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16. Abstract

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The National Transportation Safety Board determines that the probable cause of the accident was a stall that resulted from the pilot's control inputs aggravated by airframe icing while the pilot was under the influence of alcohol. Contributing to the cause of this accident was the failure of the other flightcrew members to prevent the captain from attempting the flight.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

Adopted: January 16, 1979

JAPAN AIR LINES CO., LTD.
MCDONNEL-DOUGLAS DC-8-62F, JA 8054
ANCHORAGE, ALASKA
JANUARY 13, 1977

SYNOPSIS

At 0635:39 A.s.t. on January 13, 1977, Japan Air Lines Co., Ltd., JA 8054 crashed shortly after takeoff from runway 24L at Anchorage International Airport, Anchorage, Alaska. The cargo consisted of live beef cattle for delivery to Japan. The three crewmembers and the two cargohandlers aboard the aircraft died in the crash and the aircraft was destroyed.

The National Transportation Safety Board determines that the probable cause of the accident was a stall that resulted from the pilot's control inputs aggravated by airframe icing while the pilot was under the influence of alcohol. Contributing to the cause of this accident was the failure of the other flightcrew members to prevent the captain from attempting the flight.

1. INVESTIGATION

1.1 History of the Flight

On January 13, 1977, a Japan Air Line (JAL) McDonnell-Douglas DC-8-62F, JA 8054, operated as an international charter cargo flight from Moses Lake, Washington, U.S.A., to Tokyo, Japan. An en route stop and crew change were scheduled at Anchorage, Alaska. The aircraft arrived at Anchorage at 0503. 1/ The incoming flightcrew reported that the only weather they encountered en route was a layer of fog on the final approach at 800 feet 2/, and that they did not encounter any precipitation or icing.

The aircraft was serviced and a walk-around inspection was performed by JAL maintenance personnel and contract mechanics. The two contract mechanics stated that there was ice on the inlet guide vanes, the engine cowlings, and the engine bullet noses, but no ice was reported on the airfoil surfaces. The JAL personnel stated that they did not see any ice on the aircraft. One contract mechanic advised the JAL representative that the engine anti-icing system should be used by the next crew to clear the ice in the engine inlets. No maintenance was performed on the aircraft.

The outbound flightcrew was wakened about 0330, left the hotel by taxi about 0430, and arrived at the JAL dispatch office about 0500. The taxicab driver who brought the outbound crew to the airport stated that he became concerned by the captain's actions in the taxi and called his dispatcher to report his impressions.

He stated that the captain's movements were uncoordinated; that his face was flushed and his eyes were glazed; that his conversation was garbled and incoherent; that his movements were jerky and unstable; and that he had trouble getting out of the cab and had to steady himself on the car door.

About 0450 the taxi dispatcher called the operations agent for the contract maintenance company and reported that one of her drivers had taken an "intoxicated" JAL captain to the airport. The operations agent stated that "...it seemed logical that JAL would detect anything unusual and act accordingly." He further stated that at 0620, he notified his line manager of the conversation with the taxi dispatcher and that "I felt that if the captain was intoxicated JAL OPS...or his first officer would have stopped the flight immediately." The JAL dispatch personnel and the inbound JAL crew stated that they noted nothing unusual about the outbound crew. The dispatch briefing proceeded smoothly and no significant questions were asked by the outbound crew.

1/ All times are Alaskan standard based on the 24-hour clock.
2/ All altitudes are mean sea level unless otherwise noted.

The outbound crew consisted of an American captain and a Japanese first officer and flight engineer. They went to the aircraft about 0515 and boarded the aircraft with the two cattle handlers. The driver of the crew car, a friend of the captain, stated that "...he was in good condition as far as way's I've seen him sometimes and I made that statement before I ever heard any rumors that he was supposedly drunk or had been partying or whatever."

A review of the cockpit voice recorder (CVR) indicated that about 0603 the captain and first officer were checking the inputs to the inertial navigation system. They also checked the Automatic Terminal Information Service (ATIS) for local visibility, received their clearance, and began their prestart checklists about 0609. The weather on the ATIS report was in part: "...sky partially obscured, visibility one-quarter mile, fog...." The checklists were completed and the takeoff data reviewed. About 0615 the engines were started and the stickshaker (stall warning system) was tested. The after-start checklist was completed and the aircraft was cleared to taxi to runway 24L. During the taxi, the flight engineer requested and received permission from the captain to turn the engine anti-ice system on because of the ice on the inlet guide vanes. The flight controls and spoilers were checked while taxiing and the flaps were extended to 23^{o}. The taxi checklist was completed and the takeoff data, the flap settings, and the trim settings were again reviewed. The captain, in response to the challenge "anti-ice, de-ice, and rain removal," said, "Ok, we will use engine anti-ice." The de-ice system was reported "off" by the flight engineer.

The captain briefed the crew on the takeoff and abort procedures he would use. He commented that the runway was slippery and he didn't think they would abort.

