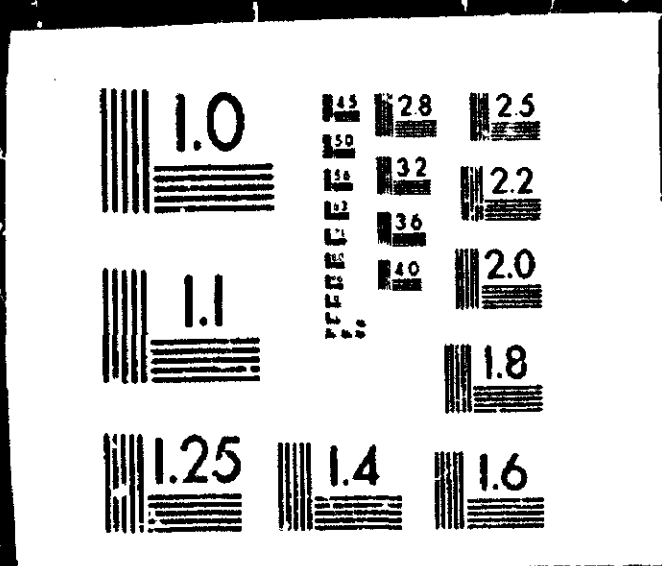


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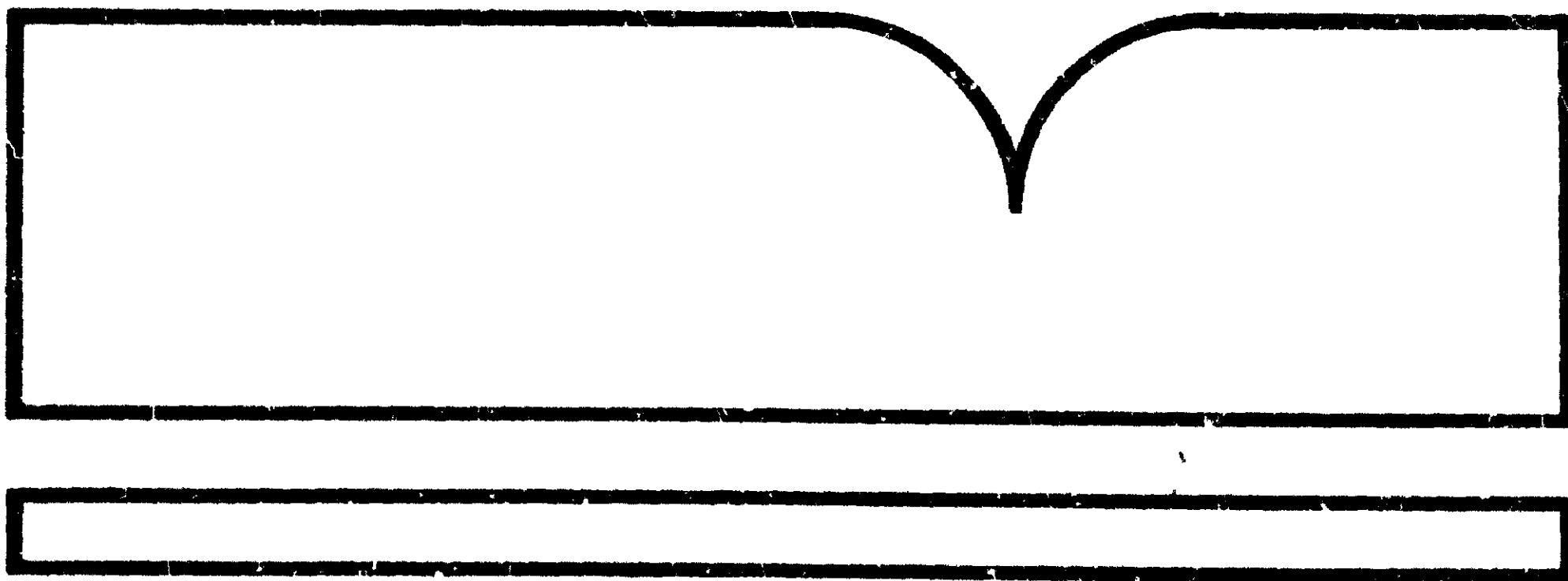


PB81-249427

Special Investigation Report--Search and
Rescue Procedures and Arming of Emergency
Locator Transmitter: Aircraft Accident near
Michigan City, Indiana, December 7, 1980

(U.S.) National Transportation Safety Board
Washington, DC

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NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

SPECIAL INVESTIGATION REPORT

**SEARCH AND RESCUE PROCEDURES AND
ARMING OF EMERGENCY LOCATOR TRANSMITTER:**

**AIRCRAFT ACCIDENT NEAR MICHIGAN CITY,
INDIANA,**

DECEMBER 7, 1980

NTSB-SIR-81-2

UNITED STATES GOVERNMENT

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16. Abstract The circumstances surrounding the crash of a Beechcraft E-90, near Michigan City, Indiana, on December 7, 1980, prompted the Safety Board to initiate this special investigation of the search and rescue activities following the accident and of the associated operation of the aircraft's emergency locator transmitter (ELT). As a result of not following proper notification procedures, coordination oversights, and communication gaps, the search for the missing aircraft was significantly hampered. The actual crash site was not reached by search personnel until nearly 4 hours after the crash. The aircraft's general condition, the fact that no bodies were found in the aircraft, and the observation from the beach of a flashing light at the crash site indicate that some or all of the aircraft's four occupants, who died of hypothermia, probably survived the original crash. No signal was transmitted by the ELT. Examination of the ELT switch revealed that it was in the OFF position. The National Transportation Safety Board believes that a rescue could have been effected if the proper authorities had been notified in a timely manner and given accurate information regarding the aircraft's last known position. Additionally, the improper arming of the ELT could be a significant problem in any emergency situation.					
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**NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON D.C. 20594**

SPECIAL INVESTIGATION REPORT

Adopted: August 11, 1981

**SEARCH AND RESCUE PROCEDURES
AND ARMING OF EMERGENCY LOCATOR TRANSMITTER:
AIRCRAFT ACCIDENT NEAR
MICHIGAN CITY, INDIANA, DECEMBER 7, 1980.**

INTRODUCTION

The circumstances surrounding the crash of a Beechcraft E-90 near Michigan City, Indiana, on December 7, 1980, prompted the National Transportation Safety Board to initiate this special investigation of search and rescue activities after the accident and of the associated operation of the emergency locator transmitter (ELT) installed in the aircraft.

