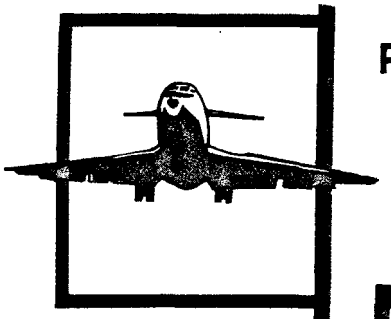

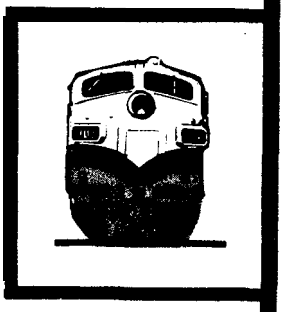

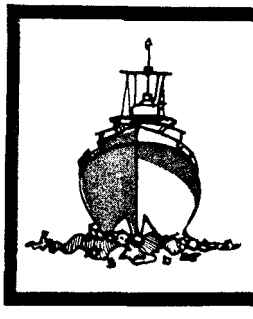

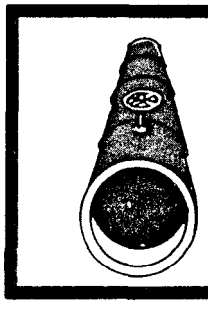

PB87-910411

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT/INCIDENT SUMMARY REPORTS

DES MOINES, IOWA -- NOVEMBER 25, 1985

CHICAGO, ILLINOIS -- AUGUST 10, 1986

NTSB/AAR-87/03/SUM

UNITED STATES GOVERNMENT

TECHNICAL REPORT DOCUMENTATION PAGE

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12. Sponsoring Agency Name and Address **NATIONAL TRANSPORTATION SAFETY BOARD** *Washington, D. C. 20594*	13. Type of Report and Period Covered *Aircraft Accident/Incident Summary Reports, 1985 and 1986* 14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This publication is a compilation of the reports of two separate aircraft accidents investigated by the National Transportation Safety Board. The accident locations and their dates are as follows: Des Moines, Iowa, November 25, 1985, and Chicago, Illinois, August 10, 1986.

17. Key Words	18. Distribution Statement
instrument meteorological conditions; emergency locator transmitter; instrument landing system approach; uncontrolled altitude deviation; icing conditions; fire; oxygen system	*This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161*

19. Security Classification (of this report)	20. Security Classification (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	*UNCLASSIFIED*	*22*	

NTSB Form 1765.2 (Rev. 9/74)

National
Transportation
Safety Board
Washington, D.C. 20594

AIRCRAFT ACCIDENT/INCIDENT SUMMARY

File No.:	2896
Aircraft Operator:	Iowa State University
Aircraft Type and Registration:	Rockwell International 500S, N81589, "Shrike Commander"
Location:	Des Moines, Iowa
Date and Time:	November 25, 1985, 1742 central standard time
Persons on Board:	7
Injuries:	7 fatal
Aircraft Damage:	Destroyed
Other Damage or Injury:	Trees and power lines
Type of Occurrence:	Loss of control, inflight collision with object
Phase of Operation:	Approach

On November 25, 1985, at 1742 1/ a Rockwell international 500S, N81589, owned and operated by Iowa State University crashed in the front yard of a Des Moines, Iowa, residence. Instrument meteorological conditions prevailed and an instrument flight plan had been filed. The commercial pilot and his six passengers received fatal injuries. The airplane was demolished by impact and postcrash fire.

At 1242 on November 25, 1985, an instrument flight rules (IFR) flight plan had been filed with the Green Bay, Wisconsin, flight service station (FSS) for N81589. This flight was to be from Milwaukee, Wisconsin, to Ames, Iowa. At 1348, the previous flight plan information was changed to reflect Des Moines as the new destination.

Two other Rockwell International 500S airplanes (N2BZ and N768WC) from Iowa State University accompanied N81589 on the trip from Milwaukee to Des Moines. At Milwaukee General Mitchell Airport, the three pilots checked the en route weather with the Green Ray FSS and with the Wisconsin Aeronautics teletype at the Aero Services fixed base operation in Milwaukee. The three pilots discussed the en route weather before departure and also while en route, on a discreet radio frequency. N2BZ departed Milwaukee at 1430 and N768WC at approximately 1450. N81589 departed at 1517.

The pilots of the first two airplanes stated that the departure runway was slick from a light freezing mist. The top of the freezing level in the Milwaukee area was approximately 3,500 feet above mean sea level (msl) with clouds and rain in the warm air above 3,500 feet msl. Approximately 50 miles east of Des Moines, the tops of the clouds were 3,900 feet msl.

When N768WC was north of Cedar Rapids, Iowa, the pilot received a weather update for Des Moines and Waterloo, Iowa, from the Cedar Rapids FSS. The pilot relayed this weather to N2BZ and N81589. N2BZ made an instrument landing system (ILS) approach to runway 12L at the Des Moines International Airport. The pilot saw the ground lights at 1,400 feet msl and the approach lights at 1,300 feet msl. Airport elevation is 957 feet

1/ All times are in central standard time and are shown using the 24-hour clock.

msl. The pilot indicated that after parking, he observed a trace of light rime ice on the propeller spinners. The pilot of N768WC also made an ILS approach to runway 12L and he saw the approach and runway lights shortly after passing the outer marker inbound. The pilot inspected the airplane after parking and later described the ice buildup as light.

At 1712, when he was 45 miles northeast of Des Moines at 6,000 feet msl, the pilot of N81589 called the Des Moines tower and was advised to expect a runway 12L ILS approach to the Des Moines International Airport. N81589 was sequenced to follow a Boeing 727, American Airlines flight 824. At 6 miles outside the outer marker, N81589 was cleared for the runway 12L ILS approach. The Des Moines tower asked the pilot if the airplane had accumulated any ice. The pilot stated that he had not looked, but did not have much on the windshield. At 1738:01, when N81589 was just outside the outer marker, the Des Moines tower requested a speed reduction of "20 knots if practical." At 1738:07, after a frequency change request, N81589 asked the tower to repeat the airspeed requested and the tower answered, "If practical, reduce speed one zero knots Commander 589, contact tower one one eight point three."

At 1738:25, the Des Moines tower announced that N81589 was to follow the Boeing 727 on a 1 1/2-mile final. At 1738:31, N81589 asked if the tower wanted him at 100 knots and the tower answered, "Yes sir, a hundred or a hundred ten will be fine." N81589 was cleared to land on runway 12L with a runway visibility of more than 6,000 feet, with braking action for the first half of the runway reported as fair, and with winds from 120° at 5 knots.

During the approach, the radar indicated flight progress of N81589 was monitored by Des Moines Approach Control. They were using the secondary radar returns (transponder) for tracking information. The secondary radar returns did not reflect receipt of any mode C (altitude) information from N81589.

The first radar return after 1740:36 indicated that N81589 was on a new heading, generally northeast and approximately 90° to the left of the ILS heading. At 1741:08, when the aircraft was about 0.7 mile left of course, the pilot stated, "Des Moines, 589, I seem to have some real trouble here, ah, I'm ah I'm in severe turbulence." The tower asked if he could climb and maintain 3,000 feet. N81589 answered, "I'm trying but I'm not doing very well." At 1741:26, the Des Moines tower announced, "Commander 589, roger, ah, fly heading 360 if able climb and maintain 3,000 feet."

