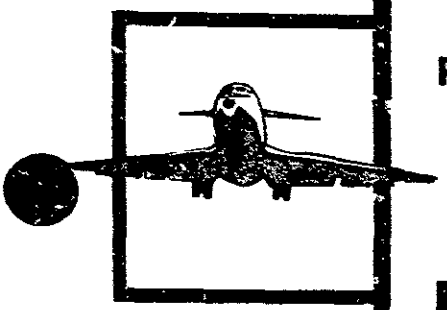

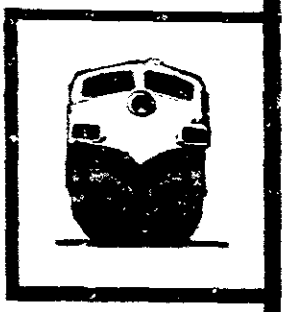

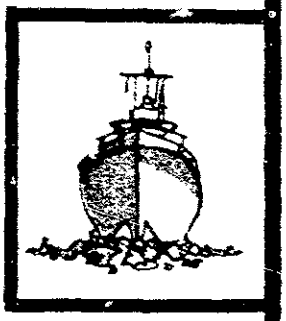

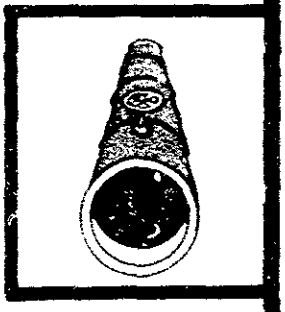

PB87-910407

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

PIPER PA-23-150, N2185P
AND PAN AMERICAN WORLD AIRWAYS
BOEING 727-235, N4743
TAMPA, FLORIDA
NOVEMBER 6, 1986

NTSB/AAR-87/06

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

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15. Supplementary Notes

16. Abstract

On November 6, 1986, a Piper PA-23 Apache, N2185P, was cleared for an instrument landing system approach to runway 36L at Tampa International Airport, Florida. The pilot was unable to land during his first approach. On the second approach, the Apache touched down on taxiway W, parallel to and about 406 feet to the right (east) of runway 36L. At the same time, a Pan American Boeing B-727 was proceeding southbound on taxiway W. When the captain of the B-727 saw the Apache emerge from the fog directly ahead of him, he turned to the right in an attempt to avoid the impending collision. About 2 seconds later, the Apache's left engine struck the B-727 in the radome. Two passengers and a flight attendant were injured after they evacuated the airplane. The Apache was almost destroyed and the pilot, the sole occupant of the airplane, was killed. The safety issues discussed in this report include the pilot's decision to continue his approach below decision height when the visibility was below landing minimums and the adequacy of current Federal regulations that allow pilots operating under Part 91 to conduct approaches when the reported visibility is below the published minimum visibility for landing.

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The National Transportation Safety Board determines that the probable cause of this accident was the decision of the pilot of the Apache airplane to continue a precision instrument approach below the published decision height when the required visual references were not distinctly visible and identifiable. Contributing to the accident was the pilot's failure to obtain a predeparture weather briefing before choosing a means to travel to his destination.

CONTENTS

EXECUTIVE SUMMARY

On November 6, 1986, a Piper PA-23 Apache, N2185P, was cleared for an instrument landing system approach to runway 36L at Tampa International Airport, Florida. The pilot was unable to land during his first approach. On the second approach, the Apache touched down on taxiway W, parallel to and about 406 feet to the right (east) of runway 36L. At the same time, a Pan American Boeing B-727 was proceeding southbound on taxiway W. When the captain of the B-727 saw the Apache emerge from the fog directly ahead of him, he turned to the right in an attempt to avoid the impending collision. About 2 seconds later, the Apache's left engine struck the B-727 in the radome. Two passengers and a flight attendant were injured after they evacuated the airplane. The Apache was almost destroyed and the pilot, the sole occupant of the airplane, was killed.

The safety issues discussed in this report include the pilot's decision to continue his approach below decision height when the visibility was below landing minimums and the adequacy of current Federal regulations that allow pilots operating under Part 91 to conduct approaches when the reported visibility is below the published minimum visibility for landing.

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As a result of its investigation, the Safety Board issued two safety recommendations to the Federal Aviation Administration (FAA). One recommends that 14 CFR Part 91 be amended to prohibit a pilot from executing an instrument approach to a runway equipped with a runway visual range system that is indicating a visibility below the published landing minimum visibility. The second recommends that principal maintenance inspectors verify that any modified escape slide containers open freely and without resistance or interference.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

Adopted: June 25, 1987

PIPER PA-23-150, N2185P AND PAN AMERICAN WORLD AIRWAYS BOEING 727-235, N4743 TAMPA, FLORIDA NOVEMBER 6, 1986

1. FACTUAL INFORMATION

1.1 History of Flight

At 2101 1/ on November 5, the pilot of N2185P, a Piper PA-23-150 Apache airplane, telephoned the Federal Aviation Administration (FAA) Flight Service Station (FSS) at Fort Myers, Florida, and filed an instrument flight rules (IFR) 2/ flight plan from Pine Shadows Airpark, near Fort Myers, to Tampa, Florida, with a proposed departure time of 0600 the next morning. He did not file an alternate airport. He estimated his en route time as 40 minutes for an air distance of 85 statute miles, and he requested a weather briefing. The following terminal forecast for Tampa International Airport was given to the pilot:

> Clouds 2,500 feet scattered. After 2300: clouds 500 feet scattered, visibility--3 miles in fog; occasionally ceiling--300 feet broken; visibility--1/2 mile in fog. After 0900: clouds 1,000 feet scattered, visibility--5 miles in haze. After 1100: VFR.

The forecast was revised later that night and again early the next morning. The second amendment, issued at 0420 and valid from 0500 to 0900, was:

> Ceiling 100 feet obscured; visibility--1/8 mile in fog; occasionally partial obscuration ceiling 300 feet broken; visibility--1 1/2 miles in fog.

According to his wife, the pilot retired to bed about 2130, he arose about 0500, and he departed the runway near their home in VFR conditions at 0612 on November 6. There was no evidence that he called the FSS for a predeparture weather briefing before departing Pine Shadows on the morning of the accident. The pilot contacted the Fort Myers FSS at 0613, and was given the current Tampa weather:

> Indefinite ceiling 0 feet obscured; visibility—1/16 mile in fog; temperature—71° F; wind—080° at 3 knots; altimeter—30.06 inHg. Runway 36L visual range 1,000 feet variable 1,600 feet.

1/ All times in this report are eastern standard, based on the 24-hour clock.
2/ Rules governing the procedures for conducting instrument flight.

At 0614, the pilot contacted the Miami Air Route Traffic Control Center (ARTCC) to request an IFR clearance to Tampa, and at 0621, the center issued the clearance. No alternate airport was filed. At 0628:51, while in contact with the Sarasota sector of Tampa Approach Control, the pilot of the Apache confirmed that he had received the following information from the automatic terminal information service (ATIS) 3/:

> This is Tampa International information Papa, the one zero five one record observation, indefinite ceiling zero, sky obscured, visibility one sixteenth of a mile with fog, temperature and dew point seven one, wind zero eight zero at three, altimeter three zero zero six, the runway three six left visual range is one thousand variable to sixteen hundred, arriving traffic expect ILS 4/ runway three six left approach, advise you have information Papa.

At 0633:55, N2185P changed over to the Gibbs sector of Tampa Approach Control. The approach controller told him to expect an ILS approach to runway 36L. (See figure 1.)

Two other airplanes, a DC-9 and a Cessna 172, were attempting to land at Tampa at that time. The first, Airborne Express (ABEX) flight 110, was certified to conduct ILS approaches to Category II 5/ minimums; a runway visual range (RVR) 6/ of 1,200 feet was required to begin the approach. At the time ABEX 110 was cleared for approach, the RVR was 1,400 feet. The pilot of ABEX 110 stated that when he reached 150 feet, about four rows of approach lights were visible, and that at the decision height (DH) 7/ of 100 feet above the runway he could not see any of the approach lights or runway edge or centerline lights. The pilot executed a missed approach at 0637 and proceeded to his alternate airport, Sarasota Bradenton Airport.

The Cessna, N6613D, followed ABEX 110 and was given an RVR of 1,200 feet. The Cessna pilot stated that about 300 feet above the runway he saw three strobe flashers directly below his airplane, and that at his Category I DH of 200 feet above the runway he was in "solid" instrument meteorological conditions and therefore executed a missed approach at 0640:29. He then proceeded to his alternate airport, St. Petersburg Clearwater Airport.

At 0640:57, the pilot of the Apache contacted Tampa tower from SNORK intersection on the ILS localizer, 7.7 miles from the end of runway 36L. The local controller at Tampa Tower cleared the pilot to continue his approach. At 0641:55, the

3/ The continuous broadcast of recorded noncontrol information in selected terminal areas.

4/ A precision instrument approach system which normally consists of a localizer, a glideslope, an outer marker, a middle marker, and an approach light system.

5/ An ILS approach procedure which provides for approach to a height above touchdown of not less than 100 feet and with runway visual range of not less than 1,200 feet.

6/ An instrumentally derived value, based on standard calibrations, that represents the horizontal distance a pilot will see down the runway from the approach end. RVR, in contrast to prevailing or runway visibility, is based on what a pilot in a moving airplane should see looking down the runway. RVR is horizontal visual range, not slant visual range.

7/ The height at which a decision must be made to either continue an approach or execute a missed approach.

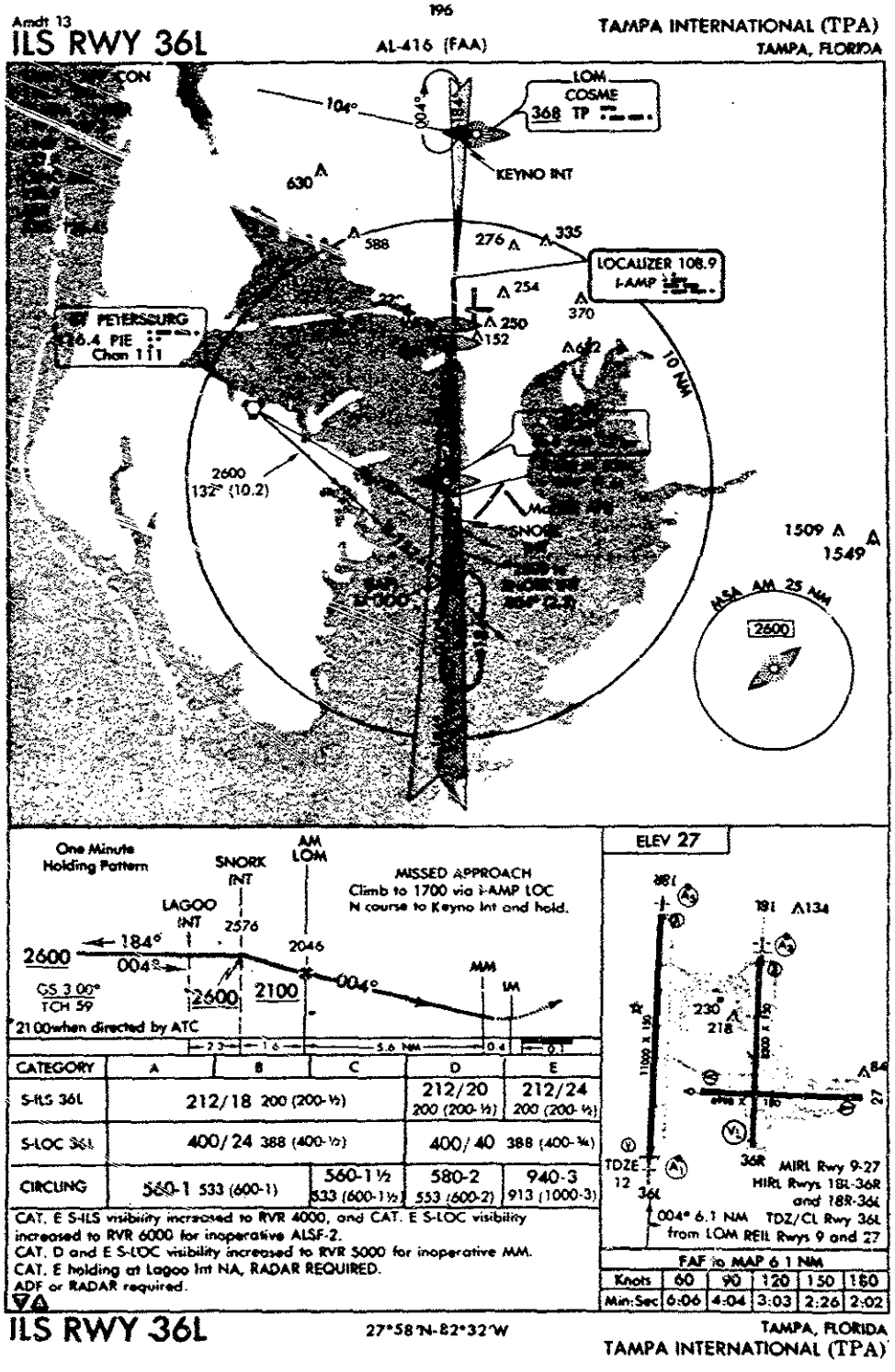

Figure 1.--ILS approach to runway 36L.

controller reported the RVR to be 600 feet at touchdown, 800 feet at the runway midpoint, and 800 feet at the rollout end. At 0645:05, the controller called the Apache and reported that the RVR at touchdown was 600 feet and that midpoint and rollout were 800 feet. The pilot acknowledged the transmission.

The Piper Apache is classified as approach category A. The minimum visibility for the ILS runway 36L approach at Tampa for category A aircraft is 1800 RVR.

Meanwhile, the local controller was relieved by another controller. Neither controller issued the Apache a clearance to land. The first controller issued a clearance to "continue the approach"; he told Safety Board investigators that he planned to issue the clearance to land when the airplane was closer to the runway. The second controller said that he habitually issued the landing clearance at the point in the approach where the first controller had issued the clearance to continue and that he assumed the airplane had been cleared to land. The pilot continued his approach without requesting landing clearance. At 0647:47, he told the local controller that he was executing a missed approach; the controller cleared him to contact departure control. When departure control asked his intentions, the pilot said "[I'd] like to go back and try it again."

When N2185P was southbound on his downwind leg, Tampa Approach reported that the RVR was 800 feet, the midpoint was 3,000 feet, and the rollout was 800 feet. The pilot said, "That three thousand sounds better I hope," and the approach controller replied "Yes it does." TranStar 548, a DC-9, had departed from runway 36L at 0651, 2 minutes before the reported improvement in the midpoint RVR. The approach controller told Safety Board investigators that the increase in the midfield RVR was "probably due to TranStar 548 departing," but that he did not convey this belief to N2185P.

At 0658:11, when he cleared N2185P for a second ILS approach, the controller reported that the touchdown RVR was 600 feet, 1,000 feet at the midpoint, and 800 feet at the rollout end of the runway. At 0703:13, when N2185P was 2.2 miles from the end of the runway, Tampa Tower reported the touchdown RVR as 600 feet, the midpoint as 800 feet, and the rollout RVR as 800 feet. The pilot of N2185P acknowledged this transmission. This was the last recorded transmission from N2185P.

Meanwhile, N4743, Pan American flight 301, a Boeing 727 with 17 passengers and a crew of 6, had been cleared by the Tampa ground controller to taxi to runway 36L via taxiway W at 0701:15. (See figure 2.) (Pan American's Operations Specifications required an RVR of 600 feet for takeoff.) The B-727's rotating beacon and navigation lights were on, and the landing lights were off. The airplane was not equipped with strobe lights. Due to the fog, the taxi speed was slower than normal. When the airplane was southbound on taxiway W, the captain noted "pockets" in the fog where the runway edge lights and centerline lights were visible. (The distance between the centerlines of the runway and taxiway is 406.25 feet, and the distance between the taxiway centerline and the far side runway lights is about 500 feet.) As he was passing taxiway W-2, the B-727 captain looked up and saw the Apache coming out of the fog on a head-on collision course. The captain said that the approaching airplane did not appear to have touched down yet, but that it looked like it was in a "flaring" attitude; that is, its nose had been raised slightly in anticipation of touchdown. The captain immediately turned his airplane to the right. The first officer said that the Apache pitched up and banked slightly to the left and may have been attempting a go-around. Tire marks on the taxiway indicated that the Apache touched down near the centerline and about 200 feet from the B-727.