As a result of improper ELT operation, faulty notification procedures, coordination oversights, and communication gaps, the search for the missing aircraft was significantly hampered and the actual crash site was not reached by search personnel until nearly 4 hours after the crash. The aircraft's general condition, the fact that no bodies were found in the aircraft, and the observation from the beach of flashing lights at the crash site indicate that some or all of the aircraft's four occupants probably survived the original crash but later died from hypothermia. No signal was transmitted by the ELT. Examination of the ELT switch revealed it was in the off position. The Safety Board's determination of probable cause of the accident is appended to this report.

The Safety Board believes that a successful rescue could have been effected if the proper authorities had been notified in a timely manner and given accurate information regarding the aircraft's last known position. Additionally, had it been armed, the ELT could have aided searchers to more promptly locate the aircraft.

THE ACCIDENT

About 1643 central standard time (c.s.t.), 1/ a Beechcraft E-90, N2181L, owned and operated by Queen Airmotive, Inc., of Dowagiac, Michigan, crashed into Lake Michigan while making a nondirectional beacon approach (NDB) to runway 20 at the Michigan City Airport. The aircraft, which was being operated as an air taxi under 14 CFR Part 135, was on an instrument flight rules (IFR) flight plan from O'Hare Field, Chicago, Illinois, to Michigan City, Indiana. There were four occupants--a pilot and three passengers.

1/ All times used herein are central standard time based on the 24-hour clock.

Following a routine departure from runway 36 at O'Hare Field and a routine climb, N2181L established radio contact with South Bend, Indiana, approach control at 1636:27. The current South Bend weather was given as "indefinite ceiling two hundred, sky obscured, visibility 7/8 in fog, wind calm, altimeter 30.10."

As cleared by South Bend approach control, N2181L flew direct to the Michigan City NDB. At 1640:59, South Bend approach control established positive radar contact with the aircraft and advised N2181L to turn left, heading 070°, and that vectors would be given for the NDB approach to Michigan City. The pilot acknowledged, and shortly thereafter South Bend approach control cleared N2181L to descend and maintain 2,700 feet. Once again the pilot responded. The aircraft continued to fly on a heading of 070° as instructed.

Vectors were provided by South Bend approach control, and the pilot of N2181L continued to acknowledge them until 1643:36 when radar contact with the plane was lost about 6 nmi northeast of the Michigan City Airport. The satellite clearance delivery controller at South Bend approach control tried to contact N2181L at 1647:09, 1647:21, and 1652:41; no reply was received to the calls. The operator at the South Bend satellite position telephoned the flight service station (FSS), and at 1654:10 the supervisor of the FSS called Michigan City Airport to ask if N2181L was on the ground there. He was advised that N2181L had not landed.