At 1741:36, the pilot of N81589 stated, "I can't do anything, I'm in the trees now." N81589 passed through the tops of trees for approximately two city blocks, then passed through high-voltage powerlines at the intersection of Shriver Avenue and Country Club Boulevard and crashed inverted into trees in the front yard of a Des Moines residence about 1.5 miles left of course. Most of the witnesses located near the point where the airplane made the 90° left turn stated that they heard sounds of a low-flying airplane with one engine operating at high power and one engine operating at intermittent power. Witnesses along the last portion of the flightpath heard either one or both engines running well. No intermittent engine sounds were heard along this last portion of the flightpath.

The aircraft caught fire at impact and was demolished by impact and postimpact fire. Tree limbs in the tops of the trees along the last portion of the flightpath were broken. Some of the tree limbs had been sliced by propeller blades. The high voltage powerlines were broken causing interruption of electrical power in the area for a considerable period of time. The trees and the front yard proper of the residence where the airplane made the final impact were damaged extensively.

The accident airplane was a 1977 model Rockwell International 500S "SHRIKE COMMANDER." The airplane was equipped with two Avco Lycoming IO-540-E1B5, 290-horsepower engines which turned Hartzell three-blade, constant-speed, full-feathering propellers. At the time of the accident, the airframe had been operated a total of 3,185 hours. The left engine had been operated 362 hours since major overhaul, and the right engine had been operated 394 hours since major overhaul.

The most recent annual inspection was accomplished on October 4, 1985, and the airplane had been flown 41 hours since that time. The airplane was certified, equipped, and maintained in accordance with Federal Aviation Administration (FAA) regulations and approved procedures. The investigation revealed that the maximum allowable gross weight was exceeded by 149 pounds at takeoff, but was within allowable limits at the time of the accident.

The airplane was equipped with propeller, windshield, and airframe deicing equipment. The deicer system was not certified for flight into known icing conditions although it was an FAA-approved installation. According to the flight manual, a placard for the system stated "deicers to be off during takeoff and landing." The wing deice boots covered about 80 percent of the exposed leading edges and the boots could be cycled automatically at 60-second intervals. There were no indications that the airplane had accumulated any large amount of airframe ice during its flight or during the approach to the Des Moines area. Small accumulations of ice (less than 1/4 inch) would have increased the stall speed. The stall speed (no ice) was calculated to have been 65 knots.

Flight test data on similar airplanes show that the stall speed can increase as much as 25 to 38 knots with 1/4 inch of rime ice buildup. Many airplanes buffet significantly during stalls when small amounts of ice are present. Ice can make the stall characteristics of the airplane sharper and more severe. Ice-induced stalls may make roll control difficult or impossible. Once the airflow becomes detached (stall), a 10- to 15-knot increase in airspeed above stall speed may be required to reattach the air flow to the wing. In the presence of an ice-induced stall, full power may not result in the airplane climbing and/or accelerating.

Although the deice boots might have been set to cycle at 60-second intervals, ice may not have been shed on each cycle. It is common for light coatings of ice to remain attached when the boots are cycled.

While N81589 was in contact with the Chicago Air Route Traffic Control Center (ARTCC), the controller broadcast SIGMET Juliet 2. This SIGMET, valid until 1800, concerned moderate to occasionally severe icing in clouds below 8,000 feet. It covered the area from Aberdeen, South Dakota, to 60 miles northwest of Eau Claire, Wisconsin, to 60 miles east of South Bend, Indiana, to Grand Island, Nebraska, and back to Aberdeen.

At 2304:09, the pilot of N81589 asked the Chicago ARTCC to provide the current Mason City and Waterloo, Iowa, weather. The Chicago ARTCC controller reported the current Mason City and Waterloo weather as follows:

Mason City

Indefinite ceiling 400 feet, sky obscured with 3/4 mile visibility, light freezing drizzle and fog, temperature 26° F, dew point 25° F, winds from 110° at 10 knots.

Waterloo

Measured ceiling 500 feet overcast, 1 1/2 miles visibility, light freezing drizzle, temperature 30° F, dew point 28° F, winds from 120° at 10 knots.

As N81589 approached the Des Moines area, the pilot was issued the following weather:

Des Moines

Sky partially obscured, measured ceiling 100 feet overcast, visibility 1/2 mile, light freezing drizzle and fog, temperature 30° F, winds from 120° at 3 knots, altimeter 29.83, runway 12L visibility more than 6,000 feet.

At the Des Moines International Airport, the inbound crossing altitude for the runway 12L outer marker was 2,542 feet; the magnetic heading of the localizer was 127°; and the glide slope descent angle was 3°. The decision height (DH) was 200 feet above the touchdown zone elevation of 921 feet. Minimum visibility for a full ILS approach was 4,000 feet runway visual range (RVR) or 3/4 mile.

The wreckage path started approximately two city blocks west of the impact area. Tree limbs were scattered in the yards on the north side of the street for the full two blocks. Some pieces of tree limbs had propeller slice marks on each end. The longest of these, a piece 16 inches long, was found on the west end of the flightpath. The pieces became shorter toward the east and the shortest piece, 6 1/2 inches long, was found just to the east of the final impact area.

In the airplane's final descent, it passed between two trees that were not far enough apart to allow a wing's level passage. The airplane passed inverted through a string of powerlines, hit a powerpole with the right wing, and then struck a 22-inch-diameter tree, approximately 2 feet above ground level. According to witnesses, there was no explosion, and there was no indication of preimpact fire, but the airplane started to burn shortly after impact with the 22-inch-diameter tree.

The pilot and passenger compartments were demolished by impact and fire. The outer portions of the left and right wings were not damaged by fire but received severe impact damage. The outer third of the right wing was severed by impact with the powerpole. The right engine, propeller, and nacelle remained attached to the wing. All three blades of the right propeller received impact damage and one received severe fire damage. As the left wing touched down, it contacted several small trees and the left engine and propeller became detached from the firewall and came to rest under the top of the left wing. All three blades of the left propeller had severe impact damage.

Preimpact continuity of the flight controls to their respective surfaces could be confirmed outside the cockpit and passenger area, but due to the extreme impact and fire damage, control continuity could not be confirmed within the cockpit and passenger area.

Some of the flight and engine instruments and the position of many of the switches on the overhead panel were documented; however, the validity of these documented positions were questionable since the cockpit area was inverted and was disturbed during occupant removal. Switches for the deice systems were located on the right overhead switch panel. The airframe deice switch was found in the "Automatic" position, and the left and right pitot heat switches were found in the "Off" positions. The windshield and propeller deice switches were found in the "Off" positions.

The landing gear was up and locked, and the wing flaps were extended 15° at impact. Both landing lights were retracted, although a witness reported seeing the landing lights before the airplane struck the trees.

The airplane was equipped with an emergency locator transmitter (ELT). A report from an airborne airplane indicated an ELT was activated about the time of the crash.

The pilot of N81589 was employed by Iowa State University in 1959. From 1972 until the accident, he was employed as general manager of the school's flight department. He was certified to exercise the privileges of a commercial pilot and had the following ratings: airplane single and multiengine land, instrument, and instrument flight instructor. His latest airman physical, a class 2, was accomplished on December 5, 1984, and had the following limitation: "Must wear glasses for far and near vision." Medical records indicate that the pilot was given a waiver for a defective color vision after a practical test with signal lights on June 12, 1956.

As of the day of the accident, the pilot had a total pilot time of 7,020 hours. Of this, 1,553 hours had been flown in this make and model airplane. The pilot's logbook indicated that he had flown 1,334 hours under actual instrument conditions. On August 29, 1985, the pilot was given a biennial flight review in N81589.