About 2 seconds later, the left engine of the Apache struck the B-727 in the lower nose area, separated from the Apache, and remained embedded just behind the radome. Fuel from the Apache's ruptured tanks ignited as it passed under the wing of the

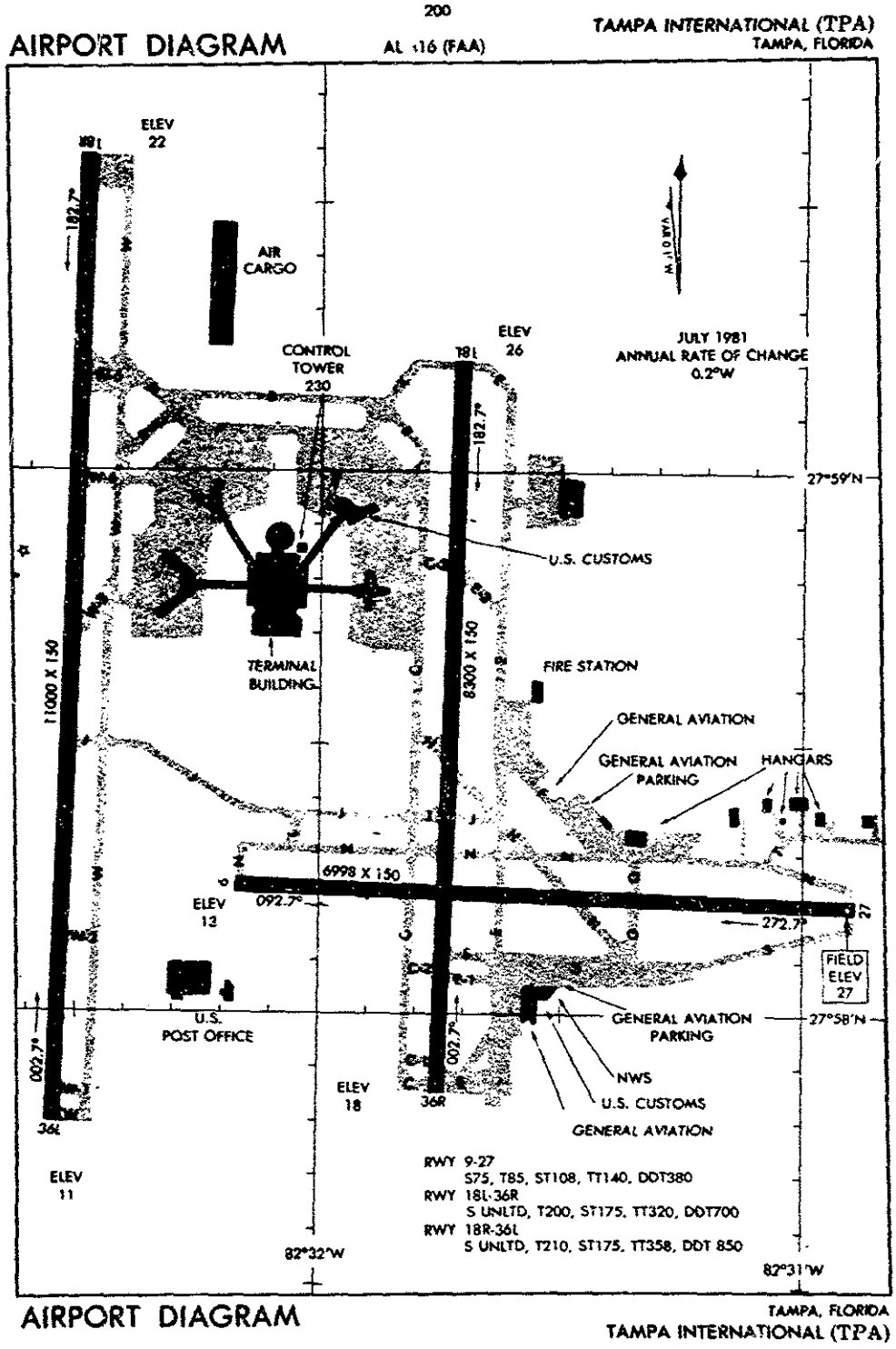

Figure 2.—Diagram of Tampa International Airport.

B-727. The B-727 captain attempted to stop; however, his hydraulic brakes were ineffective. As he applied the emergency air brakes, the first officer applied his hydraulic brakes, and the B-727 rolled onto the grass between the taxiway and runway. The Apache came to rest and continued to burn on the taxiway about 100 feet behind the 727. The pilot of the Apache sustained fatal injuries.

As soon as the B-727 came to a stop on the grass, the captain ordered the airplane to be evacuated. At 0705:05, the first officer of Pan American 301 broadcast on the local control frequency:

> Hello hello mayday mayday Clipper's been hit by a light airplane on the ta on the taxiway, I don't think there's any injuries but there may be some damage, send out the equipment.

Flight attendants opened doors and deployed escape slides at the forward left and right doors and at the aft left door. The forward left door was difficult to open, and the aft right door could not be pushed open far enough to deploy the slide. Attempts to open this door were abandoned after all passengers had been evacuated via the other doors. Two passengers and one flight attendant sustained injuries during the evacuation; 15 passengers, 2 flight attendants, and the 3 flightcrew members were uninjured.

1.2 Injuries to Persons

Injuries	Apache N2185P	B-727 Crew	B-727 Passengers	Other	Total
Fatal	1	0	0	0	1
Serious	0	0	1	0	1
Minor	0	1	1	0	2
None	5	1	15	0	20
Total	1	6	17	0	24

1.3 Damage to Aircraft

The Apache, N2185P, was almost destroyed by the impact and the subsequent fire. The outboard panel of the left wing, the left horizontal stabilizer, and the elevators were the only major components that were not extensively damaged.

The Boeing 727, N4743, sustained substantial damage in the area of the radome and forward electronic compartment. The left side fuselage skin was scratched, dented, and torn. Fire damage was confined to the surface of the left lower wing and adjacent fuselage area.

1.4 Other Damage

None.

1.5 Crew Information

The flightcrews of both airplanes were properly qualified and certificated in accordance with current Federal regulations. (See appendix B.)

The pilot of the Piper Apache had been employed as a pilot by Eastern Airlines (Eastern) since April 9, 1965. He had flown a total of about 20,000 hours, of which 4,360 hours were in the DC-9. He had satisfactorily completed a line check on

Figure 3.--N4743, a Boeing 727.

September 21, 1986, and a DC-9 proficiency check on September 29, 1986. He had flown 79.5 hours in the DC-9 in the previous 90 days. The pilot's personal flight logbook indicated that he last flew N2185P on September 1, 1986. In the previous 12 months, he had flown 58 hours in his Apache, and he had landed it at Tampa International 33 times. The Apache pilot had last flown 5 days before the accident.

On the day of the accident, the Apache pilot was scheduled to command Eastern Airlines flight 164, a DC-9, from Tampa to Newark, New Jersey; flight 164's scheduled departure time was 0805. His check-in time was 0720. His wife stated that the pilot regularly used the accident airplane to commute from his home at Pine Shadow Airpark, near Fort Myers, Florida, to his assigned duty station at Eastern's facility at Tampa International Airport. She also stated that he was in good health and that he was not taking any medication.

A review of the pilot's personnel record at Eastern disclosed a letter from the chief pilot that indicated that the pilot had reported late for an assigned flight on June 13, 1981, causing a departure delay of 4 minutes. The letter stated that "the Company considers reporting late for work and causing a delay to be a serious failure to fulfill your job responsibility." The letter continued by recommending that the pilot "take corrective measures to prevent a recurrence." (See appendix C.) No disciplinary action was taken against the pilot.

The captain, the first officer, and the flight engineer of the B-727 were properly qualified in their respective crew positions. They possessed valid medical certificates and were in compliance with all rest and duty time limitations.

All air traffic control personnel involved in the handling of N2185P and Pan American 301 were qualified in their respective positions.

1.6 Airplane Information

N2185P, a Piper PA-23-150 Apache, was manufactured on November 16, 1956. The airplane was owned by the deceased pilot. Damage to the Apache was estimated at $16,000.

The current aircraft logbook was destroyed in the accident. It contained the aircraft records from May 1982 to the time of the accident.

Engine logbooks indicated that on May 19, 1986, the date of the most recent 100-hour inspection, total airplane time was 4,248.8 hours. Lycoming O-340 engines were installed in October 1959, in accordance with STC SA2-720. The left engine had a total of 1,362 hours, and the right engine had a total of 1,482.7 hours. On December 1, 1982, the altimeter, turn-and-bank indicator, directional gyro, and artificial horizon were replaced with overhauled instruments. On May 17, 1985, the airplane's generators were replaced with alternator systems; at that time, the airplane equipment list indicated that the airplane was equipped with one Narco MK 12 navigation/communication (nav/comm) transceiver, one Narco VOA 5 omni-localizer converter (indicator) with glideslope display, one Narco marker beacon receiver, and one Narco ADF 140 automatic direction finder. (See appendix D.) Two Narco MK 12 transceivers were found in the wreckage after the accident. The available airplane records did not indicate any recent malfunctions of the airplane's flight instruments or radio equipment.

Although it was not possible to determine the exact amount of fuel onboard the Apache at the time of the accident, the weight or center of gravity limitations could not have been exceeded under the existing conditions.

N4734, a Pan American B-727 was in an airworthy condition at the time of the accident. The airplane's weight and center of gravity were within allowable limits. Damage to the B-727 was estimated at $899,146.68.

1.7 Meteorological Information

At the time of the accident, a ridge of high pressure extended across the Florida peninsula. Cloud conditions varied from clear to obscured, with fog reported along the mid-west coast and northern inland regions. Winds were light from the south through the east.

The nearest weather reporting facility to Pine Shadows Airport is Page Field at Fort Myers, about 10 miles south of Pine Shadows. At the time of the airplane's takeoff, the weather at Page Field was reported as:

> 0605, Special: Ceiling measured 2,000 feet broken, 25,000 feet broken; visibility--15 miles; wind--110° at 7 knots; altimeter setting--30.11 inHg.

Civil twilight 8/ in the vicinity of Tampa International Airport began at 0620 and sunrise occurred at 0645. At 0707, the sun was 4° above the horizon and its azimuth was 109° from true north. The following weather observations were taken at the Weather Service Contract Meteorological Observatory (WSCMO) at Tampa International Airport:

> 0649: Ceiling indefinite 0 feet obscured; visibility--1/16 mile in fog; temperature--70° F; dewpoint 70° F; wind--100° at 3 knots; altimeter--30.08 inHg. Remarks: runway 36L visual range 1,000 feet variable 1,200 feet.
>
> 0712: Ceiling indefinite 0 feet obscured; visibility--0 miles in fog; temperature--70° F; dewpoint 70° F; wind--090° at 3 knots; altimeter--30.09 inHg. Remarks: runway 36L visual range less than 1,000 feet, aircraft mishap.

The visibility at Tampa International Airport was reported as 1/16 mile at 0245 and remained at or below that level until 0748.

The RVR readings reported by the National Weather Service at Tampa were compared to the recorded RVR trace and found to be accurate.

At the time of the accident, St. Petersburg-Clearwater Airport, located about 15 miles west of Tampa, was reporting an indefinite ceiling of 200 feet obscured and a visibility of 1 mile. (The published DH for an ILS approach to runway 17L is 200 feet, and the minimum visibility is 1/2 mile.)

1.8 Aids to Navigation

Tampa International Airport runway 36L is equipped with an ILS which meets Category II approach criteria. The approach light system (ALSF-1) consists of 24 rows of approach lights spaced 100 feet apart, threshold lights, and 15 sequenced flashers (strobes)

8/ The interval between sunrise or sunset and the time when the true position of the center of the sun is 6° below the horizon, at which time stars and planets of the first magnitude are just visible and darkness forces the suspension of normal outdoor activities.

which extend from the 1,000-foot row to the 2,400-foot row of approach lights. The runway also is equipped with high intensity edge lights, touchdown zone lights, and centerline lights.

The ILS components, the approach lights, and the sequenced flashers are equipped with monitoring systems. On the morning of the accident, the sequenced flasher alarm actuated at 0520. The monitoring system is designed to actuate when three or more lights fail. When the system was inspected after the accident, lights Nos. 12 and 14 were found to have burned out. It could not be determined why the alarm actuated when only two lights were inoperative. Air traffic control personnel stated that invalid alarms are a common occurrence, and that their normal procedure is to verify the operation of the sequenced flashers by requesting a pilot report. ABEX 110 was asked if he "saw the flasher" during his approach, and he confirmed that they were operating. No other alarms actuated on the morning of the accident. The pilots of Cessna N6613D and ABEX DC-9 did not experience any difficulties with the ILS facilities. A flight test of the ILS approach facilities on the day of the accident determined that all equipment was performing within the established parameters.

1.9 Communications

There were no known communications difficulties.

1.10 Aerodrome Information

Tampa International Airport is located 5 miles west of downtown Tampa, Florida. The field elevation is 27 feet above mean sea level. The airport is served by three runways. Runway 36L, the runway in use at the time of the accident, is constructed of concrete and is 11,000 feet long and 150 feet wide. The centerline of taxiway W, which is east of and parallel to runway 36L, is 406.25 feet from the centerline of the runway. The intersection of taxiways W and W-2, the approximate location of the accident, is located about 2,200 feet north of the approach end of runway 36L. Taxiway W is 75 feet wide and is surfaced with asphalt.

The air traffic control tower is equipped with a radar display used for monitoring weather in the vicinity of the airport and for traffic sequencing. The radar was set on the 20-mile range at the time of the accident. The local controller stated that he had monitored the radar and that he did not observe any deviations from the normal approach path during N2185P's two approaches. Since no altitude data was available, his monitoring was limited to observing N2185P's track in relation to the localizer.

1.11 Flight Recorders

The Apache was not equipped with a cockpit voice recorder (CVR) or a flight data recorder (FDR). Neither is required by current regulations.

The Pan American Boeing 727 was equipped with both recorders. The FDR was not read out, as the data it contained were not pertinent to the accident. The CVR tape was replayed at the Safety Board laboratory. It was of good quality, but it did not contain any significant information relating to the accident other than the time interval between the flightcrew's first exclamation upon seeing the approaching Piper and the sound of impact. This time was calculated to be 2.4 seconds. A transcript of the tape was not made.

1.12 Wreckage and Impact Information

1.12.1 Piper Apache, N2185P

Most of the structure of the Apache received severe fire and impact damage with the exception of the left horizontal stabilizer, elevators, and the outboard panel of the left wing which separated from the airplane during the initial impact. The preimpact position of the rudder trim tab was in the approximate neutral position, and the elevator trim tab position related to a slight nose-up trim condition. The instrument panel was almost destroyed.

The throttle quadrant was burned and almost melted, but small portions of the various engine and propeller control levers remained. Both throttle levers were in the full aft position, and both mixture control levers were in the full rich position. The two propeller control levers were in the full forward (high rpm) position. The fuel selector valve positions indicated that the left engine was being fed by the left tank and that the right engine was being fed by the right tank. The crossfeed lever was in the off position. Cockpit instruments that were recovered from the Piper Apache yielded the following readings:

Altimeter:	760 feet; barometric setting unreadable.
No.1 omni indicator:	Localizer needle centered. Glideslope indicator 1-2 dots low. To-from indicator in "To" position.
Vertical speed indicator:	600 feet/minute down.
Turn needle:	Centered.
Directional gyro:	135°.

These instruments were damaged by the impact and postcrash fire.

Two Narco MK 12 nav/comm transceivers were found. An examination of the No. 1 transceiver's tuning shaft and rotary dial indicated that the selected frequency was either 108.0 or 108.9 Megahertz. The selected frequency for the No. 2 nav/comm transceiver was 116.4 Megahertz. (The frequency for Tampa's runway 36L ILS is 108.9 MHz, and the St. Petersburg VOR frequency is 116.4 MHz.)

The landing gear was in the down and locked position. The flaps were destroyed in the ground fire, but the flap actuating cylinders were found in the fully extended position, indicating that the flaps were fully retracted. The severe damage precluded establishing aileron and elevator control continuity. Rudder control continuity was established from the rudder pedals to the rudder.

The left propeller blades exhibited heavy spanwise bending and chordwise twisting, and both blades were bent rearward. The left propeller dome was intact. The right propeller blades were found in the feathered position, but they showed leading edge damage and chordwise scratching. The right propeller dome was fractured, and the oil had escaped from the dome.

Magnetos and sparkplugs on both engines were examined; all four magnetos sparked satisfactorily when examined, and all sparkplugs were normal in appearance and color. The right engine's carburetor was intact and properly attached. Disassembly showed that the float was melted and that the float bowl was dry and did not contain any foreign sediment. None of the carburetor's mechanical components appeared to be defective. The vacuum pump installed on the right engine was intact, rotated normally, and produced normal suction.

1.12.2 Boeing B-727-235, N4743

The left engine and propeller of the Apache separated at impact and remained imbedded in the B-727 in the radome area. The radome and radar antenna were destroyed. The forward half of the B-727 nose gear left wheel well door was torn away. The electrical cable for the left main landing gear anti-skid system was severed. The horizontal stabilizer control drum mechanism and all mechanical systems located in the forward electronic compartment were damaged by the impact. The left side of the B-727 fuselage sustained scratches; dents and tears, including a deep dent; and scratches on the lower surface of the left forward entry door. Heat and fire damage were evident on the underside of the left wing between the fuselage and the midwing area. The left fuselage area and air conditioning bay access panels also were damaged by heat and fire.

1.13 Medical and Pathological Information

One flight attendant and two passengers were injured during the evacuation. The flight attendant sprained her ankle while running away from the airplane. One passenger injured his arm when he fell just after getting off the escape slide. The other passenger fell as he was running from the airplane and sustained a fractured ankle.

The pilot of the Apache died as a result of the injuries he sustained during the collision and fire. An autopsy conducted by the Hillsborough County Medical Examiner determined the cause of death to have been blunt trauma and total body burns.

The Federal Aviation Administration (FAA) Civil Aeromedical Institute's (CAMI) Forensic Toxicology Research Unit examined specimens taken by the medical examiner. According to the CAMI report, there was no indication of alcohol, acidic, basic, or neutral drugs found in the blood or urine. The medical examiner's toxicological report indicated that no alcohol was found in the blood.