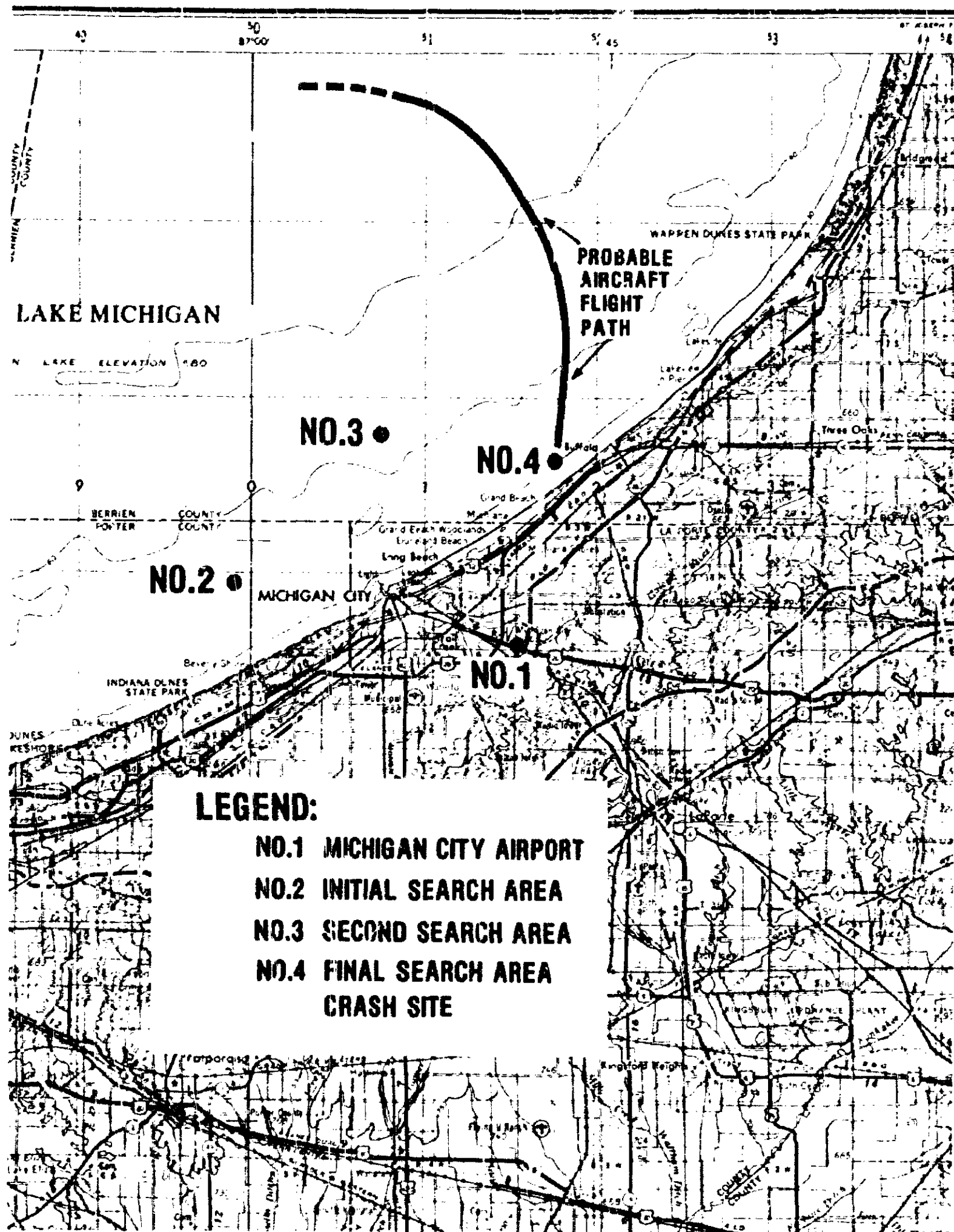
South Bend tower personnel notified the Indiana State Police of the possibility of a missing aircraft about 20 minutes after communications and radar contact had been lost. The tower did not follow prescribed procedures and failed to advise the Chicago Air Route Traffic Control Center (ARTCC) about the missing aircraft. About 2 1/2 hours after the aircraft was lost on radar, the Indiana State Police notified the U.S. Air Force (USAF) Search and Rescue Center at Scott Air Force Base, Illinois, about the missing aircraft. About 3 hours after radar contact had been lost, the Chicago ARTCC was advised of the missing aircraft by the USAF Search and Rescue Center at Scott Air Force Base, Illinois, and the ARTCC contacted the South Bend tower and requested information on the missing aircraft.

The Indiana State Police notified the United States Coast Guard (USCG) at Michigan City of the missing aircraft about 45 minutes after it was lost on radar. The Michigan City USCG dispatched a search vessel within minutes of notification. However, due to incomplete information on the aircraft's last known position, the USCG's initial search was begun too far west of the crash site to be effective. (See figure 1.) About 4 hours after the aircraft was lost on radar, the USCG received reports from shore observers of lights flashing in the water. Their search of this area disclosed aviation fuel floating on the water. No survivors or the main wreckage were found at this time.

Following 3 1/2 days of search efforts, the wreckage was located in Lake Michigan on December 11, 1980, in 38 feet of water 6 miles northeast of Michigan City Airport. The location of the aircraft was at 41°47' north latitude and 86°48' west longitude. Two pairs of shoes, laces untied, one single shoe, and suit coats were found in the aircraft cabin. No bodies were found in the wreckage. Two bodies were recovered later from the water, and two remain missing and are presumed dead. Pathological examinations revealed that the two persons died from hypothermia. No electronic signal from the ELT was detected during the search, and most smaller USCG vessels do not have the capability to detect ELT signals.

Wreckage Examination

Before the aircraft was removed from Lake Michigan on December 18, 1980, divers made the following observations as the aircraft lay on the bottom of the lake.



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Figure 1.--Map of accident area depicting search sites.

The aircraft was inverted with the cabin and nose section buried in the soft sand. The fuselage was stuck in the sand at an angle of about 20° to 30° with the top of the vertical stabilizer resting on the bottom. The vertical stabilizer, rudder, and horizontal stabilizer were not damaged. Both engines were attached. The right engine appeared to be bent to the right; the left engine did not appear damaged. Both propellers were attached to the engines. All propeller blades were visible, except two blades on the right propeller; these two blades were buried in the sand. Both wing sections and ailerons were not damaged; the main cabin door on the left side of the fuselage was closed; the cockpit windows were closed; the emergency escape hatch above the right wing, which can only be opened from within, was not twisted or bent and was found unlatched and open; the main cabin door was opened without difficulty. The main cabin door was closed and latched when the divers first examined the aircraft.

To remove the aircraft from the water, lifting devices were attached to the tail surface and around the fuselage. The aircraft was examined after being transported to the hangar. There was no blistered paint, discolored metal, or smoke patterns on the wings or fuselage.

The cabin and cockpit areas were undamaged--there was no loss of occupiable space because of crushing. The cabin interior revealed no evidence of smoke or burned upholstery. The passengers' luggage was stored in the aft compartment. The sliding door was partially opened. There were eight seats in the aircraft, including the cockpit. (See figure 2.) All seats and restraint systems were essentially undamaged.