The autopsy performed on the pilot revealed nothing medically that could have contributed to the accident. Toxicological tests for drugs and alcohol were negative. The pilot died from multiple injuries, and there was no evidence of inhalation of combustion products.

Postcrash teardown and examination of the engines and propellers disclosed no evidence of preimpact mechanical malfunction or failure of these components. The right engine and propeller were given a partial teardown inspection at a fixed base operator (FBO) in Des Moines. The engine crankshaft was rotated, and continuity throughout the engine was established. A dry compression check indicated that three of the cylinders were 70 psi or above, and the other three cylinders were 69, 64, and 52 psi. The engine was severely damaged by impact and postimpact fire. Both magnetos were melted away, and the right side of the engine mount was fractured. All three blades of the right propeller were bent back but had compound curves. One-third of one of the blades had melted away. One of the other blades was curled at the tip. The impact damage indicates that the right engine was delivering power to the right propeller during the final impact.

There was no physical evidence that the left engine was not delivering power to the left propeller just before and during the final impact. However, the left engine was sent to Avco Corporation (Lycoming Division) in Williamsport, Pennsylvania, for inspection and an operational test. With minor changes and repairs to items rendered unusable by impact and fire, the engine was operated satisfactorily in a test cell.

The left propeller was examined at the Hartzell Products Division in Piqua, Ohio. Operational evaluation at Hartzell indicated the propeller was not feathered at impact and was capable of normal operation.

The audio laboratory of the National Transportation Safety Board evaluated cassette recordings of air traffic control transmissions from the airplane to determine the engine performance. This was accomplished by evaluating the audio signatures of engine sounds which were recorded by the tower during the pilot's radio transmissions while on the approach to Des Moines. A sound spectrum examination indicated the rotation speed of one or both propellers was about 2,580 rpm.

Because the pilot stated over the radio to the Des Moines tower that he was in severe turbulence, the weather was studied in detail. The findings showed no possibility for weather-associated turbulence in the area of the accident. However, weather conditions did have the potential for light and possibly moderate mixed icing below 4,000 feet near Des Moines. Reports from the Boeing 727 and the two other Iowa State University aircraft indicated the icing was probably light rime during their approaches to Des Moines in the hour before the accident. There was a temperature inversion between 2,600 and 4,000 feet msl. The winds beneath the inversion would have been light. Some turbulence would have been expected in the vicinity of the inversion, but little to none should have occurred between the inversion and the surface, where the approach was being made.

The possibility that N81589 was upset by wake turbulence from the preceding Boeing 727 was considered. The wind at the surface was almost straight down the runway, but shifted more southerly with altitude. Based on the theoretical and flight test data, wingtip vortices from the Boeing 727 would have descended beneath the flightpath at a rate of 300 to 500 feet-per-minute and would have stabilized at no more than 900 feet below the intended flightpath of N81589. A National Aeronautics and Space Administration expert predicted that, for the Boeing 727, wingtip vortices would decay in about 60 seconds and drop 400 to 600 feet in the wind and atmospheric conditions described for this accident.

According to radar data, the separation between the Boeing 727 and N81589 was 3.74 miles when the airplanes were outside the outer marker. This was less than the 4 miles required by paragraph 5-72e of FAA Handbook 7110.65d, which specifies the procedures for traffic separation and wake turbulence avoidance during instrument approaches. However, the controller had asked the pilot of N81589 to reduce speed. By the time the Boeing 727 had passed the point of N81589's eventual course deviation, the separation had increased to about 4.7 miles in distance and 2 minutes 40 seconds in time.

Radar data and a readout and corresponding data plot from the flight data recorder of the Boeing 727 showed that the Boeing 727 did not deviate from a normal ILS approach. Radar data showed that N81589 had intercepted the localizer about 3 miles outside the ILS outer marker. Airspeed derived from radar data showed that N81589 was slowing from about 100 knots indicated airspeed (KIAS) at the outer marker to about 80 KIAS at the point of deviation. During the deviation, the airspeed increased to about 100 KIAS and subsequently decreased to about 70 KIAS as the airplane approached the crash site.

In summary, the Safety Board believes that during a night ILS approach in low ceilings, low visibility, light drizzle, and icing conditions, N81589 entered an uncontrolled altitude deviation for undetermined reasons. At some point in the sequence of events that led to the accident, the aircraft deviated sharply to the left of the instrument approach path and one engine suffered a temporary loss of power for an undetermined reason. Although both engines were delivering high power to the propellers during the last phase of the flight, the airplane was flying over rising terrain. The Safety Board believes that the pilot was unable to obtain sufficient airspeed to climb or turn toward lower terrain. Subsequently, the aircraft contacted the tops of trees, powerlines, and a powerpole, and crashed and burned.

Following is a chronological summary of factual findings that were identified during the investigation:

1. N81589 encountered icing conditions during arrival to Des Moines.

2. The amount of ice buildup on N81589 was not determined, but ice buildup on airplanes that preceded it was reported as light.

3. N81589 was vectored for an ILS approach to runway 12L behind a Boeing 727.

4. Radar data showed that the separation between the aircraft was 3.74 miles in the early stages of their approaches, but had increased to 4.7 miles by the time the Boeing 727 had passed the point where N81589 subsequently made a course deviation. The elapsed time was 2 minutes 40 seconds.

5. The Boeing 727 was nominally on the ILS localizer and glide slope during its approach to the airport.

6. The predicted altitude drop of the Boeing 727's wingtip vortices would have been 400 to a maximum 900 feet. The predicted vortex life was 60 seconds.

7. There was no convective weather activity or wind shear that would have caused turbulence. There was a temperature inversion, but it was well above the approach altitudes of both aircraft.

8. Transponder altitude information from N81589 was not available; however, after the point of the course deviation, witnesses described the aircraft as being near treetop level over the city.

9. N81589 was slowing from about 100 knots to about 80 knots from the outer marker to the point of course deviation.

10. During the course deviation, N81589 accelerated from about 80 to 100 knots.

11. N81589 decelerated from about 100 knots to about 70 knots between the point of course deviation and the crash site.

12. Witnesses indicated that one engine of N81589 had a power loss near the course deviation. However, near the crash site, no unusual engine sounds were noted and there was evidence that both engines were providing power when the aircraft contacted the tops of trees.

13. The stall speed with approach flaps was about 65 knots (assuming a 1 G flight condition and no airframe icing).

14. Structural icing could have increased the stall speed from 65 to 80 KIAS.

15. Minimum control speed (Vmc) was 74 knots.

16. About 30 seconds after deviating from the ILS course, and about 0.7 mile to the left of course, the pilot reported that he was "in severe turbulence."

17. The aircraft did not climb above the rising terrain and collided with trees.

18. The deice switch was found in the "Automatic" position, which would have resulted in 60-second cycles. The pitot heat switches and the windshield and propeller deice switches were found in the "Off" positions. However, due to impact, fire, and rescue activities, the precrash position of these switches could not be verified.

19. After a substantial altitude deviation in the approach or landing configuration, the aircraft's ability to climb and/or accelerate would have been seriously degraded, if structural icing and/or engine power loss occurred.

20. The normal approach speed (without airframe ice) is 100 KIAS or greater.

Although the reason for N81589's altitude deviation could not be positively determined, the Safety Board believes that it was most likely due to a combination of relatively slow flight and the presence of light airframe icing, which resulted in premature aerodynamic stall. It is also possible that N81589 had descended well below the ILS glide slope and encountered wake turbulence that lasted considerably longer and remained much higher than either theory or flight tests would indicate possible. The Safety Board believes that the pilot's reference to "severe turbulence" is consistent with an encounter with either ice-induced aerodynamic buffeting or wake turbulence. The engine may have lost power due to the unporting of fuel lines during the loss of control.