1.14 Fire

The Tampa Fire Department (TFD) station at the airport was initially notified at 0704:52 of a "Red Alert Three" incident on taxiway W at the intersection of taxiway J by the airport control tower. At 0705:07, the notification conversation terminated and the airport fire station responded with crash-fire-rescue (CFR) units Nos. 1, 2, 3, and 4. When the CFR units did not find the aircraft at taxiway J, they continued southbound on taxiway W until they arrived at the crash site. Additional equipment was dispatched from other TFD stations.

The TFD Airport CFR units arrived at 0708 and discharged foam on the Piper Apache, bringing the fire under control 30 to 45 seconds later. The fire was extinguished within 3 minutes. Dense fog hampered the response by the airport units to the accident site.

The communications network at Tampa International Airport consisted of a designated phone link between the airport control tower, the CFR station, the Hillsborough County Aviation Authority Communications Center, and the TFD Communications Center. When one of the four phones is picked up, the phones at the other three agencies rings automatically.

1.15 Survival Aspects

There were no infants, children, or handicapped passengers on board the

Boeing 727. One nonrevenue passenger, a Pan American flight attendant, was seated in the first class cabin. The 16 revenue passengers were all seated in cabin class, most of them forward of the wing in the nonsmoking section. There was very little cabin baggage, and it had been properly stowed before taxi. At the time of the collision, the predeparture passenger briefing and safety demonstration had been accomplished, the flight attendants had checked the cabin for proper upright positioning of the seatbacks and tray tables, and the flight attendants had proceeded to their assigned jumpseats and fastened their restraint systems. During taxi, which the flight attendants described as slower than normal, the purser, seated in the forward jumpseat, said that she felt a swaying motion followed by the loud noise of impact. She heard an announcement on the public address system to ". . . wait for instructions," the standard company announcement used to alert the cabin crew that a possible emergency condition exists. Within seconds, she heard a second announcement to evacuate the airplane. The purser opened the forward left door approximately 18 inches and found that it would not open farther. The captain attempted to open the door but was unable to move it to the fully open position. When the captain and purser pushed together, the door opened and the escape slide deployed. No passengers used this exit, and the purser left the airplane through the forward right door.

Flight attendants Nos. 2 and 3 were seated on the aft jumpseat. Flight attendant No. 2 opened the aft left door with the assistance of flight attendant No. 3. The aft left escape slide deployed, and flight attendant No. 3 remained at the door and shouted evacuation commands to the passengers. Flight attendant No. 2 then went to the aft right exit and "cracked" the door, but she could not open it fully. At that time, the flight engineer told her to "forget it" because all the passengers were off the airplane. Both flight attendants then exited via the aft left slide.

The nonrevenue flight attendant seated in the first class cabin opened the forward right door, noting that the door opened "easily" and that the slide deployed automatically. She supervised the exit of four passengers through this door before leaving the airplane.

When all of the passengers had evacuated the airplane, the flight attendants escorted them to the east side of taxiway W.

Two paramedic ambulances were dispatched to the accident site. The injured flight attendant and the two injured passengers were treated at the scene and then was transported to a nearby hospital, where they received further treatment. They were released at 1300 on the same day.

When Safety Board investigators inspected the cabin of the B-727, they found five tray tables had dropped from their stowed positions. An inspection at the Pan American maintenance facility in Miami disclosed that all five tray tables had opened because of improper adjustment of set screws that control the angle of the table top when in the stowed position. Once the tray tables were properly adjusted, the latches prevented them from dropping out of the stowed position.

Although the overwing exits were not used during the evacuation, investigators found that the seat back at position 16A was pitched forward about 20° into the projected opening of the overwing exit adjacent to that seat. An inspection of the seat revealed that a nut, a bolt, and a stack of washers had been used in an attempt to lock out the breakover mechanism instead of using the part required by the seat manufacturer.

All four inboard halves of the slide containers were covered with a thin carpet-like material which was wrapped around the edges of the container and glued in place. The slide container from the aft right door was examined and tested in Miami. The covering material caused the inboard half of the container to bind against the door mounted half and significantly increased the effort required to open the door when the slide was armed.

The slide container is mounted to the door and consists of two halves that are hinged at the top edge and are held shut by two mating clips at the bottom. The clips are held together by a T-shaped latch assembly which is pulled out by a lanyard when the slide is armed and the door is opened. One clip on the aft right door container was bent in a manner that allowed it to fit to the inside of the other clip, rather than fitting to the outside. This reduced the space available for installation of the T-shaped latch, resulting in slightly higher than normal resistance when the door was opened and the latch was pulled out by the lanyard.

1.16 Tests and Research

Recorded radar data obtained from the Tampa Approach Control facility were used to reconstruct the flightpath of the Piper Apache during both of its approaches to runway 36L. Since the Apache was not equipped with an altitude-encoding altimeter, no recorded altitude information was available. (See figures 4 and 5.)

1.17 Additional Information

1.17.1 Federal Aviation Regulations

The Piper Apache was operating under the provisions of 14 Code of Federal Regulations (CFR) Part 91. In 1981, 14 CFR Part 91 was amended to clarify the criteria for continuing an instrument approach below DH. (See appendix E.) Paragraph 91.116 states that:

* * * * *

(c) Where a DH . . . is applicable, no pilot may . . . continue an approach below the authorized DH unless-

(1) The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers . .

(2) The flight visibility is not less than the visibility in the standard instrument approach procedure being used;

(3) . . . at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:

(i) The approach light system, except that the pilot may not descend below 100 feet above the touchdown zone elevation using the approach lights as a reference unless the red terminating bars or the red side row bars are also distinctly visible and identifiable.

(ii) The threshold.

(iii) The threshold markings.

(iv) The threshold lights.

(v) The runway end identifier lights.

(vi) The visual approach slope indicator.

(vii) The touchdown zone or touchdown zone markings.

(viii) The touchdown zone lights.

(ix) The runway or runway markings.

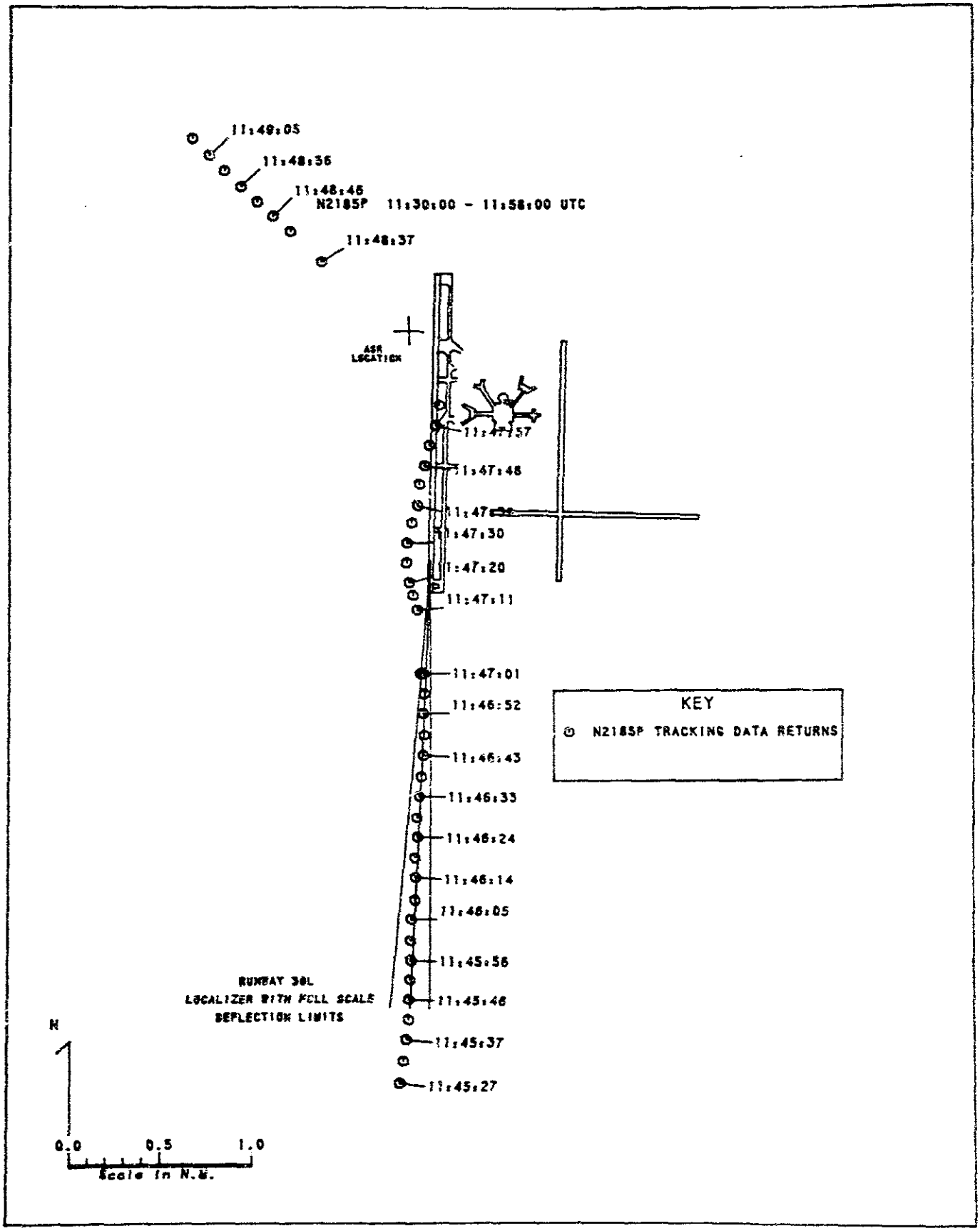

Figure 4.--First approach of the Piper Apache.

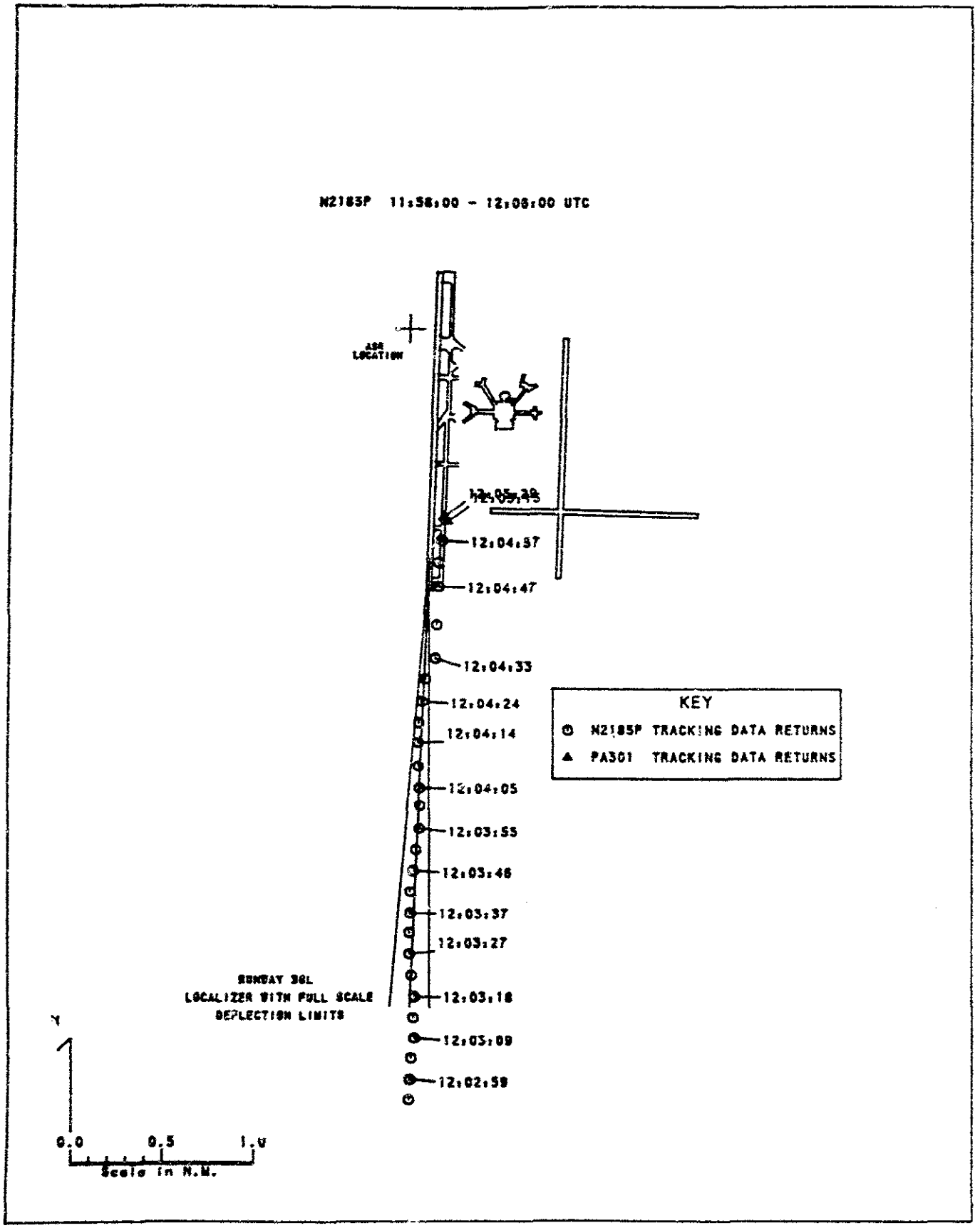

Figure 5.--Second approach of the Piper Apache.

> (x) The runway lights . . .
> (d) Landing. No pilot operating an aircraft . . . may land that aircraft when the flight visibility is less than the visibility prescribed in the standard instrument approach procedure being used.
> (e) Missed Approach Procedure. Each pilot operating an aircraft . . . shall immediately execute an appropriate missed approach procedure . . .
> (1) Whenever the requirements of paragraph (c) of this section are not met . . . upon arrival at the missed approach point, including a DH where a DH is specified and its use is required, and at any time after that until touchdown.

A pilot operating under 14 CFR Part 91 is allowed to execute an instrument approach down to the published DH even though the reported visibility is lower than the minimum visibility specified in the approach procedure being used.

If a pilot is operating an airplane under the provisions of Part 121, 125, or 135, however, the pilot cannot continue an approach past the final approach fix unless the reported visibility is equal to or more than the published visibility minimums for that approach. If the visibility goes below the published minimums after the airplane has passed the final approach fix, the pilot may continue the approach to DH and may land if the visual cues and flight visibility meet requirements identical to those specified in 14 CFR 91.116(c).

According to the supplementary information published with Amendment 91-173 on January 8, 1981, the intent of the change was to assure that descent below DH was not based on the "general glow of approach lights through a layer of fog or other obscurations where the visual references themselves were not discretely identifiable." The supplementary information also contains the following discussion:

> It is important to note the provision to continue an approach below MDA [minimum descent altitude] or DH if flight visibility is considered by the pilot to be above minimums and one of the acceptable visual references is in sight is not an encouragement for pilots to deliberately misestimate visibility to land in unsafe conditions with ground reporting prevailing visibility or RVR reported below minimums. The FAA intends to closely review the circumstances related to any landings made when weather is reported below minimums. To assess compliance with 91.116(c) and 121.651(c) and for enforcement cases, the FAA will continue to consider a variety of factors such as ground-reported weather, variability of the weather, reports of other pilots who attempted or completed landings, pilots awaiting departure located in a position to judge visual reference in the area on (sic) the touchdown zone, reports of visual reference seen by other crewmembers on the aircraft, air traffic personnel, or ground observer reports, or many other such factors. Should evidence of a poor safety record continue or there be evidence of deliberate disregard of the visual reference provisions . . ., the FAA will reconsider both the applicability and precedence of ground-reported visibility and RVR and the potential applicability of additional rules. If necessary, provisions similar to 121.651(b) . . . may then be developed to apply to all operations.

1.17.2 Eastern Airlines Personnel Policies

Although Eastern does not have a policy which specifically addresses employees who commute to work in personal airplanes, the Eastern Flight Operations Manual, under "Off Duty Flying," states that:

> Flying for personal transportation or pleasure is permissible. However, flying other than Eastern airplanes within 12 hours of a scheduled flight for EAL is discouraged.

Eastern's chief pilot for the Southern Region stated that pilots are required to report for duty 45 minutes before their flight's scheduled departure. The chief pilot said that if the pilot scheduled to fly flight 164 had proceeded to a nearby alternate airport and had taken a taxi to Tampa, the flight most likely would have been delayed until the captain's arrival, rather than calling a reserve pilot to replace him.

If he was late, the captain would have been required to explain to the chief pilot the reason for his late arrival. According to the chief pilot, because of his good record and perfect attendance for 5 years, the only action taken against the captain would have been a warning letter placed in his personnel record. The chief pilot also stated that although the captain had been late once before, on June 13, 1981, that event could not have been used to justify disciplinary action because it had occurred over 3 years before the day of the accident. The chief pilot said, however, that the captain may not have been aware of the 3-year limitation.

The chief pilot stated that over the last year he had seen a gradual buildup of "pressures" on flightcrew personnel, as a result of uncertainty over the future of Eastern following its acquisition by Texas Air Corporation in February 1986. He said that, since the merger, there had been more emphasis on eliminating crew delays, and that morale is the lowest he had seen because "pilots are not sure what's going to happen to them."