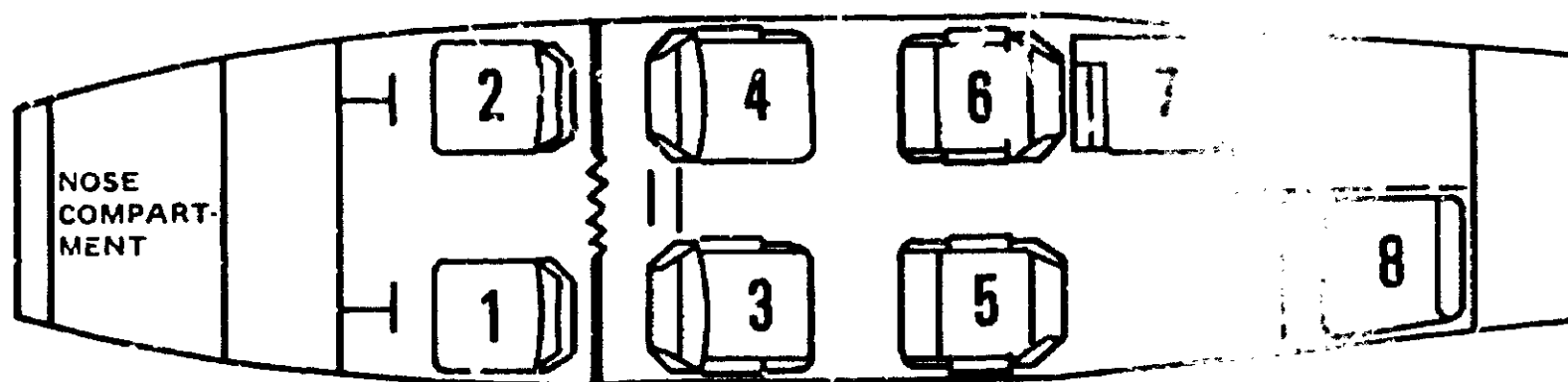
Search and Rescue Procedures

The National Search and Rescue (SAR) Plan assigns the responsibility for the conduct of physical search and rescue operations to the military agencies--USAF and USCG. The plan also assigns responsibility to the Federal Aviation Administration (FAA) to assure that SAR procedures will be initiated if an aircraft becomes overdue or fails to report. The FAA accomplishes this responsibility through the air traffic control (ATC) system for instrument flight rules aircraft and the flight plan system for visual flight rules aircraft. ARTCC's serve as central points for collecting information, for coordinating with BART, and for distributing any necessary Alert Notices concerning overdue or missing IFR aircraft.

Air Traffic Control Handbook 7110.65B, dated January 1, 1980, prescribes air traffic control procedures and phraseology for use by personnel providing ATC services. Controllers are required to be familiar with the provisions of this handbook which pertain to their operational responsibility and to exercise their best judgment if they encounter situations not covered by it. Chapter 8, EMERGENCIES, Section 1 and Section 2, have been summarized in the following paragraphs.

When a terminal facility receives information about an aircraft in distress, detailed data should be forwarded to the ARTCC in whose area the emergency exists. It should coordinate efforts to the extent possible to assist any aircraft believed overdue, lost, or in emergency status. Also, it should request necessary assistance from other facilities as soon as possible.

If assistance is required, it should begin as soon as enough information has been obtained to act. In the case of an overdue aircraft, the facility should consider an aircraft to be overdue when neither communications nor radar contact can be established with it and 30 minutes have passed since its estimated time of arrival over a specified or compulsory reporting point or at a clearance limit in the facility's area. Facility personnel should consider that an aircraft emergency exists and notify the ARTCC when an emergency is declared by either the pilot or facility personnel.



CABIN ARRANGEMENT

Figure 2.--Interior and exterior of N2181L.

An example of an emergency which should be declared by facility personnel is simultaneous unexpected loss of radar contact and radio communication with an aircraft. Also, an aircraft emergency should be considered to exist if reports indicate the aircraft has made a forced landing, an ELT signal is heard or reported, or a need for ground rescue appears likely.

If an aircraft is considered to be overdue or in emergency status, facility personnel should alert the ARTCC and forward the following information, as available:

Flight plan including color of aircraft if known; time of last transmission received, by whom, and frequency used; last position report and how determined; action taken by reporting facility and proposed action; number of persons on board; fuel status; facility handling aircraft and frequency; last known position, estimated present position and maximum range of flight of the aircraft based on remaining fuel and airspeed; position of other aircraft near aircraft's route of flight if requested; whether or not an ELT signal has been heard or reported in the vicinity of the known position and other pertinent information.

When an aircraft is considered to be overdue or in emergency status, the ARTCC should alert the responsible Rescue Coordination Center (RCC) and forward the following information, as available:

Facility and person calling; flight plan including color of aircraft, if known; time of last transmission received, by whom, and frequency used; last position report and how determined; action taken by reporting facility and proposed action; number of persons on board and fuel status;

facility working aircraft and frequency; last known position, estimated present position, and maximum range of flight of the aircraft, based on remaining fuel and airspeed; position of other aircraft near aircraft's route of flight, when requested; whether or not an ELT signal has been heard or reported in the vicinity of the last known position; and other pertinent information.

The ARTCC, in addition to advising the regional office communications control center, should issue an Alert Notice. The ARTCC should transfer responsibility for further search to the RCC when 30 minutes have elapsed after the estimated aircraft fuel exhaustion time, within 1 hour after Alert Notice issuance, or the Alert Notice search has been completed with negative results.

Each control tower has its own "Facility Notification Procedures." The FAA control tower at South Bend uses a standard form (FAA Form 8020-3) titled "Facility Accident Notification Record," which lists those agencies and individuals who are to be called in the event of an accident or suspected accident. The Chicago ARTCC is not listed as an agency to be notified on the South Bend Facility Accident Notification Record. This is contrary to the previously cited provision of Chapter 8 of the Air Traffic Control Handbook. The tower's notification list indicates that the primary RCC contact for search and rescue is the USCG Search and Rescue Center at Cleveland.

Like most of the 150 USCG rescue stations, the Michigan City Coast Guard Station was established for maritime search and rescue. It has no radiomen; however, seamen on watch monitor marine emergency frequencies such as 2,182 kcs and channel 16 on VHF. There are no facilities to guard the air emergency frequencies. The station must be alerted by telephone to commence a search for any downed aircraft. All rescue boats have radar, and those boats 44 feet long and larger also have Loran-C capability for navigation. Presently, the USCG has no plans to increase search and rescue station personnel nor provide VHF/UHF direction finding capability for all rescue boats.