Attached is a brief of accident which contains the Safety Board's findings of probable cause and related factors.

BY TBE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ JOHN K. LAUBER
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Member

July 21, 1987

National Transportation Safety Board
Washington, D.C. 20594

Brief of Accident

File No. - 2896 11/25/85 DES MOINES,IA A/C Reg. No. N81589 Time (Lcl) - 1742 CST

----Basic Information----
Type Operating Certificate-NONE (GENERAL AVIATION)
Type of Operation -PUBLIC USE
Flight Conducted Under -14 CFR 91
Accident Occurred During -APPROACH

Aircraft Damage: DESTROYED
Fire: ON GROUND

	Fatal	Serious	Minor	None
Crew	1	0	0	0
Pass	6	0	0	0

----Aircraft Information----
Make/Model - ROCKWELL INTL 500-S
Landing Gear - TRICYCLE-RETRACTABLE
Max Gross Wt - 6750
No. of Seats - 7
Eng Make/Model - LYCOMING IO-540-E1B5
Number Engines - 2
Engine Type - RECIP-FUEL INJECTED
Rated Power - 290 HP
ELT Installed/Activated - YES/YES
Stall Warning System - YES

----Environment/Operations Information----
Weather Data
Wx Briefing - FSS
Method - TELETYPE
Completeness - FULL
Basic Weather - IMC
Wind Dir/Speed- 120/005 KTS.
Visibility - .500 SM
Lowest Sky/Clouds - 100 FT
Lowest Ceiling - 100 FT OVERCAST
Obstructions to Vision- FOG
Precipitation - FREEZING DRIZZLE
Condition of Light - NIGHT(DARK)

Itinerary
Last Departure Point
MILWAUKEE,WI
Destination
SAME AS ACC/INC

ATC/Airspace
Type of Flight Plan - IFR
Type of Clearance - IFR
Type Apch/Lnds - ILS-COMPLETE

Airport Proximity
OFF AIRPORT/STRIP

Airport Data
DES MOINES MUNI
Runway Ident - 12L
Runway Lth/Wid - 9000/ 150
Runway Surface - ASPHALT
Runway Status - WET

----Personnel Information----
Pilot-In-Command
Certificate(s)/Rating(s)
COMMERCIAL,CFI
SE LAND,ME LAND
Instrument Rating(s) - AIRPLANE

Age - 59
Biennial Flight Review
Current - YES
Months Since - 3
Aircraft Type - 500-S

Medical Certificate - VALID MEDICAL-WAIVERS/LIMIT

Flight Time (Hours)

Total -	7020	Last 24 Hrs -	2
Make/Model-	1553	Last 30 Days-	UNK/NR
Instrument-	1334	Last 90 Days-	72

----Narrative----
N81589 WAS FLWG A HOEING 727 ON ILS APCH IN IFR CONDS. APRX 2.5 MI FM RWY, N81589 SUDDENLY DEVIATED LEFT NRLY 90 DEG. 39 SEC LATER, PLT RPRTD HE ENCTRD SVR TURBC, THEN S A I D HE WAS TRYING TO CLB. N81589 SUBSEQUENTLY FLEW THRU TREE TOPS ON RISING TRRN FOR APRX 2 CITY BLKS, THEN HIT PWR LNS & A POLE & CRASHED AGAINST A TREE. NO EVIDENCE OF TURBC DUE TO WX AT/NR APCH ALT. INV SHOWED 4.7 MI SEPN BTN ACFT WHEN THE 727 PASSED THE POINT OF DVN (POD). AT POD, THE 727 WAS ON THE ILS GLIDE SLOPE AT 850'; N81589'S ALT WAS NOT DETERMINED. WND WAS FM 120 DEG AT 3 TO 6 KTS, SHIFTING MORE SOUTHERLY WITH ALT. PREVAILING VIS WAS 1/2 H I ; RVR FOR RWY 12L WAS 6000LGT RIME ICG WAS RPRTD. WITNESSES HEARD PWR INTERUPTION OF 1 ENG AT POD; BUT THERE WAS NO INDCN OF PWR LOSS WHERE ACFT H I T TREE. RADAR DATA SHOWED ACFT SLOWED TO 80 KTS AT POD, ACCELERATED TO 100 KTS DRG DVN, SLOWED TO 70 KTS PER IMPACT; VMCA WAS 74 KTS. SAFETY BOARD BELIEVES HE PLT MOST LIKELY LOST CONTROL DUE TO SLOW SPD & LGT AIRFRAME ICG; POSSIBLY ENCTRD WAKE TURBC. NO REASON FND FOR LOSS OF ENG PWR.

File No. - 2896 11/25/85 DES MOINES,IA A/C Reg. No. N81589 Time (Lcl) - 1742 CST

Occurrence #1 LOSS OF CONTROL - IN FLIGHT
Phase of Operation APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Finding(s)
1. LIGHT CONDITION - DARK NIGHT
2. WEATHER CONDITION - LOW CEILING
3. WEATHER CONDITION - FOG
4. WEATHER CONDITION - RAIN
5. WEATHER CONDITION - ICING CONDITIONS
6. WING - ICE
7. AIRSPEED - REDUCED - PILOT IN COMMAND
8. AIRSPEED - INADEQUATE - PILOT IN COMMAND
9. AIRCRAFT HANDLING - NOT MAINTAINED - PILOT IN COMMAND
10. DESCENT - UNCONTROLLED -
11. DIRECTIONAL CONTROL - NOT MAINTAINED -
12. REMEDIAL ACTION - INITIATED -
13. LEVEL OFF - PERFORMED -

Occurrence #2 LOSS OF POWER
Phase of Operation APPROACH

Finding(s)
14. UNDETERMINED

Occurrence #3 IN FLIGHT COLLISION WITH OBJECT
Phase of Operation APPROACH

Finding(s)
15. TERRAIN CONDITION - RISING
16. PROPER CLIMB RATE - NOT POSSIBLE -
17. STALL/MUSH
18. OBJECT - TREE(S)
19. OBJECT - WIRE,TRANSMISSION
20. OBJECT - UTILITY POLE

Occurrence #4 IN FLIGHT COLLISION WITH TERRAIN
Phase of Operation DESCENT - UNCONTROLLED

----Probable Cause----

The National Transportation Safety Board determines that the Probable Cause(s) of this accident is/are finding(s) 6,8,9

Factor(s) relating to this accident is/are finding(s) 1,2,3,4,5,7,14,15,18,19,20

National
Transportation
Safety Board
Washington, D.C. 20594

AIRCRAFT ACCIDENT/INCIDENT SUMMARY

Pile No.:	5042
Aircraft Owner:	American Trans Air, Inc.
Aircraft Type and Registration:	McDonnell Douglas DC-10-40, N184AT
Location:	O'Hare International Airport, Chicago, Illinois
Date and Time:	August 10, 1986, 0715 central daylight time
Occupant Injuries:	None
Aircraft Damage:	Destroyed
Type Occurrence:	Fire
Phase of Operation:	Static

American Trans Air flight 131, a McDonnell Douglas DC-10-40, N184AT, operating as a nonscheduled passenger charter flight from Honolulu, Hawaii, to Chicago, Illinois, with an en route fuel stop in Los Angeles, California, arrived without incident at Chicago's O'Hare International Airport about 0600 c.d.t. on August 10, 1986. The airplane was taxied to Hardstand gate 7 in an area remote from the passenger terminal where international arrivals are routinely parked. The flight arrived at the gate at 0616. After the passengers and crew had deplaned, and while cabin cleaners were working in the passenger cabin and mechanics were servicing the airplane, smoke was discovered in the cabin. The source of the smoke was not deter-mined by the cabin cleaners or American Trans Air personnel before they exited the airplane. Subsequently, a fire spread rapidly throughout the entire cabin before it could be brought under control by firefighters. Although the airplane was destroyed, none of the service personnel were injured.