A number of Eastern pilots expressed a concern that there was a lot of talk in the cockpit concerning problems with the airline. As a result of this concern, the flight operations department issued a Flight Safety Bulletin on February 1, 1986, which said, in part:

> Distraction, as a human factor cannot be eliminated from the cockpit but we must eliminate controllable distractions such as nonoperational cockpit conversation and pre-occupation with outside personal life situations. The hazards are well known in accident files. We must consciously guard against preoccupations with personal and job-related stresses during this period of company employee negotiations. We are all subject to and affected by these outside influences at this time but the cockpit is an improper forum for discussion when it's to the detriment of safety of your flight.

The pilot's wife stated that he was resigned to whatever might happen at Eastern as a result of the changes brought about by the merger.

2. ANALYSIS

2.1 General

The investigation examined the following areas that may have been related to the cause of this accident:

- o The mechanical condition of the Piper Apache.
- o The qualifications and physical condition of the pilot of the Apache.
- o The weather conditions at Tampa International Airport on the morning of the accident.
- o The pilot's decision to fly, rather than drive, to Tampa.
- o The performance of the air traffic controllers.
- o The condition of the approach facilities.
- o The execution of the instrument approach.
- o Airline personnel policies.
- o Federal regulations governing "look-see" approaches.

The Piper Apache was certificated and maintained in accordance with current regulations. There was no evidence of preaccident failure or malfunction of the aircraft powerplants, structures, systems, or flight controls. The apparent position of the No. 2 (right) propeller blades was caused by the impact fracture of the propeller dome and the resultant loss of oil pressure, which allowed the blades to move to the feathered position. Indications on the few instruments that were recovered were unreliable due to the extensive impact and fire damage.

The Apache pilot was properly certificated and qualified to conduct the flight. There was no evidence of medical problems which could have affected his performance.

The Pan American Boeing B-727 was in an airworthy condition at the time of the accident. The malfunctions of certain items of equipment on the B-727 were unrelated to the cause of the accident, but they were of sufficient importance to the potential survivability of passengers under certain emergency conditions to warrant further investigation and analysis.

The B-727 flightcrew members were properly certificated and qualified. The captain's immediate response in turning the B-727 to the right after seeing the approaching Piper Apache probably reduced the severity of the initial impact and lessened the damage sustained by the B-727 airplane during the collision and subsequent ground fire. The flight attendants performed their emergency evacuation duties in an orderly and expeditious manner. All cockpit crewmembers of the B-727 performed in a manner that reflected a high degree of discipline and professionalism.

2.2 Meteorological Conditions

When the pilot of the Piper Apache called the Fort Myers FSS on the night before the accident, he was given a weather briefing which forecast fog at Tampa

International Airport and visibilities from 1/2 to 3 miles. If he had called again the next morning, he would have found that the forecast had been revised and called for visibilities as low as 1/8 mile, and that the current Tampa weather was below landing minimums. After he departed Pine Shadows Airport, he received the current Tampa weather, which was reported to be a ceiling of zero feet and a visibility of 1/16 mile. The pilot of the Apache was aware of the potential for reduced visibility due to fog at Tampa before he retired on the night before the accident, and the presence of fog was confirmed after he was airborne the next morning.

The pilot elected to continue to Tampa even though the reported RVR of 1,000 to 1,600 feet was well below the 1,800 feet required for landing. When he arrived in the Tampa area, he received six RVR reports, none of which indicated a touchdown RVR greater than 800 feet. The report of a midfield RVR of 3,000 feet given to him after his first missed approach was probably the result of the air movement created by the exhaust and wake turbulence from the departing DC-9, because within 5 minutes the midfield RVR had deteriorated to 1,000 feet.

The two pilots who conducted approaches to Tampa just before the first approach by the Piper Apache pilot, when the reported touchdown RVRs were 1,400 feet and 1,200 feet, were unable to see any of the required visual references and executed missed approaches. The pilot of N2185P was monitoring departure control (Gibbs Radar) when ABEX 110 called "Missed Approach" at 1138:31, and he was monitoring the local control frequency at 1142:27, when Cessna N6613D was given missed approach instructions. By the time the pilot of the Apache executed his first approach, the touchdown RVR had dropped to 600 feet. It is highly unlikely that he was able to see any of the visual references required by 14 CFR 91.116 on that approach or on the subsequent approach, when the touchdown RVR was again reported to be 600 feet.

The sun had risen about 20 minutes before the accident occurred. Daylight conditions prevailed, making the approach lights and sequenced flashers more difficult to see than they would have been when the other two aircraft missed their approaches.

2.3 Air Traffic Control and Approach Facilities

With the exception of the failure of the local controller to issue a landing clearance during the Apache's first approach, all air traffic control procedures were correctly observed. On the Apache's first approach, a change of local controllers resulted in the failure to issue a landing clearance. The failure occurred because the two controllers used different techniques for issuing landing clearances. The breakdown in coordination between the controllers did not contribute to the events that led to the accident, but it is of concern to the Safety Board. It illustrates the need for careful coordination whenever one controller turns over his responsibility to another controller.

The components of the ILS system were ground checked and flight checked after the accident, and they were found to be performing within the specified parameters. The alarms on the ILS components were operational and did not indicate any malfunctions on the morning of the accident. Other pilots who executed the runway 36L ILS approach that morning did not experience any difficulties with the approach facilities.

The radar data recorded by Tampa Approach Control indicates that the two approaches executed by the pilot of the Apache were stable and precise. He tracked the centerline of the localizer with only minor deviations, and he applied prompt and proper corrections. On both approaches, the only significant deviations occurred at a distance from the end of the runway which corresponds to the approximate point at which the DH was reached when on the glide slope, about 0.4 mile from the runway threshold. This

would be the point at which the pilot would have been looking outside for the visual references associated with the runway and approach lights, and his attention would have been diverted from his flight and navigation instruments. Therefore, the stability of the depicted approaches, the navigational aid flight test results, and the experiences of the other pilots who flew the approach confirm that the ground navigation aids and airborne navigation equipment were functioning properly.

The approach lights were operating normally, and no alarms were noted. The alarm for the sequenced flashers activated before the accident, but a subsequent inspection revealed that only two lights were inoperative, rather than the three or more required for normal alarm activation. Investigators were unable to determine the reason for this false activation of the alarm. These two lights did not have any significant effect on the visibility of the approach light system. The other pilots executing the approach that morning saw portions of the approach lights and sequenced flashers, confirming their proper operation.

Although the tower cab was equipped with radar, it was not designed or intended to be used for monitoring the precise alignment of aircraft with the runway during the final moments of an instrument approach. The relatively small distance between the runway and parallel taxiway precluded any clear definition of aircraft alignment on the radar display.

In summary, the Safety Board concludes that the ILS components, the approach lights, the airborne navigation equipment, and the actions of ATC personnel were not relevant to the cause of this accident.

2.4 Pilot's Decision to Fly

The sequence of events leading to the accident began with the pilot's decision to fly, rather than drive, to Tampa. The weather briefing that he received on the night before the accident indicated the probability of fog in Tampa on the next morning. Although the forecast did not indicate that the visibility would be below landing minimums, the Safety Board believes that a prudent pilot would have seriously considered driving to Tampa, rather than flying, under those circumstances. If the pilot had planned for the possibility of fog by arising earlier and calling for a revised weather forecast, he would have had the option of flying if the weather was suitable, or driving if it was not. By waiting until he was airborne before obtaining the current Tampa weather, he deprived himself of the option to drive.

2.5 Conduct of the Approaches

The only information available concerning the Apache pilot's execution of the two ILS approaches is found in the radar data recorded by Tampa Approach Control. Although the airplane was equipped with a transponder, it did not have an altitude reporting capability or an encoding altimeter. Therefore, there is no data available to determine the altitudes flown during those approaches. The course data indicate that both approaches were flown with a high degree of precision. There was normal bracketing of the localizer centerline, but no significant deviations were evident. As the two approaches progressed toward the middle marker, located 0.5 nautical mile from the end of the runway, the slight deviations decreased. Just inside the middle marker, however, at a point where the airplane should have been arriving at DH, slight excursions from the localizer were noted. On the first approach, this deviation was to the left (west) of course, and on the second approach, the airplane moved to the right (east) and lined up with taxiway W. At this point, the pilot would probably have been looking for the visual

references that would have allowed him to continue the approach below DH. If those references were not immediately recognized, he should have initiated a missed approach.

Title 14 CFR 91.116 requires that at least one of the specified visual references related to the landing runway is distinctly visible and identifiable at DH and that it remains visible for the remainder of the approach. The requirement is intended to provide protection against the pilot's disorientation during the most difficult portion of the approach--the transition from instrument references to visual references that are adequate to effect a landing. The required minimum visibility for an approach procedure is based on two factors: the accuracy of the available radio navigation aids and the lighting systems installed on a given runway. The combination of DH and minimum visibility, generally referred to as landing minimums, is designed to allow a pilot to descend on instruments to a point at which visual references will allow the pilot a normal descent to landing on the intended runway. The fact that the pilot of the Piper Apache landed on the parallel taxiway indicates that he descended below DH without having any of the required visual references related to runway 36L "distinctly visible and identifiable" as specified in 14 CFR 91.116(c)(3).

Therefore, the Safety Board concludes that during his second approach, the Apache pilot intentionally descended below DH in an attempt to visually identify the runway. He inadvertently flew to the right of the ILS localizer during the time when his attention was divided between the cockpit instruments and the search for outside visual references. Whether he realized before touchdown that he was aligned with the parallel taxiway or thought he was landing on the runway cannot be determined conclusively from the existing evidence. However, the differences in width, surface color, and lighting between the taxiway and the runway should have been apparent to the pilot at some point during the flare and before touchdown, particularly since the pilot was very familiar with the Tampa airport. Therefore, the possibility exists that the pilot may have recognized shortly before touchdown that he was over the taxiway rather than the runway and that he may have accepted the situation because of a strongly perceived need to report for duty on time. The possibility also exists that he recognized his mistake at the last minute and was initiating a missed approach when the accident occurred. Lastly, he may have thought he was actually landing on the runway. Unfortunately, the evidence is insufficient to draw a conclusion on this matter.

2.6 Airline Personnel Policies

The Apache pilot elected to descend below DH and attempted to land even though he did not see the appropriate ground references. Since this decision was inconsistent with his experience and reputation as a capable pilot, his motivation for choosing this course of action was examined.

After the unsuccessful first approach, the pilot could have diverted to an alternate airport, such as St. Petersburg. However, since he was commuting to work, diverting to an alternate airport would have caused him to be late for his scheduled reporting time. Therefore, the Safety Board examined those Eastern personnel policies that would have applied to such a situation and that might have influenced the pilot's decision.

The Apache pilot was probably aware that the Eastern Airlines Flight Operations Manual discouraged pilots from flying their personal aircraft within 12 hours of a scheduled Eastern flight. The chief pilot stated that the pilot may have thought that he would be disciplined for delaying his scheduled trip departure, since he had previously received a letter recommending that he "take corrective measures to prevent a recurrence" of a delay which took place over 5 years before the accident. This delay was

described as a "serious failure to fulfill your job responsibility." Although the pilot had a perfect attendance record for those 5 years, he may not have been aware of the 3-year limitation on disciplinary action for a second trip delay. Consequently, the pressure to successfully land at the Tampa airport, rather than to divert to an alternate airport in order to report for duty on time at Eastern probably was largely self-generated on the part of the Apache pilot.

2.7 Regulations Governing Instrument Approaches

When 14 CFR Part 91 was amended in 1981, the criteria for continuing an instrument approach below DH were clarified. The revised rule specified the visual references which allow descent below DH, and it required that those visual references be "distinctly visible and identifiable." The Safety Board believes that this accident clearly illustrates the need to reconsider this "look-see" provision of 14 CFR Part 91. This accident would not have occurred if the pilot had observed the existing regulations which prohibit descent below DH without the required visual references. However, the fact that a pilot is allowed by 14 CFR Part 91 to conduct an instrument approach when the reported visibility is less than the required landing visibility provides the opportunity to continue descent below DH for a pilot who is highly motivated to complete a landing. In this accident, the pilot was probably motivated by his perception of the importance of reporting for work on time.

The Safety Board addressed this subject in 1969 in Safety Recommendation A-69-32 and again on April 6, 1982, when it urged the FAA to:

A-82-30

> Take action to amend 14 CFR 91.116 to provide that takeoffs cannot be initiated or an approach continued past the final approach fix or into the final approach segment of an instrument approach procedure unless the latest weather report for that airport issued by the U.S. National Weather Service, a source approved by that Service, or a source approved by the Administrator, reports the visibility to be equal to or more than the visibility minimums prescribed for that procedure.

The FAA did not concur with these recommendations, and both are classified as "Closed--Unacceptable Action."

In cases where there is no weather observing facility at the airport of intended landing or where weather observations may not accurately measure the visibility at the approach end of the active runway, the "look-see" concept probably should be retained. However, when RVR equipment is installed and operating, it should be considered sufficiently accurate to be the criterion for initiating an approach. The fact that an experienced, well-trained professional pilot failed to effect a successful landing emphasizes the importance of all pilots adhering to published landing minimums. Therefore, the Safety Board believes that the FAA should amend 14 CFR 91.116 to require that, for instrument approaches to runways with operating RVR equipment at the approach end, no pilot may continue an approach past the final approach fix unless the RVR is equal to or more than the minimum visibility prescribed for that approach procedure.

2.8 B-727 Equipment Malfunctions

Although the Pan American B-727 was not involved in the cause of this accident, the subsequent investigation disclosed some problems with the airplane's cabin equipment. These problems are discussed in this report since the Safety Board believes that other operators might benefit from Pan American's experience.

The seat back tray tables that dropped out of their stowed positions did not interfere with the evacuation of the airplane. Although they were latched in the stowed position, a misadjustment of the set screws that limit the pivoting angle of the tables allowed the tray tables to drop below their retaining latches when they were shaken or jarred. This problem was resolved when Pan American revised its "B" Service Check procedures to include inspection of the adjustment of all tray tables. The same revision to the maintenance procedures added an inspection of the lockout devices that prevent seat backs from interfering with the operation of the overwing emergency exits, as was observed on seat 16A in the accident airplane.

One of the right aft door slide container clips was bent in such a way that the retaining latch may have been installed incorrectly. The resulting slight increase in force needed to pull the latch may have contributed to the difficulty experienced by the flight attendant when she tried to open that door, but it was not sufficient to prevent her from opening the door. The carpet material that had been installed on the slide containers reduced the clearance between the fixed and movable halves of the containers and greatly increased the force required to separate them when the door was opened and the slide was armed for deployment.

Although the problems encountered in opening the right aft and forward left doors did not affect the safe evacuation of the B-727, the consequences could have been more serious if the number of passengers had been greater and the accident circumstances had been different. The seemingly harmless modification to the escape slide containers, which probably was done to maintain their appearance, had a significant effect on their function in an emergency situation. This accident illustrates the need to carefully examine all of the ramifications of a proposed change to any aircraft component, even when such changes appear to be unrelated to the normal function of that component.

As in the case of the tray tables and seat back, Pan American took prompt action to correct the slide container problem; an engineering order was issued to remove the covering material and to replace it in a manner that does not interfere with normal operation.

3. CONCLUSIONS

3.1 Findings

1. The flightcrew of each airplane was properly qualified and certificated in accordance with current Federal regulations.

2. The Apache pilot was familiar with and had current experience in the operation of that airplane.

3. There was no evidence of any preaccident failure or malfunction in the Apache.

4. The ILS and approach light systems for runway 36L at Tampa International Airport were operating properly at the time of the accident.

5. The Apache pilot was told of the potential for fog at Tampa when he was briefed on the night before the accident.

6. The Apache pilot did not call for a weather briefing before taking off on the morning of the accident.

7. The presence of fog was confirmed after the Apache pilot was airborne.

8. The two pilots who executed approaches to Tampa shortly before the accident were unable to see any of the required visual references related to runway 36L when they reached decision height.

9. The captain of the Pan American B-727 observed a maximum visibility of about 500 feet between the taxiway and runway just before the accident.

10. The accident occurred in daylight conditions, which diminished the effectiveness of the approach lights.

11. The failure of the local controller to issue a landing clearance during the Apache's first approach did not contribute to the accident.

12. The Apache pilot flew both approaches with precision until he passed the middle marker, after which slight deviations from the localizer occurred.

13. During the second approach, the Apache pilot continued his descent below the published DH and landed his airplane on the taxiway.

14. The Apache pilot probably was highly motivated to land his airplane at Tampa airport despite the less than minimum visibility required because of his perceived need to report for work on time.

15. The extent to which recent changes in personnel policies and working conditions influenced the pilot's decision to continue the approach below DH cannot be determined.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the decision of the pilot of the Apache airplane to continue a precision instrument approach below the published decision height when the required visual references were not distinctly visible and identifiable. Contributing to the accident was the pilot's failure to obtain a predeparture weather briefing before choosing a means to travel to his destination.

4. RECOMMENDATIONS

On May 19, 1987, the Safety Board recommended that the Federal Aviation Administration:

> Alert the FAA principal maintenance inspectors of operators with airplanes that have door-mounted evacuation slide containers to verify that any modified slide containers open freely and without resistance or interference. (Class II, Priority Action) (A-87-26)

As a result of its investigation, the National Transportation Safety Board recommended that the Federal Aviation Administration:

> Amend 14 CFR 91.116 to require that, for instrument approaches to runways with operating runway visual range (RVR) equipment at the approach end, no pilot may continue an approach past the final approach fix unless the RVR is equal to or more than the minimum visibility prescribed for that approach procedure. (Class II, Priority Action) (A-87-90)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ JOHN K. LAUBER
Member

/s/ JOSEPH T. NALL
Member

/s/ JAMES L. KOLSTAD
Member

PATRICIA A. GOLDMAN, Vice Chairman, did not participate.