Conduct of the Notification and Search

During its investigation the Safety Board interviewed FAA South Bend tower personnel, USCG personnel, and Indiana State Police personnel and reviewed the communications logs of the Chicago ARTCC and the FAA control tower and FSS at South Bend. Also, the Safety Board reviewed the communications logs of the USCG stations at Cleveland and Michigan City, the Indiana State Police District stations at South Bend and Lowell, and the Michigan City Police. This review indicated that published FAA notification procedures for a missing aircraft were not followed.

When an ARTCC is notified of a missing aircraft, a plan is initiated which includes the alerting of the proper Federal and SAR agencies. The Chicago ARTCC would notify the USAF SAR center at Scott AFB, Illinois, and the USCG SAR center at Cleveland, Ohio. In this instance, the South Bend tower supervisor notified the Indiana State police of the missing aircraft, which is not on the tower's notification list. There is no record to indicate that tower personnel initiated any communications with the SAR on-scene-commander or any other USCG unit, or the ARTCC.

The control tower's accident notification record indicates that only four phone calls were logged during the notification process. The initial notification call was made to the Indiana State Police about 20 minutes after the aircraft was lost on radar. (It is common practice for the controller to spend 20 minutes or longer determining by phone if the aircraft has landed at its intended destination or gone on to an alternate airport before declaring the aircraft missing.)

The remaining three calls were internal to the FAA--the first call was to the Facility Chief, who could not be reached, the second call was to the General Aviation District Office, and the final call was a return phone call to the Chicago ARTCC more than 3 hours after the aircraft was lost on radar. The aircraft's last known position--about 6 miles north-northeast of the Michigan City Airport--equates to a point about $020^{\circ}6$ nmi from the airport and closely coincides with the location of the aircraft wreckage. Because of a lack of direct communications between the FAA control tower and the USCG search personnel, the aircraft's correct last known position was not received by the USCG search personnel. As a result, several hours were lost in a fruitless search west of the actual crash site.

The USCG at Michigan City was advised of the missing plane by the Indiana State Police about 45 minutes after the aircraft was lost on radar. The USCG Facility at Michigan City has a staff of 17 enlisted personnel, no officers. The unit has 3 vessels assigned, a 44-foot motor life boat (MLB), a 21-foot Boston Whaler, and a 14-foot ice skiff. The 44-foot MLB was dispatched 7 minutes after notification of the missing aircraft. The coxswain who commanded the 44-foot MLB was the on-scene-commander. The 21-foot Boston Whaler was dispatched later for use by the standby diver team. The team was not deployed that night since the aircraft wreckage was not located for several days.

The USCG Center at Cleveland is in overall command of a search and rescue effort and through its computer and other resources suggests the type of search, areas of search, and vessels to be employed. The Center also assigns a SAR mission coordinator, in this case the Muskegon USCG station. The Muskegon unit has a lieutenant commander in charge. The Muskegon unit's responsibility was to relay information to the on-scene commander. The on-scene commander has the option of determining the best procedure to follow, based on his on-site observations. A USCG spokesman stated the USCG was initially advised the aircraft could be down 5 miles from the "light." It interpreted "the light" to mean the lighthouse near the Michigan City harbor. As a result, although a search vessel was dispatched immediately, the initial search was centered at a point about $270^{\circ}12.5$ nmi from the airport, nearly 15 nmi from the aircraft's last known position. (See figure 1.)

The USCG mission coordinator at Muskegon called the FAA facility in South Bend for more precise information on the search area. The USCG mission coordinator related later that he was given the aircraft's last position as 3 to 5 miles west of the intersection of the 233° radial of the Keeler VOR and the 271° radial of the South Bend VOR. The USCG mission coordinator was not familiar with this method of position plotting, since he was trained to plot latitudes and longitudes; also he did not have any aeronautical charts. After further discussions, he was able to estimate the aircraft's last known position closer to the actual site; however, the plotted position was still too far west.

About 2 hours after radar contact was lost with the aircraft, the South Bend control tower advised the Indiana State Police that the aircraft may have gone down within a 3-mile radius of Michiana Shores. Although this correct information would have been beneficial to searchers, there is no record that this information was received by the USCG on-scene commander at Michigan City.

About 3 hours after the aircraft was lost on radar, the USCG moved the search area to a point about $330^{\circ}8$ nmi from Michigan City Airport, about 8 nmi from the aircraft's last known position. Shortly afterward, the ARTCC asked the South Bend control tower for details about the missing aircraft, and the ARTCC then issued an Alert Notice on the situation.

Lights were observed flashing off the beach near Michiana Shores by a Long Beach policeman about 3 1/2 hours after the aircraft was lost on radar. The USCG dispatched vessels to the site, 020°/6.5 nmi from Michigan City Airport. About 4 1/2 hours after the aircraft was lost on radar, floating fuel was found; after a lengthy search the sunken aircraft wreckage was located near this area--about 3 1/2 days after the aircraft was lost on radar.

Emergency Locator Transmitter (ELT) Operation

The ELT is an electronic signaling device that can be used in conjunction with homing devices to determine the position of aircraft or personnel in distress. N2181L was required under 14 CFR Part 135 to be equipped with an operational ELT. A CIR-11-2 Emergency Locator System, including the TR70-13/13A/16 ELT was installed on N2181L. The ELT is water resistant and should operate submerged for up to 20 hours. However, the transmitting range of the ELT is severely reduced if the unit is submerged. Under normal temperatures and with a fully charged battery, the ELT will emit signals for at least 48 hours, although not at full output power. (See figure 3.)

