested by Safety Recommendations I-89-4 through -9, -11, and -12, these recommendations have been classified as "Open--Unacceptable Response."

As you are aware, the intent of Safety Recommendation I-89-10 has been achieved as a result of recent legislation. Although the Safety Board had urged the DOT to take a regulatory approach to this issue, the intent of the recommendation has now been met by action of Congress, and it has been classified as "Closed--No Longer Applicable."

The Safety Board encourages you to act expeditiously on the unresolved issues raised in the Board's recommendations.

Sincerely,

James L. Kolstad
Chairman