The occurrence was classified as an incident rather than an accident (even though the airplane was destroyed) because it did not occur incident to flight. Thus, it did not meet the Safety Board's definition of accident contained in Title 49 Code of Federal Regulations (CFR) Part 830.2.

During the previous flight from Los Angeles to Chicago there were no passenger complaints about smoke or fumes. The flightcrew reported that there were no aircraft discrepancies during the flight, except that the seatback of seat 12C would not remain in an upright position. American Trans Air maintenance personnel did not note any additional discrepancies during a postflight walkaround inspection of the airplane. When the flightcrew left the airplane, the airplane auxiliary power unit (APU) was operating, all three air conditioner packs were on, and cargo compartment heat was on. Galley power was reportedly off and there was no external power connected to the airplane. Maintenance personnel later turned off the number 2 air conditioner pack.

Passenger baggage had been loaded only in the rearmost cargo compartments, designated C2 and C3. Baggage unloading was commenced before all of the passengers had deplaned and was still in progress when a team of seven cabin cleaners boarded the airplane about 0645 to prepare the airplane for the next flight. Meanwhile, an American Trans Air mechanic was servicing the engines with oil and was tasked with replacing the broken seatback.

The mechanic reported that he went to the forward cargo compartment (C1) where five to seven passenger seatbacks were temporarily stored with company materials in an LD-3 aluminum cargo container. Maintenance personnel thought that one of those seatbacks might have been a suitable replacement for that of seat 12C. The mechanic reported that he found the LD-3 container in the left rear corner of the C1 compartment. He examined the container contents by leaning through the rearward-facing opening which was not obstructed by a door nor a curtain. The contents of the container included a cardboard box filled with seatbacks, cases of engine oil and hydraulic fluid, oil servicing carts, a box of tray tables, and five cardboard boxes of wool seat covers. The box containing the seatbacks also contained bubble plastic packing material. Supplemental oxygen systems were installed in some of the seatbacks.

The mechanic entered the C1 compartment about 0650 and remained there for about 10 minutes, during which he removed and examined individually each of the seatbacks in the container. Discovering that none of the seatbacks was serviceable, the mechanic returned them to the box, stacking the seatbacks as he had found them. The mechanic reported that the supplemental oxygen compartment door of one of the seatbacks was open and would not latch when closed. He also reported that an oxygen generating canister associated with a seatback oxygen generating system was loose. It was attached to a seatback only by a plastic hose through which oxygen is supplied to an associated face mask. The mechanic said he did not determine whether the canister had been previously activated and he said he handled it only by its plastic hose. He placed the canister back into the box without determining to which seatback the canister was associated. The mechanic said he noticed no unusual odor, smoke, or heat in the C1 compartment. The mechanic left the C1 compartment, closed and locked the compartment door, and resumed servicing of the airplane engines. The engine oil and the oil servicing cart in the C1 compartment were not used in servicing the engines.

When they entered the cabin of N184AT about 0645, some of the cabin cleaners complained that the cabin was cold. However, the cabin cleaners found that as they worked the cabin became uncomfortably hot. One of the cleaners noted that the air was warmest near the cabin floor. A few minutes later, the cabin cleaners noticed gray smoke in the middle passenger cabin (several rows aft of the L2 exit). They reported that the smoke was coming from beneath the seats near the cabin wall. The cabin cleaners said the smoke grew darker and rapidly intensified, but they did not observe flame before they left the cabin. About 0715, the cleaners evacuated the airplane and notified American Trans Air passenger service and maintenance personnel that there was smoke in the airplane. About the same time, American Trans Air maintenance personnel saw smoke coming from the cabin outflow valve, below the cabin floor on the left side of the airplane.

The mechanic servicing the engines entered the cabin and saw smoke, but he could not locate the fire. He proceeded to the cockpit and stopped there just long enough to shut down the APU. He said he did not look at the annunciator lights, and therefore was not able to determine if a smoke or fire warning was displayed. (The C1 compartment was equipped with a smoke detector and a Halon fire extinguisher system. The fire extinguisher system is manually activated from the cockpit.) The C1 compartment fire extinguisher was not activated.

The assistant maintenance supervisor met the mechanic in the airplane and they both went to the middle cabin to try to locate the fire. However, the smoke had become too thick to investigate aft of the L2 door although flames were not yet visible. They exited the airplane and the supervisor initiated notification of the fire department by

radioing company personnel. American Trans Air mechanics then unlocked the C1 compartment door to determine whether a fire was in that compartment. Movement of the door handle opened a small vent door, within the larger cargo compartment door. The mechanics found the cargo compartment door hot and observed smoke from the vent door when it was opened. They elected not to open the larger cargo door so as not to provide additional oxygen to the fire.

About 0728 the flightcrew of the next scheduled flight of N184AT arrived at the airplane. They observed flames through cabin windows aft of the L2 exit. Witnesses stated that within a few minutes the flames had reached the L1 door near the front of the airplane. The flames eventually spread throughout the cabin and burned through the cabin roof in several locations. The first area to burn through was above the mid-cabin area where smoke and flame were first observed by witnesses.

The fire department was not notified of the incident immediately after discovery of smoke in the airplane because of communications problems at the Hardstand gate area and because the American Trans Air employees who first observed smoke coming from the outflow valve elected to investigate, before reporting the incident to the fire department. The American Trans Air assistant maintenance supervisor did not have portable radio equipment capable of communicating directly from the airplane to either the fire department or the control tower. Neither did he have a direct communications link with his maintenance office, because it was not staffed at that time (Sunday morning, limited staffing) or with his operations office, which was in the terminal building and out of radio range. He attempted to report the fire to the American Trans Air operations office by radio at 0718, but it was necessary for company employees en route from the Hardstand area to relay the message. As a result of these problems, the fire department was not notified of the incident until 0722.

Another possible factor delaying the notification of the fire department was the absence of emergency alarm boxes in the vicinity of Hardstand gate 7. The emergency alarm system, in use at O'Hare International Airport in August 1986, included about 111 alarm boxes installed in strategic locations about the airport. A map showing the locations of the alarm boxes indicated that a box 50 was located near Hardstand gate 7. However, the investigation revealed that box 50 had been removed several months earlier due to construction. Further, it was learned that the building which housed the American Trans Air maintenance office was a temporary building, and because it was temporary, it did not have emergency alarm boxes. A random check revealed that fire department alarm boxes were not typically installed on temporary buildings at the airport.

The City of Chicago Fire Department was initially notified by American Trans Air personnel that there was smoke coming from N184AT. Although it was not reported initially that the airplane was on fire, fire department vehicles were dispatched immediately. Fire department records indicate that the first fire department personnel reached N184AT at 0728 and found the airplane was already "totally involved." Some fire department personnel cooled down the wings and fuselage while other units mounted an interior attack. One of the firefighters conducting the interior attack was injured due to smoke inhalation after his mask was knocked off by spray from a foam turret. There were no other injuries associated with the incident. Although about 46,000 pounds of fuel was aboard the airplane, the fire was confined to the fuselage and did not ignite the fuel in the wings.