When activated, the ELT transmitter will transmit omnidirectional radio frequency signals on the international distress frequencies of 121.5 and 243.0 MHz. The ELT transmitter is equipped with an ARM-ON-OFF function switch and an impact "g" switch integrally located on the unit. When the ARM position is selected, the impact switch will automatically activate the transmitter following an impact of 5.0 ± 0.2 "g" along the flight axis of the aircraft. The transmitter may also be manually activated by moving the function switch to the ON position.

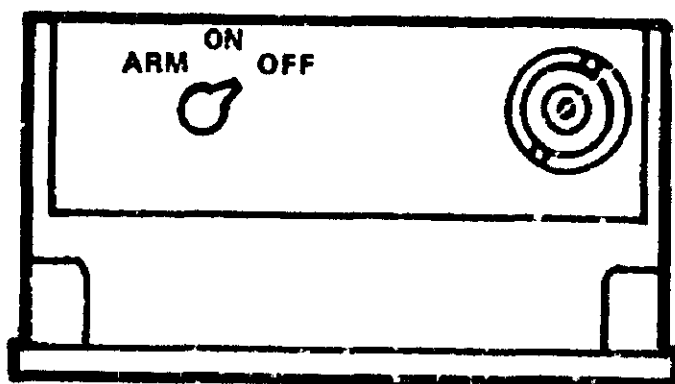
The ELT transmitter unit is normally mounted on a bracket inside the aircraft fuselage, usually in the rear of the aircraft. Depending on its location, operator access to the ELT transmitter unit could be difficult.

If a "hard" landing or an emergency landing of sufficient "g" force is encountered, the impact switch will automatically activate the transmitter. Because of the continuing problem of unwanted activation of the ELT during "hard" landings and occasional difficulty in getting to the unit, a remote reset capability was included. With this feature, the impact switch may be reset from a remote location, such as the external fuselage, providing the pilot with a ready means of manually resetting the impact switch from outside the aircraft without actually gaining access to the ELT unit itself. The remote switch is an entirely separate switch, physically located away from the ELT unit and its integral ELT function switch. The remote switch can be positioned to ARM, OFF, or ON regardless of the position of the ELT function switch.

The remote switch ON capability was included for two reasons. First, a pilot wishing to test the ELT transmitter may do so by positioning the remote switch to ON, bypassing the ELT transmitter function switch, and turning the ELT transmitter on. When the pilot tunes the radio to 121.5 MHz and hears the ELT, he or she can assume that the transmitter is functioning properly. This test does not indicate the condition of the battery or its capacity. Furthermore, this test does not determine the status of the impact switch or whether the ELT transmitter function switch is in the ARM position. The pilot must visually ascertain that the ELT transmitter function switch is in the ARM position. Second, the remote switch ON position was included to provide the pilot with a means of activating the ELT remotely in the event of a "soft" crash, where the force of the crash would not be sufficient to activate the impact switch.

It is important that pilots recognize the limitations of the remote switch feature of the ELT. The ELT cannot be armed by means of the remote switch; it must be armed by

(a)



EMERGENCY LOCATOR TRANSMITTER
(LOCATED INSIDE AIRCRAFT FUSELAGE)

(b)

EMERGENCY LOCATOR TRANSMITTER
SWITCH

————— **ARM--OFF--ON** —————
(LABEL ON ELT REMOTE SWITCH ON NZ181L)

(c)

EMERGENCY LOCATOR TRANSMITTER
SWITCH

————— **REARM--ARM--XMIT** —————
(NEW ELT REMOTE SWITCH LABEL INCLUDED IN BEECH KIT 101-3062)

Figure 3.—Emergency locator transmitter.

manually turning the ELT transmitter function switch to ARM. However, if the ELT function switch is in the ARM position, turning the remote switch to ARM will reset the impact switch if it has been activated. Placing the remote switch to the ON position will generate a signal but does not verify that the ELT is armed. Moving the remote switch to ARM only resets the impact "g" switch, it does not ARM the ELT if the ELT transmitter function switch is in the OFF position. The remote switch, when placed in the ON position, bypasses the ELT transmitter function switch regardless of its position and causes a signal to be generated. If the ELT transmitter function switch is in the OFF position, then turning the remote switch to either ARM or OFF has no effect on the ELT unit.

The Collins CIR-11-2 ELT unit installed on N2181L was mounted inside the aft section of the fuselage on the right side. The position of the transmitter function switch on the ELT could not be seen through the inspection hole. The aircraft operator is responsible for ensuring that the ELT is armed and functioning.

Investigation of the wreckage disclosed that the ELT antenna was connected and the unit was secured in the bracket. The transmitter function switch on the ELT was found in the OFF position.

The remote switch on N2181L was accessible through a spring loaded, 1 1/8 inch diameter inspection hole which was located on the right side of the fuselage below the leading edge of the horizontal stabilizer. The remote switch had three positions as shown on the placard on the side of the fuselage just below the inspection hole. (See figure 3.) The placarded remote switch positions on N2181L read from left to right, "ARM", "OFF", "ON". The remote switch, when moved to the left toward the ARM position, was spring loaded so that the switch would return to the center OFF position.