JOSEPH T. NALL, Member, filed the following dissenting statement:

I respectfully disagree with my colleagues' adoption of the recommendation to the Federal Aviation Administration (FAA) to amend 14 CFR 91.116 to prohibit an instrument approach for Part 91 operations when the runway visual range (RVR) is reported below the flight visibility needed to land. To the extent of that recommendation, I dissent.

In the subject accident, there is substantial evidence that the pilot of the PA-23 Apache chose to disregard the requirements imposed upon him by the existing regulation, Section 91.116(c). He violated the regulation by descending below the decision height (DH) for the instrument landing system (ILS) 36L approach at Tampa International Airport. The Safety Board has correctly ruled that this apparently deliberate violation was the probable cause of the accident.

However, the question arises as to whether this single accident creates a sufficient basis for prohibiting such approaches in the future. It is my opinion that sufficient safeguards exist for their safe conduct. In support of this belief, I offer the following comments.

The Safety Board is unable to demonstrate that the approach to DH in instrument meteorological conditions (IMC) is an inherently unsafe practice or that a statistically significant number of accidents have occurred during this phase of an instrument approach at airports which would be affected by the recommendation. In fact, the record in this case shows that the pilots of a DC-9 executing a Category II approach, a Cessna 172, and the PA-23 Apache pilot himself were all able to execute an approach safely down to DH, in compliance with the Federal aviation regulations. The DC-9 and the Cessna 172

properly executed missed approaches and safely landed at alternate airports; the PA-23 Apache pilot elected to fly a second approach, which ended in catastrophe when he descended below DH without sighting the runway environment.

In addition to the safeguards of Section 91.116(c), Section 91.116(d) prohibits aircraft from landing when the landing visibility is less than that visibility prescribed in the standard instrument approach procedure being used. Given the abundance of evidence from the RVR readings and observations of controllers and pilots operating on and over the runway, an FAA enforcement action would surely have been successfully concluded had the pilot executed the landing. If it is the lack of vigorous enforcement efforts by the FAA that the Safety Board feels is wanting, the recommendation should address that need instead.

The recommendation proposed would have the effect of closing the best equipped airports to Part 91 aircraft during low visibility conditions and thus induce Part 91 pilots to divert to alternate airports in the area with less sophisticated navaids and approach/runway lighting systems, usually having shorter runways and no on-field weather observation capability. I am unable to say that this result is safer than allowing the "look-see" approach to DH at airports with strobe sequenced alignment lighting, ILS navaids capable of Category II and III operations, expanded hold lines, runway centerline lighting, edge lighting, radar service for sequencing and separation, and long runways.

RVR is not necessarily an accurate measurement under all weather conditions of "flight visibility," the current measurement under the Federal aviation regulations of landing visibility. Fog and other obscuring phenomena often are localized and may cover only the landing portion of the runway, leaving ample room for Part 91 aircraft to land beyond. Aircraft operating under Part 91 regularly execute safe IMC approaches to runways served by RVR sensors and land when the pilot has the required flight visibility. Experience has shown that pilots do execute missed approaches when the RVR is reported higher than the required flight visibility and, conversely, pilots have landed when the RVR was reported below the required flight visibility. Both circumstances exist because the controlling factor is "flight visibility" and the RVR is the horizontal visual range (that is, what the pilot in a moving aircraft should see looking down the runway on the surface from the approach end), not the slant range as viewed from the aircraft some 200 feet higher and 1/4 mile before the runway threshold. RVR values may also deviate from the true observed visual range due to brief time delays in reporting, nonhomogeneous obscurations, rapidly changing visibility conditions, and the fact that the transmissometer receiver measures the light from the projector mounted on a tower 250 feet away as it passes through the obscuration and then extrapolates that data.

It is also noteworthy that several countries, such as Austria, the Bahamas, Belgium, Denmark, Germany, Hungary, Italy, the Netherlands, Saudi Arabia, and Switzerland, which are regularly used by American air carriers, allow all operators a "look-see" option. The United Kingdom has recently relaxed its former rule similar to Section 91.116 in acknowledgement of improved ground and airborne navigational equipment.

I would vote against approval of the recommendation.

/s/ JOSEPH T. NALL
Member

June 25, 1987

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board was notified of the accident about 0800 eastern standard time on November 6, 1986, and an investigative team was dispatched from its Washington, D.C., headquarters. Investigative groups were formed for operations/air traffic control, meteorology, airworthiness, and survival factors.

Parties to the investigation were the Federal Aviation Administration; Pan American World Airways, Inc.; Piper Aircraft Corporation; the Airline Pilots Association; Flight Engineers International Association; International Union of Flight Attendants; and the Hillsborough County Aviation Authority.

2. Public Hearing

There was no public hearing or deposition procedure held in conjunction with this accident.

APPENDIX B

PERSONNEL INFORMATION

Piper Apache, N2185P

William S. Bain

Captain Bain, 56, had been flying for 40 years. He had served in the U.S. Air Force, and had been an FAA air traffic controller for 7 years. He joined Eastern Airlines on April 9, 1965, and at the time of the accident was a DC-9 captain based at Tampa. He held an Airline Transport Pilot certificate, dated September 30, 1979, with ratings of airplane multiengine land, DC-9, and commercial privileges for airplane single-engine land and sea. He also held certificates for flight instructor, flight engineer, and mechanic-airframe and powerplant. His most recent first class medical certificate was dated May 1, 1986, and contained the limitation that "the holder shall wear glasses which correct for near vision and distant vision." His distant vision, according to his last medical examination was 20/50 corrected to 20/15. His near vision was 20/100 corrected to 20/30.

Pan American B-727, N4743

Edwin C. Lunsford

Captain Lunsford, 47, was pilot-in-command of Pan American flight 301. He was employed by Pan American World Airways, Inc., on January 3, 1967. He holds an Airline Transport Pilot certificate with single and multi-engine land privileges and a B-727 type rating. His first class medical certificate was issued on October 8, 1986, with no limitations or waivers.

Captain Lunsford qualified as a B-727 captain on November 1, 1978. His last proficiency check was satisfactorily completed on September 19, 1986, and his most recent line check was completed satisfactorily on June 26, 1986. At the time of the accident, he had a total flight time of 15,539 hours, including 4,025 hours as pilot-in-command of the B-727.

Robert D. Thornton

First Officer Thornton, 46, was employed by Pan American on June 5, 1967. He holds an Airline Transport Pilot certificate and a first class medical certificate issued on December 2, 1985, with the limitation that glasses are required for near vision. He completed his B-727 qualification by passing a proficiency check on June 29, 1986. At the time of the accident, he had flown a total of 9,101 hours, of which 251 hours were in the B-727.

Herman C. Bridwell

Flight Engineer Bridwell, 42, was employed by Pan American on October 9, 1978. He holds a flight engineer certificate with a turbojet rating. His first class medical certificate, issued on July 8, 1986, contained a limitation that glasses were required for near vision.

Mr. Bridwell completed his initial B-727 qualification on November 14, 1978, and satisfactorily completed a proficiency check on September 21, 1986. He had a total flight time of 3,683 hours, all in the B-727 at the time of the accident.

Air Traffic Control Personnel

John C. Wing

Mr. Wing was the air traffic controller responsible for Tampa Tower local control at the time of the accident.

Mr. Wing had been employed by the FAA since April 1968. He was assigned to Tampa in October 1979, and he attained full proficiency level on February 4, 1981. His most recent medical examination, dated November 26, 1985, contained no restrictions. An over-the-shoulder evaluation was completed on June 2, 1986, and no errors were noted.

APPENDIX C

LETTER FROM CHIEF PILOT TO CAPTAIN BAIN

Captain W. S. Bain — Miami

A. W. Dunlop — Miami

Cockpit Crew Delay
Flight 952/20 March 1981 — June 19, 1981

Our Crew Scheduling records indicate that you reported late for your flight assignment #690/13 June 1981 which caused a Code 36 crew delay of four minutes.

In conversation with Captain W. D. Hill, you readily admitted your error in reporting late, and accepted full responsibility. Although I appreciate your honesty, be certain that the Company considers reporting late for work and causing a delay to be a serious failure to fulfill your job responsibility.

Because of your honesty, your good past employment record and your good attitude toward your job, no further action will be taken by this office.

I do recommend that you take corrective measures to prevent a recurrence.

A. W. Dunlop
Director & Chief Pilot
Miami

TJK:b

APPENDIX D

AIRCRAFT INFORMATION

Apache Piper PA 23-150, N2185P, serial No. 23-794, was manufactured on November 16, 1956. On May 19, 1986, when the most recent 100-hour inspection was performed, the airplane had logged a total time of 4,248.8 hours. It was equipped with two Lycoming O-340-A1A engines, with total times of 1,362 hours and 1,482.7 hours.

Captain Bain had purchased the Piper Apache on April 12, 1984. On May 17, 1985, he completed a modification to the airplane's electrical system, removing the generators and voltage regulators, and replacing them with new alternators and regulators in accordance with STC SA 334 SW. At that time, he updated the airplane's equipment list as follows:

Equipment on Aircraft:

1 Narco MK 12 (nav/comm transceiver)
1 Narco VOA 5 (omni-localizer indicator)
1 Narco Power Supply
1 Narco ADF 140 (automatic direction finder)
1 ADF Loop (antenna)

A second Narco MK 12 nav/comm transceiver was found in the airplane wreckage, but no record of its installation was located. It is possible that that record was in the airplane at the time of the accident.

APPENDIX E

14 CFR 91.116 AND AMENDMENT 91-173 TO 14 CFR 91

INSTRUMENT FLIGHT RULES

§ 91.115 ATC clearance and flight plan required.

No person may operate an aircraft in controlled airspace under IFR unless—

(a) He has filed an IFR flight plan; and

(b) He has received an appropriate ATC clearance.

§ 91.116 Takeoff and landing under IFR.

(a) *Instrument approaches to civil airports.* Unless otherwise authorized by the Administrator for paragraphs (a) through (k) of this section, when an instrument letdown to a civil airport is necessary, each person operating an aircraft, except a military aircraft of the United States, shall use a standard instrument approach procedure prescribed for the airport in Part 97 of this chapter.

(b) *Authorized DH or MDA.* For the purpose of this section, when the approach procedure being used provides for and requires use of a DH or MDA, the authorized decision height or authorized minimum descent altitude is the DH or MDA prescribed by the approach procedure, the DH or MDA prescribed for the pilot in command, or the DH or MDA for which the aircraft is equipped, whichever is higher.

(c) *Operation below DH or MDA.* Where a DH or MDA is applicable, no pilot may operate an aircraft, except a military aircraft of the United States, at any airport below the authorized MDA or continue an approach below the authorized DH unless—

(1) The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers, and for operations conducted under Part 121 or Part 135 unless that descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing;

(2) The flight visibility is not less than the visibility prescribed in the standard instrument approach procedure being used;

(3) Except for a Category II or Category III approach where any necessary visual reference requirements are specified by the Administrator, at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot:

(i) The approach light system, except that the pilot may not descend below 100 feet above the touchdown zone elevation using the approach lights as a reference unless the red terminating bars or the red side row bars are also distinctly visible and identifiable.

(ii) The threshold.

(iii) The threshold markings.

(iv) The threshold lights.

(v) The runway end identifier lights.

(vi) The visual approach slope indicator.

(vii) The touchdown zone or touchdown zone markings.

(viii) The touchdown zone lights.

(ix) The runway or runway markings.

(x) The runway lights; and

(4) When the aircraft is on a straight-in nonprecision approach procedure which incorporates a visual descent point, the aircraft has reached the visual descent point, except where the aircraft is not equipped for or capable of establishing that point or a descent to the runway cannot be made using normal procedures or rates of descent if descent is delayed until reaching that point.

(d) *Landing.* No pilot operating an aircraft, except a military aircraft of the United States, may land that aircraft when the flight visibility is less than the visibility prescribed in the standard instrument approach procedure being used.

(e) *Missed approach procedures.* Each pilot operating an aircraft, except a military aircraft of the United States, shall immediately execute an appropriate missed approach procedure when either of the following conditions exist:

(1) Whenever the requirements of paragraph (c) of this section are not met at either of the following times:

(i) When the aircraft is being operated below MDA; or

(ii) Upon arrival at the missed approach point, including a DH where a DH is specified and its use is required, and at any time after that until touchdown.

(2) Whenever an identifiable part of the airport is not distinctly visible to the pilot during a circling maneuver at or above MDA, unless the inability to see an identifiable part of the airport results only from a normal bank of the aircraft during the circling approach.

(f) *Civil airport takeoff minimums.* Unless otherwise authorized by the Administrator, no pilot operating an aircraft under Part 121, 123, 125, 129, or 135 of this chapter may take off from a civil airport under IFR unless weather conditions are at or above the weather minimums for IFR takeoff prescribed for that airport under Part 97 of this chapter. If takeoff minimums are not prescribed under Part 97 of this chapter for a particular airport, the following minimums apply to takeoffs under IFR for aircraft operating under those parts:

(1) For aircraft having two engines or less—1 statute mile visibility.

(2) For aircraft having more than two engines—½ statute mile visibility.

(g) *Military airports.* Unless otherwise prescribed by the Administrator, each person operating a civil aircraft under IFR into or out of a military airport shall comply with the instrument approach procedures and the takeoff and landing minimums prescribed by the military authority having jurisdiction of that airport.

(h) *Comparable values of RVR and ground visibility.* (1) Except for Category II or Category III minimums, if RVR minimums for takeoff or landing are prescribed in an instrument approach procedure, but RVR is not reported for the runway of intended operation, the RVR minimum shall be converted to ground visibility in accordance with the table in paragraph (h)(2) of this section and shall be the visibility minimum for takeoff or landing on that runway.

(2)

RVR (feet)	Visibility (statute miles)
1,600	¼
2,400	½
3,200	⅝
4,000	¾
4,500	⅞
5,000	1
6,000	1¼

(i) *Operations on unpublished routes and use of radar in instrument approach procedures.* When radar is approved at certain locations for ATC purposes, it may be used not only for surveillance and precision radar approaches, as applicable, but also may be used in conjunction with instrument approach procedures predicated on other types of radio navigational aids. Radar vectors may be authorized to provide course guidance through the segments of an approach procedure to the final approach course or fix. When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, shall, in addition to complying with § 91.119, maintain the last altitude assigned to that pilot until the aircraft is established on a segment of a published route or instrument approach procedure unless a different altitude is assigned by ATC. After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC. Upon reaching the final approach course or fix, the pilot may either complete the instrument approach in accordance with a procedure approved for the facility or continue a surveillance or precision radar approach to a landing.

(j) *Limitation on procedure turns.* In the case of a radar vector to a final approach course or fix, a timed approach from a holding fix, or an approach for which the procedure specifies "No PT", no pilot may make a procedure turn unless cleared to do so by ATC.

(k) *ILS components.* The basic ground components of an ILS are the localizer, glide slope, outer marker, middle marker, and, when installed for use with Category II or Category III instrument approach procedures, an inner marker. A compass locator or precision radar may be substituted for the outer or middle marker. DME, VOR, or nondirectional beacon fixes authorized in the standard instrument approach procedure or surveillance radar may be substituted for the outer marker. Applicability of, and substitution for, the inner marker for Category II or III approaches is determined

Amendment 91-173
Takeoff and Landing Minimums
Adopted: December 30, 1980 **Effective: May 8, 1981**

(Published in 46 FR 2280, January 8, 1981)

SUMMARY: These amendments clarify the conditions under which a pilot may approach and land at an airport when the weather conditions do not allow the pilot to see the runway until shortly before landing. They also add certain requirements that must be met before a pilot may take off an air carrier aircraft in weather conditions that limit the pilot's visibility. These amendments are necessary to clarify the regulations and to provide the additional requirements needed for operating an aircraft safely under these weather conditions.

FOR FURTHER INFORMATION CONTACT:

Harold E. Smith, Regulatory Projects Branch (AVS-24), Safety Regulations Staff, Associate Administrator for Aviation Standards, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C. 20591; telephone (202) 755-8716.

SUPPLEMENTARY INFORMATION:

NOTICE OF PROPOSED RULE MAKING

These amendments are based on Notice of Proposed Rule Making (NPRM), Notice No. 80-4, published in the *Federal Register* on March 6, 1980 (45 FR 14802.) All interested persons have been given an opportunity to participate in the making of this rule and due consideration has been given to all information submitted. Except for the changes discussed below these amendments and the reasons for their adoption are the same as those stated in Notice 80-4.

EFFECTIVE DATE OF AMENDED RULE

This rule is effective May 8, 1981, to provide for public dissemination of its provisions and to conduct the necessary pilot education regarding compliance.