Examination of the airplane revealed a large hole burned through the cabin floor on the left side of the middle cabin (between fuselage stations 980 and 1080). The hole was about 7 feet wide by 8 feet long and was above the LD-3 container in the left rear corner

of the C1 compartment. (See figure 1.) The cabin floor beams were burned away in this area, and debris from the cabin had fallen into the cargo compartment and adjacent tunnel area through which pneumatic ducting, hydraulic lines, and wiring were routed. There were no other holes burned through the cabin floor. There were no other areas in the cabin with evidence of comparable heat or fire concentration.

The entire cabin was destroyed by the fire. However, with the exception of the C1 compartment, there was minimal evidence of heat damage below the cabin floor. The center accessory compartment (below the cabin floor, aft of the C1 compartment and forward of the rearmost cargo compartments) was sooted but revealed no evidence of intense heat. The airplane batteries and wiring in the center accessory compartment appeared to be in serviceable condition. Likewise, the C2 and C3 cargo compartments were not fire damaged, except for a small scorch mark on the ceiling of the C3 compartment.

The C1 compartment was extensively fire damaged, particularly in the left rear corner where the LD-3 container was located. Besides the LD-3 container, the C1 compartment contained only boxes of plastic trays and cups and a wooden pallet. The pallet and boxes were covered with partially burned debris from the passenger cabin, but had minimal fire damage.

The ceiling and left side wall of the C1 compartment were burned away above and adjacent to the LD-3 container. The tunnel area, between the left side wall of the C1 compartment and the fuselage skin, contained pneumatic bleed air ducts, hydraulic lines, thin wall aluminum ducting for cargo compartment heat, and several aluminum wiring harnesses. The pneumatic bleed air ducts and hydraulic lines revealed no evidence of leakage. Several feet of the thin wall aluminum ducting was burned away adjacent to the LD-3 container, but the ducting was intact upstream and downstream of the burned area. The jet pump nozzle of the cargo heat system was intact and was not sooted. The wiring harnesses revealed no evidence of electrical arcing and appeared to be in good condition outside the burned area. The examination of the airplane system components routed through the tunnel area did not reveal an ignition source or materials which would have sustained combustion for an extended period.

The aft wall of the C1 compartment was scorched with a small area of burn-through exposing wiring into the center accessory compartment. The wiring showed no evidence of electrical arcing. Examination of the forward galley power relays indicated that the forward galley power was off. Switch positions in the cockpit also indicated that galley power was off.

The ceiling and upper left side of the LD-3 container was burned away. The contents of the container were partially burned. Examination of the contents revealed that one can of engine oil (located near the forward left corner of the container) had ruptured; none of the hydraulic oil cans were involved in the fire. The cardboard box which contained the seatbacks was located near the rear center area of the LD-3 container and was adjacent to cardboard boxes of seatcovers, located to the right and left. A loose oxygen generator canister with a dented percussion cap, indicating manual activation of the canister, was found near the bottom of the stack of seatbacks which were in the LD-3 container. There was evidence of burning of the adjacent seatcover material down to the level of the manually activated oxygen canister. The seatbacks in the LD-3 container were heavily burned and were found in the lowest area of heavy burn damage in the LD-3 container and the airplane. The manually activated canister was identified by a data plate as Scott Aviation part number 801386-06C and having been

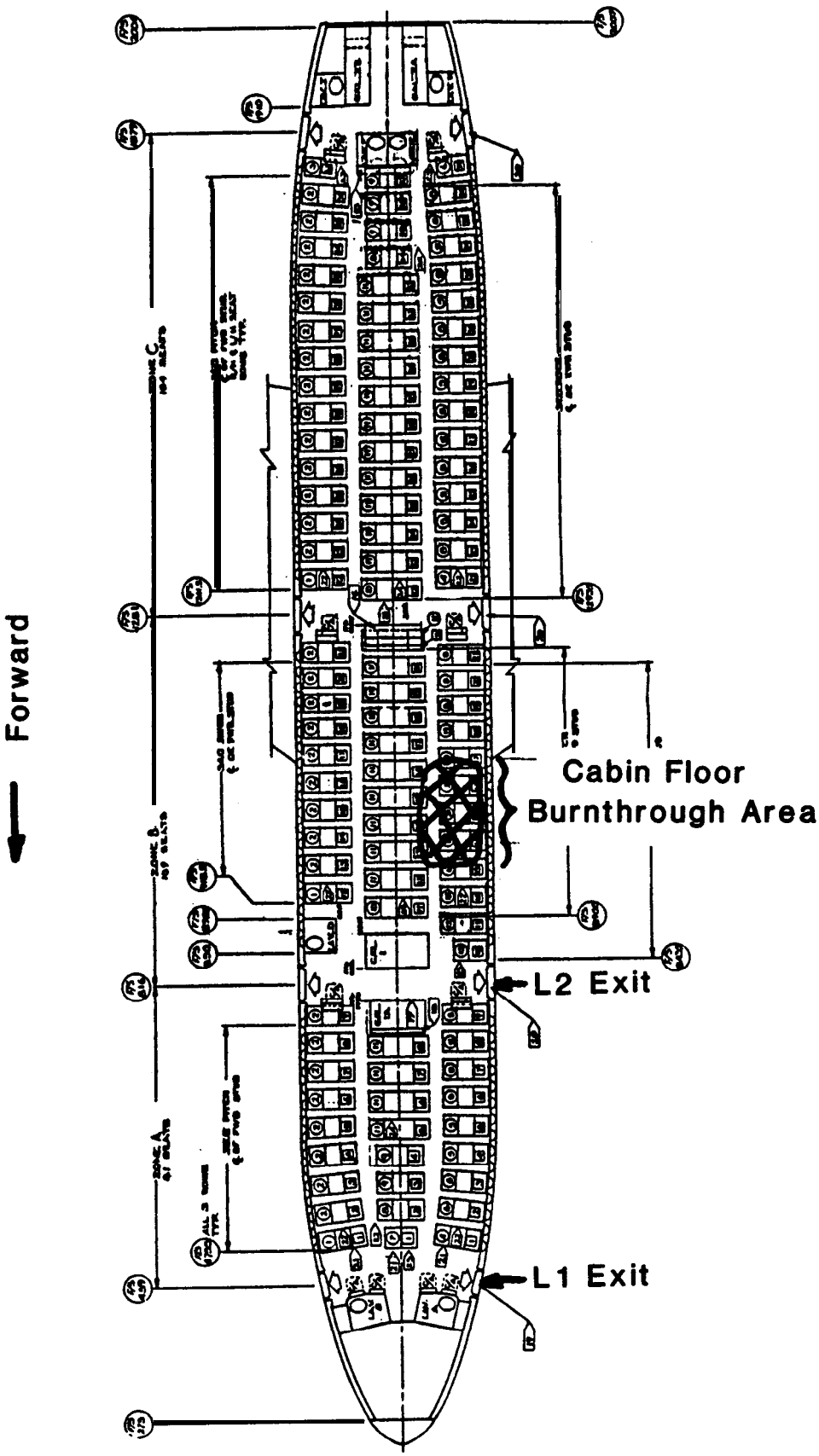

Figure 1.—American Trans Air DC10-40, N184AT (interior configuration).

manufactured in July 1973. It was part of a three-man unit manufactured by Scott Aviation of Lancaster, New York (a leading manufacturer of solid state oxygen generators for aircraft). None of the other oxygen generators found in the C1 compartment had been activated manually.