Since this accident, the ELT owners manual, Document 350012, has been updated to include supplementary information regarding the function of the remote switch, and Beech Aircraft has designed a modification consisting of a bracket which will not allow the remote switching plugs to be plugged into the unit unless the ELT transmitter function switch is in the ARM position. The expanded description of the ELT remote switch functions and the modification, which includes new labeling of the remote switch, should reduce misunderstanding of its use. The modification insures that the remote switch is only operational when the ELT transmitter function switch is in the ARM position. As a result, the problem of testing the ELT by turning the remote switch to ON and generating a positive test signal with the ELT transmitter function switch OFF should be eliminated. For example, the old label read "ARM-OFF-ON", which may have suggested to some operators that activation of the remote switch to the ARM position would arm the ELT. The new label reading "REARM-ARM-XMIT" should make the remote switch function clearer to operators. This modification, Beech Kit No. 101-3062-1, applies to all Beech aircraft which have this ELT installed; however, installation of the modification is not required.

ANALYSIS

Search and Rescue

Examination of the aircraft wreckage before and after it was recovered from the lake indicated this was a survivable crash. The cockpit and cabin areas were practically undamaged, there was no loss of occupiable space due to crushing, and there was no evidence of material or section rebound. The seatbelts were not damaged and all seats, except the left forward facing seat, were attached to the floor tracks.

The minimal damage to both the exterior and interior of the aircraft suggests a high probability that some or all of the occupants survived the crash. This probability is reinforced by the recovery of the shoes and suit coats found in the cabin. By far, the most convincing evidence to support this probability is the fact that no bodies were found in the aircraft, yet all the doors and windows except the emergency hatch were closed, and the pathological report on the two bodies recovered in the water disclosed that both persons died from hypothermia, not crash-related injuries. The autopsies were unable to establish how soon the victims died. The anticipated survival time in 38°F water temperature (the temperature of Lake Michigan on December 7, 1980) is 20 minutes or less. However, it is not known how long the aircraft stayed afloat before the survivors were forced into the water.

Lights, sighted by observers on the beach, which were flashing at the water crash site hours after the crash, cannot be positively attributed to survivor's attempts to signal for help. However, this is a possibility since only minimal damage was sustained in the crash, and the aircraft could have remained afloat for a substantial period of time.

The USCG search and rescue vessel on alert at Michigan City harbor was capable of immediate launch and could have reached the crash site in minutes. Had the USCG initially received the correct last known position of the aircraft, more than 3 hours of fruitless searching could have been avoided, and the lives of the survivors possibly saved.

In 1982 and continuing into 1984, a worldwide search and rescue system, SRSAT (Search and Rescue Satellite-Aided Tracking), will be put into operation. It is an international venture which proposes to detect and locate downed aircraft and ships in distress all over the globe. Polar satellites in orbit will continually monitor ELT and EPIRB (Emergency Position Indicating Radio Beacon) frequencies 121.5 and 243.0 MHz and an experimental frequency, 406 MHz, and relay detection and location information to command centers on earth for dissemination to the proper rescue station. Through a major communication network, all USCG search and rescue stations will become part of this system. SRSAT is intended to eliminate the need for any monitoring of emergency frequencies by the stations and will remove any requirement for direction finding capability on small rescue boats by its precision in detecting distress locations within 2 to 5 miles. Radar on existing rescue boats is effective for these ranges.

The Air Traffic Control Handbook and South Bend tower's published "Facility Accident Notification Record" are quite specific in detailing the actions to be taken when an aircraft is lost on radar, missing, or overdue. However, these procedures were not followed by South Bend tower and as a result the critical information required by the USCG on-scene-commander was being relayed second- and third-hand to him. Alerting the ARTCC as soon as radar and radio communications were lost with the aircraft should have assisted in accurately plotting the aircraft's last known position sooner by introducing additional search and rescue resources, particularly communications. The communications logs were unclear as to why the correct last known position of the aircraft was not forwarded to the USCG on-scene-commander. It was also unclear why the original search was initiated so far from what ultimately was determined to be the actual crash site. Direct communication between the FAA and the USCG on-scene-commander could have eliminated any confusion as to the recommended search area.

Direct communication through land lines was available to Cleveland, Muskegon, and the Michigan City USCG units. The on-scene commander could have been contacted by the FAA through the marine operator via a telephone patch to the VHF radio. In any case, the USCG had direct radio contact with the on-scene commander at all times.

Additionally, the aircraft's correct last known position could have been readily available to the USCG earlier if the South Bend tower and the USCG had been using similar charts. The confusion arising through the use of aviation charts and intersecting radials versus maritime charts and latitudes and longitudes to plot positions was unnecessary.

Emergency Locator Transmitter

The ELT on board N2181L had been installed on October 15, 1980, by the pilot who was flying N2181L when it crashed. It is possible that, from installation until the crash, the ELT transmitter function switch had been in the OFF position and would not have been automatically activated under any condition. Or, the operator may have incorrectly assumed that the ELT was properly armed by turning the remote switch to ARM.

Examination of N2181L revealed that the remote switch for the ELT was located in the rear section of the aircraft. When the ELT was tested and the wiring diagram was checked, the ARM position on the remote switch actually acted as a reset when the ELT impact switch was activated. Further testing of the remote switch revealed that a signal could be transmitted through the ELT, regardless of the position of the transmitter function switch on the ELT. Thus, a CIR-11-2 ELT unit can be installed with the transmitter function switch in the OFF position and a normal test signal will be radiated by momentarily placing the remote switch to the ON position. With the transmitter function switch on the ELT unit in the OFF position, the emergency, or automatic "g" function of the unit, is eliminated. The possibility of confusion of the operators on these functions was recognized and responded to (1) by Collins General Aviation Division when it issued Service Information Letter 1-81, "Supplemental Information on ELT Remote Functions" dated July 15, 1981, and updated the ELT owner's manual and by (2) Beech Aircraft when it provided a modification kit for all Beech aircraft equipped with the CIR-11-2 ELT.

Although the vessel the USCG dispatched to initiate the search did not have homing equipment capable of tracking the aircraft's ELT had it automatically activated, if the ELT had activated it would have audibly alerted the tower or others required to monitor the distress frequencies. This should have significantly reduced the time spent by the tower in checking local airfields to determine if N2181L had landed. It also would have expedited the initial request for search support.