BACKGROUND

Part 97 of the Federal Aviation Regulations prescribes standard instrument approach procedures for instrument letdown to many airports in the United States and prescribes the weather minimums applicable to takeoffs and landings under instrument flight rules (IFR) at those airports for which procedures are prescribed. Rules applicable to the use of these instrument approach procedures previously were set out in §§ 91.6, 91.116, and 91.117 and for air carriers in §§ 121.651, 121.653, and 135.225. A recent addition of a new Part 125 of the Federal Aviation Regulations adds a § 125.381 for operation of certain large airplanes other than under Parts 121 or 135. Section 91.116(b) prohibited a person from landing an aircraft using a Part 97 instrument approach procedure unless the visibility is at or above the landing minimum prescribed for the particular procedure. Section 91.117(b) prohibited a person from operating an aircraft below the prescribed minimum descent altitude (MDA) or from continuing an approach below the decision height (DH) unless certain conditions are met. The conditions specified that to continue descent the aircraft must be in position from which a normal approach to the runway of intended landing can be made, and the approach threshold of that runway, or approach lights or other markings identifiable with the approach end of that runway, must be clearly visible to the pilot. It also required that the pilot execute the appropriate missed approach procedure if the requirements of that paragraph were not met when the pilot reached the missed approach point or DH or at any time after that. Sections 121.651 and 121.653 formerly specified, and § 135.225 currently specifies, the conditions in which air carrier and commercial operator aircraft may initiate an approach if weather conditions are above published minimums, and they provide exceptions when weather conditions deteriorate below minimums while an approach is in progress.

A regulatory project was initiated in 1968 to clarify certain requirements applicable to instrument approach procedures and some of the landing rules discussed above. Notice 72-17 was issued on July 12, 1972, and a withdrawal notice was issued on December 7, 1975, due to adverse comments regarding the proposed elimination of the "look-see" privileges for Part 91 operators. An effort was initiated to resolve other changes needed to update the rules to be consistent with present standards. Comments received on Notice 72-17 were considered and changes made where appropriate for those sections of the rule being revised. Notice 80-4 was issued on March 6, 1980. Comments were received, reviewed, and necessary changes were made in the preparation of this final rule.

NEED FOR AMENDMENTS

The revised rules, including §§ 1.1, 91.6, 91.116, and 121.651, are necessary based on operating experience to ensure an appropriate level of safety in instrument approaches and landings, and are necessary to clarify certain rules which, in some cases, have been misinterpreted. Other changes are necessary to make administrative corrections to the rules, to update them, or to make them consistent with current FAA and aviation system policies and practices. Any additional changes that may be needed to update § 135.225 or the recently issued § 125.381 to be consistent with the revised §§ 91.116 and 121.651 may be taken in a subsequent rulemaking proceeding.

Approach and landing accidents are the largest single cause of air carrier passenger fatalities and also represent a significant percentage of general aviation fatalities. Between 1964 and 1975, the National Transportation Safety Board recorded 259 air carrier approach and landing accidents which constituted 41% of the total number of air carrier accidents and 46% of the fatalities. Excluding the area of very low visibility approaches conducted under Category II and III where special equipment, training, and approval procedures are used resulting in a good safety record, 62 of these accidents occurred when the reported weather conditions were less than a ceiling of 1,200 feet and 3 miles visibility. Forty-six of these involved ceilings of less than 600 feet and visibility of less than 1½ miles. The following factors were cited as causing, or possible factors contributing to, the 62 accidents: continuation of the descent below the MDA or the DH with inadequate visual cues; unrecognized altitude loss or descent rate; disorientation; collision with obstacles well below the normal descent path; visual illustration; failure to monitor or cross check altitude; inadvertent descent below the glide slope; loss of sight of the runway while below the MDA or the DH; failure to initiate a missed approach; and other factors related to lack of adequate visual reference. Since 1975 investigations of numerous incidents and accidents, such as the 1979 commuter air carrier accidents at Hyannis, Massachusetts and Rockland, Maine, indicate the inappropriate use of limited visual references during approach and landing. Pilot use of inappropriate visual references also occurs in general aviation operations. For example, data from the FAA's General Aviation Accident Data System for 1979 indicate that use of inadequate visual references during the landing phase may have been a contributing factor in at least 35 accidents. Accordingly, the FAA is revising, clarifying, and combining provisions regarding takeoff and landing under IFR now in § 91.116 and the limitations on the use of instrument approach procedures now in § 91.117 into a revised § 91.116 entitled "Takeoff and landing under IFR." New § 91.116 generally redesignates former paragraphs (c) through (f) as paragraphs (f) through (i) and makes necessary revisions throughout all paragraphs. Similar provisions in the former § 91.6(c) regarding Category II operations are clarified and in some cases revised to be consistent with current practice and the revised § 91.116.

Specific Changes to the Rule and Discussion of Comments

Fifty-five comments were submitted to the docket in response to Notice 80-4, representing the views of individuals, companies, associations of U.S. airlines, pilots, and manufacturers, various government organizations, and a consumer interest group. The comments largely favor the general intent of the rule but since the vast majority of comments include recommendations for revision of one or more sections, it is difficult to

categorize the comments as a concurrence or nonconcurrence with the proposals in the notice. The problem of resolving the comments is compounded by the fact that any attempt to favorably resolve or adopt some suggestions would contradict or cause further complications with others. Although many commenters identify areas in which revisions should be made in the rule, very few offer specific suggestions that would resolve the alleged problem without making the rule so general that it would have little or no effect or contradict some other viewpoint. These issues are discussed in subsequent paragraphs referring to specific comments on the proposed rule.

It should be noted, however, that most comments submitted reflect a good appreciation for both the technical aspects of these rules and the difficulty of regulating in this area, as well as the need for amendment of these regulations. A number of commenters indirectly reinforce the need for rule making in this area because their comments show a misunderstanding of the application of the previous rules, and two commenters appear to misunderstand the rule to the point where they might be conducting operations in violation of the current rules.

Category II and Category III Operations

To appropriately address current FAA and industry practices and achieve uniformity of applications, the FAA is amending the former § 91.6, Category II operation: general operating rules, to extend its requirements to Category III operations. In general, Category III operations are conducted in accordance with an approved instrument approach procedure in visibility conditions less than 1,200 feet runway visual range (RVR) as described in FAA advisory circulars and International Civil Aviation Organization standards and recommended practices. A conforming change is made in Part 1 to include a definition of Category III operations. Previous changes to § 91.6, involving Category II operations, were made when the FAA did not have sufficient operating experience available to include Category III provisions. This is no longer the case since U.S. Category III operations have been conducted for over 8 years and regulatory safeguards similar to those for Category II operations are appropriate because administratively both types of operations are implemented in a similar way. For Parts 121, 125, and 135 operators, Category II and Category III authorizations are made under operations specifications provisions in those parts. Part 91 operators obtain letters of authorization from FAA district offices. For § 91.6(b) to apply to both Category II and Category III operations, references to ground equipment, inoperative components, and specific RVR locations and RVR readings are deleted. However, a minor change from the revisions proposed in the notice in paragraph (b) is made to delete additional references to ground components. Based on commenters' suggestions and further FAA review, the specific list in the former § 91.6(b), second sentence, is unnecessary because it is redundant to either the procedure itself, the specific authorization to conduct the operation, or because any adjustments to minimums are published in the Notices to Airmen. Including these references in § 91.6 is unnecessary because RVR inoperative components and ground equipment requirements are specifically provided for in the revised § 91.116(k), approved instrument approach procedures under Part 97, and Category II and Category III authorizations, when appropriate.

Section 91.6(d) is revised to provide definitive guidance for the pilot conducting the approach by explicitly stating those visual references the sighting of which permits the continuation of an approach below the authorized DH, when the approach procedure provides for a DH. The visual references are the same as those required in the revised § 91.116, with the exception of the runway end identifier lights and visual approach slope indicator (VASI) which are not appropriate visual references for a Category II or Category III operation. VASI's and runway end identifier lights generally are installed on runways which do not have electronic glide slope guidance.

Under § 91.6(d)(2)(i) the approach lights may be used as a visual reference to 100 feet above the touchdown zone elevation. Thereafter, the approach lights may be used as a visual reference for continued descent only if either the red terminating bars or the red

side row bars also are distinctly visible and identifiable. This provision is appropriate because of the characteristics of approach light systems with sequenced flashing lights in Instrument Landing System Category I configuration (ALSF I) or Category II configuration (ALSF II) which are designed so that the pilot should see these visual references during a Category II approach if at least landing minimums weather conditions are present. Either the ALSF I or ALSF II approach light system may be used at present for Category II operations.

The pilot should see one of the visual references specified in § 91.6(d)(2): (1) at, or before reaching, 100 feet above the touchdown zone during a Category II approach, or (2) at, or before DH during a Category III approach which requires use of a DH. Therefore, if the pilot does not see one of these visual references, Category II and Category III approach procedures that use a DH require the pilot to execute a missed approach.

One commenter states that sighting of the red terminating bars of an ALSF I approach light system may not be certain in cases of wide-body aircraft conducting a Category II approach when weather is at minimums. While this may be valid in certain unusual instances, the requirement to see the red terminating bars as a condition for continuation below 100' is necessary to ensure that appropriate visual references is present. Further, this situation is rare because only a few aircraft types are involved, and weather conditions would have to be uniform, and exactly at minimums for this situation to occur. Further, only some runways used for Category II have the ALSF I lighting system, and the FAA is in the progress of upgrading the ALSF I approach light systems to the ALSF II configuration for which the situation described by the commenter does not occur.

For Category III approaches which do not specify a DH, any necessary provision for application of landing minimums will be listed in the operations specifications or letter of authorization covering the operation. A number of commenters express concern relative to the fact that proposed § 91.6 does not clearly distinguish between fail-passive Category III operations which apply a DH and fail-operational Category III operations without a DH. A new § 91.6(f) is added to clearly distinguish and acknowledge the requirements for operations without a DH. An additional qualification is also added to § 91.6(c) to clarify that the decision height provision of § 91.6(c) does not apply to those Category III operations which do not use a decision height.

Commenters suggest, and the FAA agrees, that a further clarification is necessary for terminology previously used in § 91.117(b)(1) and proposed under §§ 91.6(d)(1), 91.116(b)(1), and 121.651(c)(1) regarding a normal descent to the runway. In addition to the former provision that for continuation of a descent the aircraft must be "continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers," another provision is added. The phrase "and where (such a) descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing" is added to clarify the intent of the former wording requiring a "normal approach to the runway of intended landing". The provision is applied for all landings in Category II or Category III and for Part 121 and 135 operations. For Part 91 and 125 operations, in other than Category II or Category III landings, this provision is not mandatory because there are aircraft types, runways, and circumstances where the additional requirement may not always be necessary for safety. Thus, the provision of § 91.116(c)(1) for touchdown in the touchdown zone is limited to Part 121 and 135 operators and for all approaches in Category II and Category III. However, it should be noted that compliance with the provision to "touchdown in the touchdown zone" is a good operating practice for all operations. The fact that it is not mandatory for Part 91 operations should not be taken as an encouragement to complete an approach by a steep descent and touchdown beyond the touchdown zone because visual references on an approach such as a nonprecision approach are not acquired until well after passing the visual descent point (VDP), or near the missed approach point.

Use of the word "touchdown" in the context of § 91.6(d)(1), § 91.116(c)(1), or § 121.651(d)(1) regarding the requirement for a normal descent to a landing is appropriate to denote the particular event (touchdown) which must take place within the touchdown zone.

Use of the word "landing" in this instance could be incorrectly taken to include other siutations such as flare or rollout to a full stop, a touch and go, or landing to the point of turnoff from runway which may or may not completely take place within the touchdown zone. Thus the word "touchdown" is used in § 91.6(d)(1) and §§ 91.116(c)(1) and 121.651(d)(1) even though the word "landing" is retained in other provisions of §§ 91.6, 91.116, and 121.651.

Other comments on the proposed changes to §§ 1.1 and 91.6 are generally supportive. A number of minor revisions were suggested such as including in the definition of "Category III operations" in § 1.1 the term "landing on" the runway in addition to an "ILS approach" to the runway. This suggestion is adopted since Category III operations specifically provide for safe rollout in reduced visibilities as well as a safe approach to touchdown. However, it should be noted that the case of a Category III approach which terminates in a missed approach rather than a landing is still considered to be a Category III operation even though a landing may not be completed.

Based on other comments, the words "straight-in" in proposed § 1.1 in conjunction with an ILS approach are unnecessary for the definition of a CAT III operation since the other type of approach is a circling approach and there are no CAT III circling approaches. Thus the term "straight-in" is deleted.

References to Part 125 are added to §§ 91.6 and 91.116 to be consistent with issuance of the new Part on October 2, 1980. Part 125 is effective February 3, 1981.

The changes to §§ 1.1 and 91.6 are adopted as proposed and discussed above to uniformly apply the criteria used under current operations specifications and letters of authorization and appropriately update the rules to be consistent with current FAA and industry practice.

Landing

Section 91.116(b) prohibited a person operating an aircraft (except a military aircraft of the United States) from landing that aircraft using a standard instrument approach procedure prescribed in Part 97 unless the visibility is at or above the landing minimum prescribed in that Part for the procedure used. The revised rule clarifies this point to specify that no pilot may operate an aircraft below MDA or DH unless the "flight visibility is not less than the visibility prescribed in the standard instrument approach procedure being used." This revised requirement is necessary to make it clear that the visibility referred to is the visibility from the aircraft. Section 91.116(c)(2) and (c)(3) also make it clear that the pilot must have this flight visibility from descent below MDA or DH until touchdown.

In particular need of clarification is the phrase "other markings identifiable with the approach end of the runway" found in the former §§ 91.117(b)(2) and 91.6(c)(2). In some instances, pilots interpret this phrase to include towers, smoke stacks, buildings, and other landmarks which may be located far from the end of the runway, and pilots may be descending below the MDA using these landmarks. This language also has been interpreted erroneously by some pilots to allow the use of a series of landmarks as progress points for instrument approaches. Use of such landmarks can result in mistaken identification of position or aircraft flight path.

To correct these practices, the revised rule specifies the visual references which are intended to allow descent below MDA or DH. The rule now precludes use of references not listed, which under the previous rule may sometimes have been used as the basis for continued descent even though they were not appropriate. Accordingly, revised § 91.116(c) prohibits descent below MDA and the continuation of an approach below DH unless at least one of the following is distinctly visible to and identifiable by the pilot for the intended runway: approach light system; threshold; threshold markings; threshold lights; runway end identifier lights; visual approach slope indicator; touchdown zone; touchdown zone markings; touchdown zone lights; runway or runway markings; or runway lights.

In Notice 80-4 the words "clearly visible" are used. However, commenters note, and the FAA agrees, that in low visibility operations visual references could rarely be considered clearly visible in the strict sense of the word due to factors such as the distortion of rain on the windshield, backscattered light of landing lights, and other reasons. The words "distinctly visible and identifiable" were suggested by commenters and are adopted because they appropriately denote the intention that the visual references be discrete and unmistakably identifiable. The change from "clearly visible" to "distinctly visible and identifiable" should not be taken to mean that descent below MDA or DH can be based on general glow of approach lights through a layer of fog or other obscurations where the visual references themselves are not discretely identifiable.

In accordance with concerns expressed by several commenters, an exclusion is added to § 91.116(c)(3) which limits applicability of this provision to approaches other than Category II or III. This is necessary to address possible misinterpretations of the applicability of § 91.116(c)(3) regarding Category II and Category III visual reference requirements. The commenters note, and the FAA agrees, that visual aids such as runway end identifier lights or VASI are not appropriate aids on which to base continuation of a Category II or Category III approach and that operations specifications, letters of authorization, or § 91.6(d)(2) provide the means to address any necessary limitations or conditions that may be appropriate in lieu of § 91.116(c)(3).

To preclude premature descents and unnecessary maneuvering at low altitudes, an additional requirement is added to § 91.116(b) for straight-in, nonprecision instrument approach procedures. For approaches which incorporate a VDP, the rule provides that the pilot may not descend below MDA until the VDP is reached if the pilot has the means to establish that point and if a normal descent to the runway can be made from that point. However, since the Department of Defense, Air Transport Association, and other commenters express concern over certain aspects of the VDP provisions of § 91.116(b)(2) as proposed, an additional exception is added. The comments suggest that the inflexible provisions of the proposed rule limit initiation of descent prior to reaching the VDP, which may adversely affect safety in cases where descent prior to the VDP is necessary to maintain a normal descent profile to the runway. A review of these comments results in the identification of cases where certain combinations of aircraft types, approach speeds, flap settings, and descent rate capability taken with possible VDP placement could possibly lead to abnormal descents from MDA to the runway if strict compliance with the rule as proposed in the notice is necessary. The commenters note, and the FAA agrees, that literal compliance with the proposal to "never descend until reaching the VDP" could adversely affect safety in unusual cases where the normal descent gradient and use of normal procedures requires the initiation of a descent shortly before reaching the VDP for some aircraft types or circumstances. Examples of situations in which it may be necessary for a pilot to descend shortly before reaching the VDP would be the case of an aircraft making a no flap approach, or an aircraft that must maintain a more shallow descent angle to provide for power settings compatible with engine anti-ice requirements. Therefore, the rule allows an exclusion in cases where literal compliance with the requirement to delay descent until passing the VDP is not appropriate for certain aircraft because it would lead to an abnormal descent path to the runway, high rates of descent, or other unusual piloting procedures if descent is delayed until reaching the VDP.

One commenter questions the applicability of the VDP provisions of proposed § 91.116(b)(2) to Part 121 operations because the VDP provisions were not repeated in proposed § 121.651. Since no exclusion of particular operations was proposed, the VDP provisions of § 91.116(c)(4) as adopted apply to Part 91, 121, 125, 135 and other operators conducting a Part 97 approach procedure. However, to clarify this issue and prevent further misunderstanding in the special case of continuation of an approach in deteriorated weather, VDP provisions are repeated in § 121.651(c)(4).