The passenger oxygen system in N184AT consisted of solid-state generators that were located in seatbacks throughout the cabin except in front row seats where they were located in overhead compartments. An oxygen canister of this type is activated manually by pulling a lanyard which releases a spring-actuated hammer which in turn strikes a percussion cap, initiating a chemical reaction. (See figure 2.) When a passenger pulls an oxygen mask away from its storage compartment, the lanyard will normally be pulled with sufficient force to release the spring-actuated hammer and initiate the thermal decomposition of the generator core. The decomposition produces oxygen for about 15 minutes. Test data indicate that the outside surface of Scott oxygen generator canisters may reach 420 to 430° F during the production of oxygen. Other test data indicate that the generators may self-ignite at temperatures above 525° F, but the hammer would not contact the percussion cap under those circumstances.

Manual activation of a similar unit removed from N184AT, wrapped in a throwaway-type paper laboratory coat, demonstrated that the canister was capable of producing sufficient heat to ignite and sustain a fire during the production of oxygen. During the test, the canister ignited and burned the laboratory coat.

The witnesses to the incident reported consistently that smoke and flame were observed initially in the middle cabin in the same general area where investigators found the hole in the cabin floor. Witness observations that the air was warmest near the floor, that smoke seemed to be coming from beneath the cabin floor, and that smoke was escaping from the cabin outflow valve were consistent with a fire which was initiated below the cabin floor level in the C1 compartment. The witness observations that the first burnthrough of the cabin roof occurred above that same mid-cabin area provided further evidence that the fire was initiated at or below the middle cabin area.

The Safety Board investigation revealed conclusively that the fire was initiated in the left rear corner of the C1 compartment in a cargo container. The fire propagated upward and burned through the cabin floor. It ignited cabin interior materials and eventually engulfed the entire cabin.

Since heat rises and fire patterns normally follow the same path (unless influenced by air currents), there was sufficient evidence to conclude that the fire which caused the burnthrough of the cabin floor was initiated at a lower level. The absence of an ignition source in the tunnel area adjacent to the C1 compartment or in the material located around the LD-3 container supported the conclusion that the fire was initiated within the LD-3 container. The container contents included numerous combustables, an ignition source, and an oxidizer which would promote the growth of a fire if it were activated. The manually activated oxygen canister provided heat and oxygen to ignite and feed the fire. The bubble plastic, cardboard packaging, and the seatcovers provided ample fuel to sustain the fire. Fuel for the fire was supplemented by engine oil from an oil can which ruptured from heat expansion after the fire intensified within the container. The heat pattern within the container showed clearly that the fire was initiated by the manually activated oxygen generator. The heat from the fire melted the LD-3 container ceiling and part of its side wall before progressing upward and burning through the cabin floor.

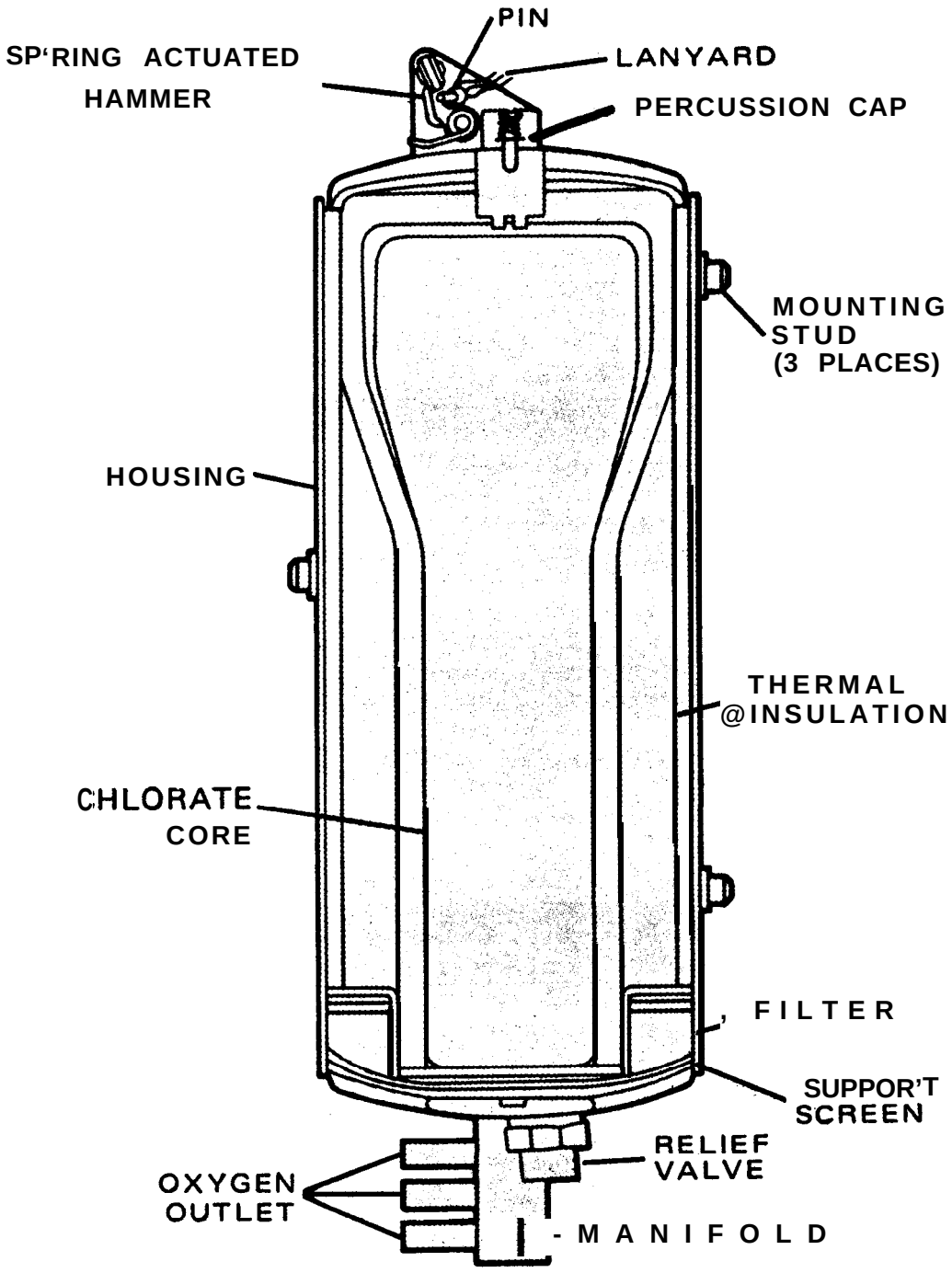

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Figure 2.-Oxygen generator (cut-away view).

The interview of the American Trans Air mechanic who had handled the seatbacks in the LD-3 container revealed that he had not previously been asked to replace a seatback or to install or repair passenger supplemental oxygen systems in a DC- 10. Consequently, the Safety Board believes that the mechanic was inadequately experienced to perform his assigned duties and was, therefore, vulnerable to making errors in the handling of the oxygen equipment. The Safety Board concludes that the fire was initiated inadvertently, as a result of the mechanic's improper handling of an oxygen generating canister associated with a seatback temporarily stored in the C1 compartment. The oxygen generator had not been packaged in accordance with Federal regulations.

The Safety Board issued a special study in March 1976, which addressed problems and hazards associated with solid-state oxygen generating systems and made several recommendations to the Federal Aviation Administration (FAA) as a result of that study. 1/ The recommendations dealt with operational problems, including potential fire hazards associated with improper handling of the units in the passenger cabin of a DC-10, but did not address the hazards associated with carrying the units as cargo.