CONCLUSIONS

1. All of the four persons on N2181L probably survived the crash.
2. The control tower did not follow the published emergency notification procedures.
3. Although required to be notified in the event of a missing aircraft, the Chicago ARTCC was not listed as an agency to be notified in the event of an accident on the South Bend Tower "Facility Accident Notification Record" form.
4. More than 3 hours after the accident, Chicago ARTCC was advised of the missing aircraft by the USAF SAR Center at Scott AFB, and the ARTCC contacted South Bend approach control to verify this information.
5. The last known position of the missing aircraft was not communicated to the USCG on-scene-commander.

6. The USCG search and rescue vessel could have reached the aircraft 20 to 25 minutes after the crash if the proper search location had been provided.
7. The control tower did not initiate any calls to the USCG during the search.
8. Identification of the proper search area was hampered by dissimilar charts and plotting methods used by the FAA and the USCG.
9. If the emergency locator transmitter had been properly armed and had operated, the aircraft's position should have been determined much sooner.
10. The pilot may have incorrectly assumed that he had armed the ELT by using the ARM position of the remote switch.

RECOMMENDATIONS

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

Take steps to make search and rescue operations less vulnerable to human error either by changes in terminal air traffic control accident notification procedures, or by changes in training, supervision, or performance monitoring. (Class II, Priority Action) (A-81-88)

Require air traffic control facilities to maintain current area maps that are standardized and coordinated with those used by local police and search and rescue authorities so that accurate search areas can be readily identified. (Class II, Priority Action) (A-81-89)

Issue an Airworthiness Directive to require that Beech Kit No. 101-3062-1 be installed on all Beech aircraft which have the remote ELT switch installed. (Class II, Priority Action) (A-81-90)

Issue a General Aviation Airworthiness Alert, advising all owners of ELT Model CR-11-2 that they should obtain and retain an updated owner's manual, Document 950012, for use in the installation and operation of this unit. The changes in the manual should also be summarized in the Airworthiness Alert. (Class II, Priority Action) (A-81-91)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

JAMES B. KING, Chairman, and G. H. PATRICK BURSLEY, Member, did not participate.

PATRICIA A. GOLDMAN, Member, filed the following comments regarding Recommendation A-81-88:

I do not believe Recommendation A-81-88 is justified, even though I agree with its general objective. We must always strive to minimize the opportunity for human error. Nevertheless, this special investigation was based on only one accident and did not include a thorough evaluation of the existing procedures, training, or supervision. Therefore, the "human error" identified in this accident may have been an isolated incident not justifying the breadth of the recommendation.

August 11, 1981.

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D. C. 20594

BRIEF OF ACCIDENT ON SPECIAL REQUEST

FILE NUMBER 3-3650

1980

FILE	DATE	LOCATION	AIRCRAFT DATA	INJURIES F S M/N	FLIGHT PURPOSE	PILOT DATA
3-3650	12/7/80 TIME - 1647	MICHIGAN CITY, IN	WEECH F90 N2181L DAMAGE-DESTROYED	CR- 1 0 0 PX- 4 0 0	COMMERCIAL AIR TAXI-PASSG	AIRLINE TRANSPORT, AGE 53, 8700 TOTAL HOURS, 1132 IN TYPE, INSTRUMENT RATED.
DEPARTURE POINT		INTENDED DESTINATION				
CHICAGO, IL		MICHIGAN CITY, IN				
TYPE OF ACCIDENT				PHASE OF OPERATION		
COLLISION WITH GROUND/WATER		UNCONTROLLED		LANDING FINAL APPROACH		
PROBABLE CAUSE(S)						
PERSONNEL - MAINTENANCE, SERVICING, INSPECTION INADEQUATE MAINTENANCE AND INSPECTION						
AIRFRAME - FLIGHT CONTROL SURFACES ELEVATOR ASSEMBLY, ATTACHMENTS						
MISCELLANEOUS ACTS, CONDITIONS - BINDING						
MISCELLANEOUS ACTS, CONDITIONS - LOOSE, PART/FITTING						
MISCELLANEOUS ACTS, CONDITIONS - MISSING						
FACTOR(S)						
PILOT IN COMMAND - IMPROPER IFR OPERATION						
PERSONNEL - TRAFFIC CONTROL PERSONNEL OTHER						
WEATHER - LOW CEILING						
WEATHER - FOG						
MISCELLANEOUS ACTS, CONDITIONS - AIRCRAFT CAME TO REST IN WATER						
WEATHER BRIEFING - BRIEFED BY FLIGHT SERVICE PERSONNEL, BY PHONE						
WEATHER FORECAST - FORECAST SUBSTANTIALLY CORRECT						
MISSING AIRCRAFT - LATER RECOVERED						
SKY CONDITION		CEILING AT ACCIDENT SITE				
OBSCURATION		100				
VISIBILITY AT ACCIDENT SITE		PRECIPITATION AT ACCIDENT SITE				
1/2 MILE OR LESS		RAIN				
OBSTRUCTIONS TO VISION AT ACCIDENT SITE		TEMPERATURE-F				
FOG		55				
WIND DIRECTION-DEGREES		WIND VELOCITY-KNOTS				
130		5				
TYPE OF WEATHER CONDITIONS		TYPE OF FLIGHT PLAN				
IFR		IFR				
REMARKS- PIVOT BOLT, P/N AN4-23A-11 ON FLOOR OF FUSELAGE, WASHER & NUT MISSING, DEST ALSTG NOT OBTAINED.						

APPENDIX
ACCIDENT BRIEF

6-11
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Washington, D.C. 20594

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