In § 91.116(c) the qualification "where an MDA or DH is applicable" is added to clearly relate the use of the MDA or DH to the specific procedure used. In cases where both an MDA or DH are provided in a single procedue, such as an ILS or localizer approach, or where either a DH or MDA is not provided, this qualification clarifies the use of either the MDA or DH as appropriate to the specific type of approach used.

The terminology used in § 91.6(d)(2)(i) regarding the limitations on use of approach lights as an exclusive condition for descent below 100' is added for consistency in §§ 91.116(c)(3)(i), 121.651(c)(3)(i), and 121.651(d)(3)(i) because of the design of lighting systems and instrument approach procedures. When an aircraft is at or below 100' above the touchdown zone, the red side row bars on an ALSF II approach light system, red terminating bars of the ALSF I approach light system, or the threshold or other references listed in § 91.116(c)(3) should be in sight. If the approach is flown to a runway which does not have one of the two approach light systems mentioned above, then at or below 100' one of the other references in § 91.116(c)(3) must also be in sight to continue descent to a landing. For other than Category II or III, regardless of the type of straight-in or nonprecision approach flown, when at or below 100' above the touchdown zone, one of the visual references specified in § 91.116(c)(3)(ii) through § 91.116(c)(3)(x) should be visible if flight visibility is at or above the specified minimums. Conversely, if the approach lights are visible, but red terminating bars or red side row bars are not visible either due to poor visibility or because they are not installed, and the other visual references specified in § 91.116(c)(3) are not visible either, then regardless of the type of approach (other than Category II or III) the flight visibility is substantially less than minimums and continued descent below 100' may not be safe and is not appropriate. Further, to apply the provision to see the red side row bars or red terminating bars only to runway may occur during rare instances in which a missed approach must be conducted from a very low altitude. This inadvertent contact may result even though proper procedures are used. This contact is not considered to be landing the aircraft within the meaning of § 91.116(d), and special piloting techniques or procedures are not required to avoid contact by the wheels with the runway under these circumstances. Therefore, most of the detailed references to touchdown are deleted in favor of the word "land" in §§ 91.6, 91.116, and 121.651. Retention of the word "touchdown" in §§ 91.116(c)(1) and 121.651(d)(1) is discussed in the section under § 91.6(d)(1).

One commenter indicates that retaining the provision for pilot determination of visibility does not improve safety because of the possibility of distraction of the pilot. However, there is no evidence that this responsibility alone has caused an unsafe condition. In fact, accident statistics and reports indicate the opposite is true. Causal factors of some accidents appear to be related to continued pilot descent below MDA or DH with only limited visual contact and inadequate reference to safely continue the approach to a landing. Thus, §§ 91.116(c)(2) and 91.116(d) retain the concept of pilot determination of the specified visibility and clarify the frequently misunderstood point that the visibility referred to is flight visibility.

Missed Approach Procedures

Additional missed approach requirements are added in § 91.116(e) to preclude unsafe situations resulting from misidentification of ground references. For the same reasons stated for retaining of the provisions of flight visibility in §§ 91.116(c)(2) and 91.116(d), a missed approach is required whenever the flight visibility required by paragraph (c)(2) is lacking, even though the pilot may have one of the visual cues required by paragraph (c)(3) distinctly in sight. A pilot is also required to follow an appropriate missed approach procedure whenever an identifiable part of the airport is not distinctly in sight during a circling maneuver.

Some commenters express concern that the FAA's use of the general term "identifiable part of the airport" in the circling maneuver provision of § 91.116(e) is inconsistent with the FAA's statement that the former § 91.117(b)(2) regarding "markings identifiable with the approach end of the runway" was inadequate and needed revision. However, these two cases are not contradictory. Formerly there were no regulatory provisions during a circling approach restricting a pilot to maintain visual contact with the airport. The revised rule adds the "identifiable part of the airport" requirement to preclude situations where the circling maneuver could be conducted far from the airport with the possibility of misidentification of landmarks not associated with

the airport. Since the circling approach provisions of § 91.116(e) specifically refer to a "part of the airport," the misinterpretation associated with the former § 91.117(b)(2) should not occur.

Some commenters express concern that the wording of proposed § 91.116(e) requiring visual contact with the airport during a circling approach might be interpreted to unnecessarily restrict pilots in the selection of a circling maneuver after establishing visual contact and while maneuvering to the point of descent from MDA for final alignment with the landing runway. However, revised § 91.116(e)(2) does not impose additional restrictions on pilots regarding selecting the direction of turn or the type of turn, such as a teardrop, 80°-260° turn, or standard traffic pattern. Such choices of a circling approach maneuver should be selected by the pilot based on good operating practice and are restricted only by limitations that may be specified in the standard approach procedure itself. There is no implication that the rule requires any particular type or direction of turn to maintain visual contact based on angle of sight or windshield view for the pilot or co-pilot depending on which pilot may be flying the approach or other such factors. Good operating practices described in the Airman's Information Manual or other instrument flight training references may continue to be used and are encouraged.

Another subject on which comments were received relates to the § 91.116(e) requirement to immediately initiate an "appropriate" missed approach if visual reference is lost. The commenters correctly note that it is unsafe in some cases to initiate an immediate missed approach which strictly follows the published procedure. This, however, is the reason why the word "appropriate" missed approach is used. Under § 91.116(e) pilots must continue to be aware that the published missed approach procedure provides obstacle clearance only when the missed approach is conducted on the missed approach segment from or above the missed approach point. If the aircraft initiates a missed approach at a point prior to the missed approach point, from below MDA or DH, or on a circling approach, obstacle clearance is not necessarily provided by following the published missed approach procedure. In this situation obstacle clearance is the pilot's responsibility. When a missed approach is initiated in this situation, the pilot must consider other factors such as the aircraft's geographical location with respect to the prescribed missed approach point, direction of flight and/or minimum turning altitudes in the prescribed missed approach procedure, aircraft performance, visual climb restrictions, charted obstacles, IFR departure procedures, takeoff visual climb requirments as expressed by nonstandard takeoff minima, or other factors not specifically expressed by the approach procedures. During a missed approach, the aircraft must be on, or must reintercept, a published segment of the procedure at or above the altitude specified in the procedure, and must maintain a climb gradient equal to or greater than the standard (1:40 or 2.5%) unless otherwise published, for obstacle clearance to be ensured by the published missed approach procedure alone. For these reasons the wording of former § 91.117(b)(2) with respect to an "appropriate" missed approach is retained in § 91.116(e).

Due to the need for exclusions approved by the Administrator, and to consolidate provisions for alternate approvals, the authority of the Administrator in sections of § 91.116, for approval of a circling maneuver where a part of the airport may not be in sight is removed from this section. Such approval is now included under § 91.116(a) in the general provisions for alternate approvals by the Administrator for § 91.116(a) through (k).

Procedure Turns

As described in the notice, due to the possibility of misinterpretation, the current limitation on procedure turns is revised in § 91.116(j) to more clearly require the pilot to obtain an Air Traffic Control (ATC) clearance before making a procedure turn under specified conditions. The former § 91.116(h) required the pilot simply to advise ATC of his intention to make a procedure turn when final clearance is received. The revised rule specifies that such a clearance must be issued by ATC. This precludes situations in which the pilot advises ATC but due to communication difficulties ATC does not receive the request or cannot comply with the pilot's request. In addition, the reference to the

designation "FINAL" in the former § 91.116(h), which is no longer used in the context of limitations on procedure turns, is deleted from this provision.

The words "final approach course" have been adopted in § 91.116(j) to be consistent with terminology used in instrument approach and air traffic control procedures rather than the term "final approach segment" used in the notice.

A question was raised regarding applicability of revised § 91.116(j) for a case where the segment of an instrument approach being flown does not specify a "No procedure turn (No PT)" limitation, but other transition segments for the procedure not used by the aircraft do have the limitation. A procedure turn may be made following segments not limited by the "No PT" restriction, but a procedure turn is prohibited unless ATC clearance is received for those segments to which the "No PT" limitation applies. No major comments suggest changing this proposed provision and it is adopted as proposed.

Inoperative or Unusable Components and Visual Aids

The revised rule incorporates the substance of § 91.117(c), Inoperative or unusable components and visual aids, into § 91.116(k), except the inoperative component tables are deleted. Making the increased minimums mandatory by those tables is unnecessary because the essential limitations are uniformly being incorporated into the instrument approach procedures under Part 97 where necessary.

A number of commenters question the philosophy and method of dealing with the middle marker as an inoperative component of an ILS as proposed. A major supplier of instrument approach procedure charts points out that it is unnecessary to uniquely consider middle marker outages in landing rules. Instead the regulatory means for accommodating middle marker beacon outages should be the same as that used for other components such as approach lights. Further consideration of this point indicates that the comment is valid and that middle marker inoperative situations are not unique in terms of the need for adjustments to minima. Safety can be maintained and such outages can be more appropriately handled by the same administrative means as other inoperative components, such as through the U.S. standard for Terminal Instrument Procedures, in combination with inclusion on FAA 8260 series forms which define Part 97 instrument approach procedures and establish minimums. This provides an equivalent regulatory basis for any adjustments necessary to minimums due to the middle marker being inoperative, but allows the adjustments to be processed and implemented with the same procedures as for approach lights or other items. It also standardizes, simplifies, and increases the likelihood of correct application of these provisions by pilots. Other commenters also point out that provisions for inoperative components, including unusable middle markers, may be adequately addressed through Part 97 instrument approach procedures as defined by FAA Form 8260. Therefore, inoperative component tables may continue to be published as a description of the adjustments made to approach procedures, but they would be based on United States Standard for Terminal Instrument Approach (TERPS) or used for training or informational purposes since the procedure itself specifies any necessary limitations. Accordingly, the middle marker inoperative adjustments are removed from § 91.116 and any necessary adjustments are accommodated in the same way as lighting or other inoperative components as part of the Part 97 instrument approach procedure or Notices to Airmen.

Since § 91.116(f) is deleted, the Department of Defense suggestion to add a military exclusion for the middle marker inoperative situation in the revised § 91.116 is unnecessary. Any special provisions for military use of civil approach procedures which specify minimums adjustments may continue to be appropriately addressed or waived by the military as necessary, and development of military standard approach procedures may be done in accordance with applicable military directives. Other than for explanation of civil approach procedure applicability and use when military aircraft land at civil airports, no provision of § 91.116 regarding elimination of the inoperative components table from § 91.116(f) requires a change to military procedures.

ILS Components

New § 91.116(k) describes the basic components of an ILS and specifies what airborne and ground equipment may be substituted for those components. As proposed, these components include the localizer, glideslope, outer marker, and middle marker. For consistency, provisions are also added to the rule to address the applicability of the inner marker for Category II and Category III operations since commenters appropriately note that the former § 91.117(c) and the notice did not specifically provide for these cases. Applicability and substitution provisions are added to § 91.116(k) for the inner marker for Category II and Category III to ensure that the provisions of § 91.116(k) are complete and consistent with current practice.

Other Comments on Section 91.116

In several provisions of § 91.116, the phrase "except a military aircraft of the United States" is added to accommodate Department of Defense comments and requirements.

Some comments indicate that the rule is too specific and should be kept only as a good operating practice, or that certain provisions of the rules should not apply to particular operators such as helicopter operations. However, comments such as these do not have supporting evidence and are vague or general and request further relaxation of the rule. It is not clear how the FAA can delete flight visibility and visual reference requirements from § 91.116 and still provide the necessary safety provisions in view of the poor accident and incident record discussed in Notice 80-4. The purpose of this rulemaking is to clarify and make changes to the rules to increase safety. Therefore the provisions of § 91.116 described in the notice are retained with the revisions noted in the previous paragraphs. The revisions include clarification of flight visibility, specific listing of visual references, incorporation of provisions limiting descent prior to reaching a VDP, and deletion of the inoperative components table in § 91.117 as redundant with Part 97, and provisions of TERPS.

Revision of Part 121

For consistency, § 121.651 combines the former takeoff and landing weather minimums for domestic and flag air carriers (§ 121.651) and those for supplemental air carriers and commercial operators (§ 121.653). For the purposes of this section, the operations of domestic, flag, and supplemental carriers are sufficiently similar that the distinction in takeoff and landing minimums is no longer necessary. This is consistent with the reduced emphasis on distinctions among these carriers which results from the Airline Deregulation Act of 1978 (P.L. 95-504) and is responsive to the President's goal of regulatory simplification. Comments on the simplification of these rules are generally supportive. One commenter suggests even further reorganization of these rules to provide separate sections for takeoff and landing minima and to simplify the redundancy between Parts 91, 121, and 135 for takeoff and landing under IFR. Although the FAA recognizes that such reorganization may have merit, it does not appear practical at this time to make such changes without further public comment. Additional action on such proposals may be a subject for future rulemaking.

Section 121.651(a) prohibits a pilot from beginning takeoff when the weather conditions reported by the U.S. National Weather Service, a source approved by that Service, or a source approved by the Administrator, are less than those specified for the takeoff airport in the certificate holder's operations specifications or, if the operations specifications do not contain minimums for the airport, the minimums specified under the Part 97 procedure. This allows weather reports by sources other than U.S. National Weather Service or sources approved by it, but which are approved by the Administrator, to apply for takeoff minimums at foreign airports. Thus this change uniformly applies takeoff minimums where weather is reported by sources approved by the Administrator, as well as at locations having U.S. National Weather Service-operated or approved weather facilities. There were no specific comments identifying problems with this section and the section is adopted essentially as proposed.

Proposed § 121.651(b) clarifies that a pilot at an airport within the United States or at a U.S. military installation which has one of the three specified acceptable weather report sources may not continue an approach past a final approach fix or, if a fix is not established in the standard instrument approach procedure, begin the final approach segment of an instrument approach procedure, unless a weather report is issued for that airport. At foreign airports, weather services for Part 121 operators are approved by the Administrator rather than the U.S. National Weather Service. Thus § 121.651(b) allows initiation of the final approach segment of instrument approaches at foreign airports not having weather reporting facilities under the jurisdiction of the U.S. National Weather Service.

The U.S. National Weather Service expresses concern regarding the language used in § 121.651(b) which states that no person may continue an approach past a final approach fix unless a weather report is issued by the U.S. National Weather Service, a source approved by that service, or a source approved by the Administrator. The concern relates to the fact that it approves weather observations within the United States, whereas the proposed rule also provides for use of sources approved by the Administrator rather than the National Weather Service. However, the provision for approval of the Administrator is necessary in this case, and must be considered in context with current § 121.101(b)(1), and (b)(2), and § 121.119. Sections 121.101 and 121.119 state the conditions under which the Administrator may approve sources of weather reports. Section 121.651(b)(1) and (b)(2) must address operations at airports other than those at which the National Weather Service approves weather observations as provided in § 121.101 and § 121.119. It is therefore necessary to provide for approval of a report by the Administrator in § 121.651 for clarity, to be consistent with established practice, and to be compatible with §§ 121.101 and 121.119.

In § 121.651(b), the provision that "no pilot may . . . *continue an approach past the final approach fix, or where a final approach fix is not used,* begin the final segment of an instrument approach procedure . . ." (emphasis added) is added to provide for the situation where a final approach segment may begin prior to a final approach fix depicted on the procedure. As proposed in such situations an aircraft waiting for a weather improvement above minimums before commencing an approach may have incorrectly held at a point further from the airport than intended because of a misinterpretation of the rule. The adopted rule clarifies the intent that the aircraft in such instances may proceed at least to the depicted final approach fix while waiting for a weather improvement even though some final approach segment in the procedure may begin earlier.

A typographical error regarding the incorrect use of the word "or" versus the correct word "and" is corrected between § 121.651(b)(1) and § 121.651(b)(2) in accordance with the original intent of the provisions of these sections discussed in Notice 80–4.

Sections 121.651(c) and (d), which govern the receipt of a later weather report indicating below minimum conditions and initiation of an approach when weather is below minimums if ILS and precision approach radar (PAR) are used simultaneously is revised. Section 121.651(c) provides that a pilot who has begun the final approach segment of an instrument approach procedure to an airport in accordance with § 121.651(b) and then receives a below minimum report or a pilot who initiates the approach under § 121.651(d) may continue the approach and touchdown if the same safeguards prescribed in § 91.116(c) are met.

The applicable provisions of § 91.116(c) are repeated in §§ 121.651(c) and 121.651(d) to clarify and simplify use of this section without the need to cross reference § 91.116(c). Sections 121.651(c) and (d) are also revised from the wording used in Notice 80–4 to retain the word "landing" in lieu of the word "touchdown" for the same reasons explained in the discussion of § 91.116(d).

Section 121.651(c) provides additional safety in case of deteriorating weather by revising the conditions for continuation of an approach when variable weather may go below minimums after the aircraft has passed the final approach fix. The former

§ 121.651(d)(2) required that aircraft on a nonprecision approach must have reached MDA as a condition for continuation of an approach. This is believed in some instances to have led to aircraft descending to MDA at higher than normal descent rates after passing the final approach fix when weather was variable and deteriorating, to be able to continue the approach if weather was subsequently reported below minima. This practice could encourage high sink rates near the ground and unstabilized approaches due to the pilot's effort to reach MDA soon after passing the final approach fix. Accordingly, § 121.651(c) only applies the condition that the aircraft be past the final approach fix to continue an approach in the situation of deteriorating weather, for both precision and nonprecision approaches, thus encouraging stabilized descents and use of normal descent gradients.