The Safety Board was concerned to learn as a consequence of this incident that some air carriers were not aware that solid-state passenger supplemental oxygen generators were capable of generating temperatures in excess of 420° F and are classified as hazardous materials when carried as company material in cargo compartments. 2/ Consequently, some air carriers were not taking the required precautions when shipping oxygen generators in their airplanes. However, following this incident, the FAA promptly notified all domestic air carriers and foreign airworthiness authorities of the circumstances of the incident and reminded them that oxygen generators are oxidizers, and therefore, are classified as hazardous materials which should be packaged and stowed securely. In addition, operators were reminded of the provisions of 49 CFR 175.10(a)(2) and the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air, which specify that hazardous materials, carried as replacements for items required to be on board in accordance with airworthiness or operational requirements, must be carried in suitable containers.

1/ For more detailed information, read Special Study—"Chemically Generated Supplemental Oxygen Systems in DC-10 and L-1011 Aircraft," March 3, 1976 (NTSB-AAS-76-1).

2/ Title 49 CFR 172.101 identifies those items classified by the Department of Transportation as "hazardous materials." Title 49 CFR Part 173 defines the applicable packaging standards for hazardous materials.

The attached brief of incident contains the Safety Board's findings of probable cause and factors related to the incident.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ JOHN K. LAUBER
Member

/s/ JOSEPH T. NALL
Member

/s/ JAMES KOLSTAD
Member

July 7, 1987

National Transportation Safety Board
Washington, D.C. 20594

Brief of Incident

File No. - SO42 8/10/86 CHICAGO, IL A/C Reg. No. N184AT Time (Lcl) - 0715 CDT

----Basic Information----

Type Operating Certificate-AIR CARRIER - FLAG/DOMESTIC
Name of Carrier -AMERICAN TRANS AIR, INC.
Type of Operation -NON SCHED, DOMESTIC, PASSENGER
Flight Conducted Under -14 CFR 121
Incident Occurred During -STANDING

Aircraft Damage
DESTROYED
Fire
ON GROUND

Injuries	Fatal	Serious	Minor	None
Crew	0	0	0	0
Pass	0	0	0	0
Other	0	0	0	7

----Aircraft Information----

Make/Model - HCDONNELL DOUGLAS DC-lo-40
Landing Gear - TRICYCLE-RETRACTARLE
Max Gross Wt - 555000
No. of Seats - 344

Eng Make/Model - P&W JT9D-20
Number Engines - 3
Engine Type - TURROFAN
Rated Power - UNK/NR

ELT Installed/Activated - NO -N/A
Stall Warning System - YES

----Environment/Operations Information----

Weather Data
Wx Briefing - UNK/NR
Method - UNK/NR
Completeness - UNK/NR
Basic Weather - VMC
Wind Dir/Speed- 160/006 KTS
Visibility - 15.0 SM
Lowest Sky/Clouds - 4000 FT
Lowest Ceiling - 4000 FT RROKEN
Obstructions to Vision- NONE
Precipitation - NONE
Condition of Light - DAYLIGHT

Itinerary
Last Departure Point
LOS ANGELES, CA
Destination
SAHE AS ACC/INC

ATC/Airspace
Type of Flidht Plan - NONE
Type of Clearance - NONE
Type Arch/Lnds - NONE

Airport Proximity
ON AIRPORT

Airport Data
O'HARE INTL
Runway Ident - N/A
Runway Lth/Wid - N/A
Runway Surface - N/A
Runway Status - N/A

-10-

----Personnel Information----

Pilot-In-Command
Certificate(s)/Rating(s)
UNK/NR

Age - UNK/NR
Biennial Flight Review
Current - UNK/NR
Months Since - UNK/NR
Aircraft Type - UNK/NR

Medical Certificate - UNK/NR

Flight Time (Hours)

Total	- UNK/NR	Last 24 Hrs	- UNK/NR
Make/Model	- UNK/NR	Last 30 Days	- UNK/NR
Instrument	- UNK/NR	Last 90 Days	- UNK/NR
tlulti-En9	- UNK/NR	Rotorcraft	- UNK/NR

Instrument Rating(s) - UNK/NR

----Narrative----

A CHARTER FLT ARRIVED & DEPLANED WITHOUT INCIDENT & WITH NO INDICATION OF SMOKE, FUHES OR HEAT. COMPANY MAINT PSNL HAD PLACED DAMAGED PASSENGER SEATPACKS (INCORPORATING SOLID-STATE CHEMICAL OXYGEN GENERATORS) IN THE FWD CARGO COHPARTHENT WITH SEAT COVERS & OIL, A COMPANY HECHANIC EXAHINED THE SEATPACKS TO FIND A SERVICEABLE UNIT. HE FOUND A LOOSE OXYGEN CANISTER & HANDLED IT IMPROPERLY BY ITS OXYGEN HOSE. SUCH HANDLING CAN RELEASE THE FIRING PIN, FIRE THE PERCUSSION CAP, TRIGGER A CHEMICAL REACTION, & GENERATE OXYGEN. THIS CAN GENERATE UP TO 430 DEG OF HEAT OUTSIDE THE CANISTER. A FIRE PGN IN THE FWD CARGO COMPARTMENT IN THE VICINITY OF WHERE AN OXYGEN CANISTER WAS FND (LATER) WITH A DENTED STRIKER PLATE. THE SEAT COVERS IGNITED, FIRE BURNED THRU THE CABIN FLOOR, & SUBSEQUENTLY, IT SPREAD THROUGHOUT THE ENTIRE CABIN. COMPANY MAINT PSNL DID NOT KNOW THAT OXYGEN GENERATORS, CARRIED AS COMPANY SUPPLIES, WERE HAZARDOUS MATERIALS. THE MECHANIC WAS NOT FAMILIAR WITH THE REPAIR OR INSTALLATION OF THE PASSENGER SUPPLEMENTAL OXYGEN EQUIPMENT.

File No. - 5042 8/10/86 CHICAGO,IL A/C Reg. No. N184AT Time (Lcl) - 0715 CDT

Occurrence #1 HAZARDOUS HATERIALS LEAK/SPILL (FUMES/SMOKE)
Phase of Operation STANDING

Finding(s)
1. SUPERVISION - IHPROPER - COMPANY/OPERATOR MGMT
2. IHPROPER DECISION,LACK OF FAMILIARITY WITH AIRCRAFT - COMPANY/OPERATOR MGMT
3. TIE DOWN/SECURITY OF CARGO - IMPROPER - COMPANY/OPERATOR MGMT
4. OXYGEN SYSTEH - NOT UNDERSTOOD - COHPANY HAINTENANCE PSNL
5. OXYGEN SYSTEM - INADVERTENT ACTIVATION - COMPANY MAINTENANCE PSNL
6. IHPROPER USE OF EQUIPMENT/AIRCRAFT,LACK OF FAMILIARITY UITH AIRCRAFT - COMPANY MAINTENANCE PSNL
7. FUSELAGE,CARGO COHPARTHENT - FIRE
8. FIRE EXTINGUISHING ERUIPHENT - NOT USED - COHPANY HAINTENANCE PSNL

Occurrence #2 FIRE
Phase of Operation STANDING

----Frobable Cause----

The National Transportation Safety Board determines that the Prohable Cause(s) of this incident is/are finding(s) 5

Factor(s) relating to this incident is/are finding(s) 1,2,3,4,6

* U.S. GOVERNMENT PRINTING OFFICE:1987-201-610:60038