As proposed, the exception of § 121.651(d), allowing initiation of an approach when weather is below minimums if ILS and PAR are simultaneously used, is retained. However, commenters correctly note that air carriers apply this provision rarely and only at a very few airports due to PAR being phased out at civil airports. Further, it is suggested that these provisions are no longer appropriate for air carrier operations. As a result, further revision or deletion of § 121.651(d) may be considered in future rulemaking but the provision is retained at this time.

Section 121.651(d) applies the same safeguards as in § 91.116(c) with the exception of paragraph (c)(4) which relates to operations prior to reaching a VDP in straight-in, nonprecision instrument approach procedures and does not apply in the instance of a precision approach.

The revisions to §§ 121.651(c) and (d) are necessary to be consistent with the revised § 91.116. They upgrade and clarify the requirements for instrument approaches for air carrier operations. They are adopted substantially as proposed in the notice.

Foreign Airports

Finally, a new § 121.651(f) is added to require a pilot making an IFR takeoff, approach, or landing at a foreign airport to comply with the applicable instrument approach procedures and weather minimums prescribed by the authority having jurisdiction over the airport, unless otherwise authorized in the certificate holder's operations specifications. This ensures that U.S. operators comply with appropriate foreign governmental regulations when conducting international operations. No specific comments were received on this section and it is adopted as proposed.

Pilots Continuously Determining Flight Visibility

Based on comments, difficult issues to resolve are the various sections dealing with requirements for the pilot to continuously determine that the flight visibility is not less than the visibility specified in the procedure used (§§ 91.116(b)(3), 121.651(c)(3) and 121.651(d)(3) in the notice and §§ 91.116(c)(2), 121.651(c)(2), and 121.651(d)(2)). Comments on these issues range from strong support for the concept and wording to significant disagreement with the concept. Some commenters state that this provision could adversely affect safety. A main objection to this provision centers on the interpretation of the phrase "continuously determine" flight visibility. It is suggested that this might be interpreted by some to mean that the pilot or pilots cannot conduct a normal cross check of cockpit instruments while below MDA or DH. Use of the term "continuous" in this context is inappropriate if it is taken to mean that scanning of instruments such as airspeed, altitude, and vertical speed is not acceptable in conjunction with scanning of outside visual references. Such an interpretation is certainly not the intent, and if this interpretation is applied, it could very well be detrimental to flight safety. Accordingly, the word "continuously" is dropped from these sections as being potentially confusing and redundant to § 91.116(e) which provides for conditions in which a missed approach must be initiated.

Another point raised in the comments is the fact that pilots do not have a means to numerically assess flight visibility and compare it with the published minimums and that

the list of visual references specified in § 91.116(c)(3)(i) thru (x) is adequate alone. Although these comments are to some degree valid in the sense that visual estimation of visibility by either a pilot or ground observer does require judgment and may not necessarily be numerically exact, it nevertheless remains a concept that provides for the necessary safety during landing. Such assessment of visibility has been the basis for many years for both ground weather observations and pilot use in compliance with the landing minima and visual flight rules. Although alternative concepts such as mandatory use of ground-reported visibility or RVR have been suggested, no other concept adequately replaces the provisions of §§ 91.116(c)(3) and 91.116(d) and provides equivalent safety without further restricting flight operations. The intent of §§ 91.116 and 121.651 is not to remove the requirement for assessment of visibility, but to further clarify its applicability by clearly specifying the often misunderstood point that the rule refers to "flight" visibility as opposed to ground-reported visibility. The associated changes to §§ 91.6, 91.116, and 121.651 provide an increase in safety by explicitly listing the references that must be in sight as a condition for continued descent below MDA or DH even though the pilot may have determined that the required flight visibility is present. Conversely, having one of these specific references in sight is not sufficient alone to safely continue descent if the flight visibility is below minimums. Thus the addition of a specific list of visual references in § 91.116(c)(3) further clarifies the runway environment terminology previously used in § 91.117(b)(2) rather than the long-standing concept of use of flight visibility.

Associated comments relate to the need for slant visual range measurements, and to the relationship between § 121.655, which addresses the precedence of ground-reported RVR in weather reports, and 121.651. A commenter indicates that minima are not and cannot be measured in terms of slant visual range, and that horizontal flight visibility at altitude may be less than the authorized reported visibility observed at ground level.

Regarding the first point, this statement is partially true. The FAA acknowledges that slant visual range (SVR) is not used now, and the FAA agrees with the commenter that there are presently no ground measurement systems available which are practical for operational measurement of SVR. The FAA plans to continue to monitor technical developments in this area for any advances which may overcome the many technical problems and practical limitations which remain. Even if numerous problems with ground measurement of SVR are resolved, it is not clear that having this information in addition to RVR contributes to or is essential for safe descent below MDA or DH. In a number of accident and incident cases, pilots have continued the approach below MDA or DH in spite of the fact that little or no visual reference existed and the pilot observed that slant visibility was poor. It is not clear how providing ground reports of SVR to the pilot would have prevented the accident or incident since the pilot has actual slant visibility information which could not have been provided by a ground sensor as accurately or in real time. Conversely, if the pilots applied the conditions specified in § 91.116(c) which clarifies the applicability of the use of flight visibility and lists acceptable visual references for continuation of descent, the continued descent below MDA or DH in marginal visibility well below that specified in the standard instrument approach procedure would clearly have been inappropriate.

The FAA also does not agree with the commenters' views that assessment of flight visibility is impossible for pilots to do. As pointed out in earlier discussions, for many years pilots have been making such judgments to safely operate aircraft, as well as to comply with former §§ 91.105, 91.116, 121.651, and 121.653, even though such judgments may not be numerically exact. For example § 91.105 requires pilots to estimate horizontal visibilities of 1 mile and 3 miles and to estimate horizontal and vertical distances from clouds of 500 feet, 1,000 feet, and 2,000 feet. Sections 91.116, 121.651, and 91.105 all require pilots to estimate flight visibility in situations where slant range and other factors such as horizontal visibility, aircraft height above ground, obstruction due to fog, rain or snow, scud, low cloud or other restrictions to visibility must be considered.

Regarding the point that horizontal visibility at altitude may be less than the authorized reported visibility at ground level, the FAA agrees. However, this is not

sufficient reason to remove the requirement for assessment of flight visibility from §§ 91.116 or 121.651. In fact, the possibility of this situation is an important reason why revised §§ 91.116 and 121.651 continue to require assessment of flight visibility. Technical literature[1] from a variety of sources suggest instances where slant visibility as seen by the pilot can be very much less than the horizontal visibility at ground level. Thus if the requirement for flight visibility assessment by the pilot is removed, it would be permissible to continue a descent below MDA or DH in the unsafe situation where visibility is reported above minimums and one or more visual references listed in § 91.116(c)(3) may be distinctly in sight but the flight visibility is much less than the visibility specified in the procedure and is inadequate to safely complete the landing.

In all of these cases, the commenters' recommended resolution of the issues appears to be less restrictive than the former rules. The previous §§ 91.116(b) and 121.651(d) required that no person land unless the visibility is at or above (greater than or equal to) the published minimums, and that for continuation of an approach in deteriorating weather for Part 121 operators, the actual weather be at or above published minimums. The commenters' suggested changes to delete sections such as § 91.116(c)(2) or § 121.651(c)(2) relating to flight visibility would lead to the rules permitting the approach to be continued in unsafe conditions.

For example, in a case where weather is reported to be above minimums, if the requirements of § 91.116(c)(2) were deleted and § 91.116(c)(3) regarding visual references alone was met by having one or more of the listed visual references distinctly in sight, a pilot could have continued the approach even though the flight visibility was very poor and much less than the published minimums. This situation is unsafe because the necessary visual reference for assessment or control of the aircraft's approach path may not be present. Other alternatives suggested by commenters, such as making ground-reported weather exclusively controlling, would require unnecessary missed approaches and diversions to alternate airports when weather is better than reported and safe for an approach and landing. The suggestion to make ground-reported RVR or meteorological visibility exclusively controlling for continuation of a descent below MDA or DH could lead to restrictions on operations with little or no overall benefit to safety. An example of this would be the case where the pilot has the listed references of § 91.116(c)(3) distinctly in sight and has determinded that the flight visibility is at or above the published minimums as in § 91.116(c)(2), but the visibility or RVR is reported below minimums due to commonly recognized weather measuring and reporting inaccuracies. In this case, the commenter's suggestion requires an unnecessary missed approach and a diversion to an alternate airport could result.

The comment that § 121.655 establishes precedence of RVR over ground-reported prevailing visibility is correct. However, the commenter's implication that this has any affect on the pilot's assessment of visibility for continuation of an approach below MDA or DH is not valid. Section 121.655 requires that the main body of the weather report, rather than other portions of the report, applies regarding compliance with § 121.651(b) for determining the weather conditions necessary for the initiation of an approach. If an RVR report is currently available, it supersedes other weather reports that may apply to initiation of an approach under § 121.651(b). It does not relieve or take precedence over the pilot's responsibility below MDA or DH to ensure that the required flight visibility exists. Once a pilot has passed the final approach fix, no provision of § 121.655 supersedes the pilot's responsibility to assess visual reference below the MDA or DH. Thus even though a report of RVR may indicate that weather is above minimums and the RVR reports take precedence over other weather reports under § 121.655 for initiating an approach, when below MDA or DH the pilot must, in his judgment, determine that the actual weather conditions are at least equal to the prescribed minimums to continue an approach. Conversely, once past the final approach fix, if the pilot determines that the visual requirements of §§ 121.651(c) and 91.116(c), (d) and (e) are met, the approach may continue and a landing may be made.

[1] Copies of these documents are contained in the docket.

It is important to note the provision to continue an approach below MDA or DH if flight visibility is considered by the pilot to be above minimums and one of the acceptable visual references is in sight is not an encouragement for pilots to deliberately misestimate visibility to land in unsafe conditions with ground reporting prevailing visibility or RVR reported below minimums. The FAA intends to continue to closely review the circumstances related to any landings made when weather is reported below minimums. To assess compliance with §§ 91.116(c) and 121.651(c) and for enforcement cases, the FAA will continue to consider a variety of factors such as ground-reported weather, variability of the weather, reports of other pilots who attempted or completed landings, pilots awaiting departure located in a position to judge visual reference in the area on the touchdown zone, reports of visual reference seen by other crewmembers on the aircraft, air traffic personnel, or ground observer reports, or many other such factors. Should evidence of a poor safety record continue or there be evidence of deliberate disregard of the visual reference provisions of §§ 91.116(c) and 121.651(c), the FAA will reconsider both the applicability and precedence of ground-reported visibility and RVR and the potential applicability of additional rules. If necessary, provisions similar to §§ 121.651(b), 135.225, and 125.381 may then be developed to apply to all operations.

Because of the problems identified with alternatives suggested by commenters and the fact that the primary intent of the proposal is to explicitly state the necessary visual references and make it clear that the visibility referred to is flight visibility, §§ 91.116(c), 91.116(d), 121.651(c), and 121.651(d) are adopted as discussed above.

Special Cases Requiring Authorization of the Administrator

Numerous commenters correctly identify areas in proposed § 91.116 where the Administrator must be able to approve approach procedures which vary from the provisions of § 91.116(a) through (k). For example, in the case of an aircraft operating on a straight-in or circling approach, it is sometimes necessary for an instrument approach procedure to provide for a visual segment from the missed approach point to the airport, as at numerous Alaskan airports and airports such as Palm Springs, California, and Missoula, Montana. Thus the Administrator must retain the authority to approve instrument approach procedures where the pilot may not necessarily have one of the visual references specified in § 91.116(c)(3) in sight. There are other cases where the Administrator's authority to issue special provisions must also be available to approve visual approaches, contact approaches, helicopter procedures, or other items such as waivers for all-weather takeoff and landing research and development. Accordingly, the provisions of former §§ 91.116 and 91.117 regarding the authority of the Administrator to authorize deviations is retained in § 91.116, but is consolidated in § 91.116(a) for applicability to § 91.116(a) through (k).

List of Visual References

One commenter suggests that the list of approved visual references proposed in § 91.116(b)(4) and adopted in § 91.116(c)(3) and § 121.651(c)(3) be expanded to include additional items such as lead-in lights and runway markings. In the case of lead-in lights, the comment is not adopted because there are numerous types of approach light systems, of which lead-in lights are just one type, and each would have to be listed and updated as frequent changes in these systems are made. Since lead-in lights and other such visual aids are specific types of approach lights, and are considered and approved by the Administrator to be credited in an instrument approach procedure, it it unnecessary to specifically list each type. In the case of runway markings, the difference in meaning of "runway markings" from the word "runway" is considered sufficient to warrant being included separately to clarify the rule. Runway markings generally consist of standard patterns painted on the runway surface which show the threshold, runway identification number, centerline, touchdown aiming point, and distance coding. In contrast, the term "runway" may refer only to the surface of the pavement. This may not be as distinctly visible as lights or markings, for example, during a night approach on a wet runway.

One comment suggests adding centerline lights to the list in § 91.6(b). This, however, is inappropriate and unnecessary because of the design of lighting systems. Centerline lights are intended to be installed along with touchdown zone lights, and since touchdown zone lights are set at an intensity greater than centerline lights, they should, in normal circumstances, be visible at the same time or before the centerline lights. Further, if the aircraft has inadvertently passed the touchdown zone prior to touchdown, and the touchdown zone lights or other items in § 91.6(b) are not visible but the centerline lights are visible, continued descent based on the centerline lights alone is not appropriate. Not only is it unlikely that weather is above minimums, but the pilot may also have no way of knowing how far along the runway the aircraft has traveled or how much runway remains for landing. If touchdown occurs past the touchdown zone, by the time the aircraft reaches the color-coded centerline lights at the opposite end of the runway there may be insufficient runway remaining to stop. Therefore, this item is not added to the list.

To clarify and uniformly apply the provisions regarding use of approach lights as a visual reference, the wording is standarized in §§ 91.6, 91.116, and 121.651 as "approach light systems." The question is raised by commenters whether the entire approach light system must be visible to the pilot. It is intended that the entire system need not necessarily be in view under either § 91.6 or § 91.116 when descending below MDA or DH. At the time Notice 80-4 was issued, the special description in proposed § 91.6 clarifying descent below 100' was considered sufficient. It was not considered necessary in § 91.116 or § 121.651 because of the relatively infrequent occurrence of this situation. However, since commenters raise the issue and are uncertain as to whether "approach lights" and "approach light systems" have different meanings and whether it was necessary to see all or just part of the approach light system, the FAA has clarified the rule by adopting the wording used in proposed § 91.6 in §§ 91.116(b)(3) and 121.651(c)(3). It should be noted, however, that even only a part of the approach light system need be visible during descent below MDA or DH to 100' above the touchdown zone elevation, the requirements of § 91.116(c) regarding adequate flight visibility must be met to continue an approach.

A question is raised regarding the intent of § 91.116(e)(1) as far as missed approaches are concerned. The commenter is uncertain as to the applicability of the rule in the case where visual references may be temporarily lost while below MDA or DH. The commenter asks whether the rule requires that a missed approach be conducted even though visual references reappear. The rule provides that any time the conditions of the rule are met, a missed approach is not required. During the time the visual references are not available below MDA or DH, however, the pilot is expected to initiate a missed approach. When below MDA or DH, any deliberate delay in initiation of a missed approach in the hope that visual references will soon reappear, is not appropriate, such as in the case of deliberate descent through low cloud, scud, or fog in which the requirements of § 91.116(c) cannot be met. If the pilot uses normal procedures, however, and does not deliberately delay taking action to transit the intermittent condition, but still has not initiated the missed approach when the visual references reappear, a missed approach is not required.

Use of Person or Pilot

Some provisions of the rules are intended to refer only to a pilot because the rule can only be used by a pilot crewmember during flight, for example sighting visual references during a landing as specified in § 91.116(c). However, other provisions of the revised rules may apply to an operator or someone other than a pilot flight crewmember, for example § 91.6(g) concerning operations specifications. In an instance such as § 91.6(g), "operation of an aircraft" may apply to other persons as well as the pilot because other persons may also be responsible for correct application of a certificate holder's operations specifications. The revised rules provide for this situation by retaining the word "person" where someone other than the pilot of an aircraft may also be involved with application of the rules, and the rules use the term "pilot" where a rule clearly is intended for use by a pilot crewmember during flight.

The Amendments

Accordingly, the Federal Aviation Administration amends Parts 1, 91, and 121 of the Federal Aviation Regulations (14 CFR Parts 1, 91, and 121) effective May 8, 1981.

(Secs. 307, 313(a), 501, 601, 601(a) and 604, Federal Aviation Act of 1958, as amended (49 U.S.C. 1348, 1354(a), 1401, 1421, 1421(a), and 1424); and Sec. 6(c) of the Department of Transportation Act (49 U.S.C. 1655(c))).

NOTE—The Federal Aviation Administration has determined that this document involves a regulation which is not significant under Executive Order 12044, as implemented by DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). A copy of the evaluation prepared for this action is contained in the regulatory docket. A copy of it may be obtained by writing to the person identified under "FOR FURTHER INFORMATION CONTACT:"

NOTE—This rule is a final order of the Administrator as defined by the Federal Aviation Act of 1958, as amended. As such, it is subject to review only by the courts of appeals of the United States or the United States Court of Appeals for the District of Columbia.

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* U. S. GOVERNMENT PRINTING OFFICE: 1987-181-101:60017