The captain taxied the aircraft southeast on the ramp, past the terminal toward runway 24L. He stopped on the ramp after being instructed to hold short of runway 24R. After several communications with the controller, the aircraft taxied onto runway 24R, and reported "...ready for takeoff." The tower advised the captain that he was on runway 24R which the captain contradicted. The controller then issued taxi instructions to get the aircraft to runway 24L. The captain made a 180^{o} turn on runway 24R before he finally taxied to the taxiway which leads to the approach end of runway 24L. The crew again reported that they were ready for takeoff at 0633:37.

Takeoff was initiated and at 0634:32 the captain called "maximum power." At 0634:50 the captain announced, "I have" and at 0634:52, "80" (knots) was called by the copilot. At 0635:10, "Vee one" was called by the copilot and at 0635:16 rotation was called and acknowledged by the captain. At 0635:19.5 the captain called "Ten degrees" and at 0635:21.4 the first officer called V_2. At 0635:26.2 a sound similar to

aircraft buffet was recorded. This sound became more frequent and continued until the sounds of impact. At 0635:32 the first officer called "Gear up" and at 0635:33 the flight engineer said "Too much speed (steep)." 3/ At 0635:38 the engineer called "stall" simultaneously the stickshaker sounded and continued until 0635:39.3, when impact was recorded.

A witness near the departure end of the runway saw the aircraft climb to an estimated altitude of about 100 feet above the ground, veer to the left, and then slide "... out of the air."

The accident occurred at night at latitude 61° 10' N and longitude 150° 2' W. The elevation at initial impact was 124 feet.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	3	0	2 cattle handlers
Serious	0	0	0
Minor/None	0	0	0

1.3 Damage to Aircraft

The aircraft was destroyed

1.4 Other Damage

None

1.5 Personnel Information

The flightcrew had been trained and certificated in accordance with the current Japanese and ICAO regulations and standards. (See Appendix B.)

1.6 Aircraft Information

The aircraft was certificated, equipped, and maintained in accordance with Japanese regulations and ICAO recommended practices. The crew that flew JA 8054 to Anchorage reported the No. 2 DME as inoperative. No maintenance was performed on the DME because there were no parts available. There was no evidence of any other preexisting aircraft problems or maintenance difficulties. (See Appendix C.)

The weight and balance were calculated to have been within the established limits. The aircraft fuel load at takeoff was estimated to have been about 117,200 pounds of Jet-AI.

3/ The exact word could not be determined.

The aircraft was equipped to haul live cattle in pens installed in the cabin area. The pens are designed to divide the cattle into small groups so that their movement was restricted in any horizontal direction. The cattle were not positively restrained and were able to move within the limits of the pens; the space for movement depended on the number of cattle in each pen. There were no vertical restraints.

1.7 Meteorological Information

The National Weather Service observation taken just after the accident was:

> 0639, Local --partial obscuration, visibility--¼ mile, fog; temperature--20°F; dewpoint--18°F; wind--340° 3 kns; altimeter setting--29.59 in.Hg; runway 06 right visual range--1,800 ft variable to 5,000 ft, 6/10 of the sky obscured by fog; (aircraft mishap).

The wind speed record from an anemometer located near the center of the airport showed 2 kns between 0630 and 0640. The freezing level was at the surface. At 0634 the fog at the airport was reported by an inbound pilot to be localized over the airport and the nearby lake.

The inbound crew of JA 8054 stated that they entered the fog at an altitude of about 800 ft during their approach to Anchorage and broke out at 250 to 300 ft.

The accident occurred in darkness with the visibility restricted by fog.

1.8 Aids to Navigation

Not involved.

1.9 Communications

There were no reported mechanical problems with aircraft to ground communications. However, some transmissions to the flight had to be repeated by the controller.

1.10 Aerodrome Information

Anchorage International Airport was equipped with three runways; 24L/06R, 24R/06L, and 31/13. Runway 24L is 10,897 ft long and 150 ft wide with a 0.3 percent upslope. The elevation of the departure end of the runway is 124 ft. There are U.S. Standard ALSF-2 approach lights installed at the departure end of the runway and the runway is equipped with high intensity runway lighting and runway centerline lighting.

The lights were operating without reported problems during the takeoff. (See Appendix D.)

In order to taxi to runway 24L, the crew had to taxi southeast on the parking ramp, northeast on a taxiway parallel to runway 24R, cross 24R, and taxi down a diagonal taxiway connecting the runways to the arrival end of runway 24L.

The terrain from the departure end of the runway to the airport perimeter road about 750 ft past the end of the runway was relatively level. About 225 ft left of the threshold lights, the terrain slopes up to a crest of 148 ft about 1,000 ft past the departure end of runway 24L. There is another crest 153 ft high about 1,800 ft past the departure end of the runway and 360 ft left of the extended runway centerline. The aircraft struck both of these crests after initial impact. (See Appendix E.)

1.11 Flight Recorders

The aircraft was equipped with a Sundstrand FA542 flight data recorder (FDR) serial No. 3611, and a Collins cockpit voice recorder (CVR) serial No. 1610. The recorders were both mounted in the aft section of the fuselage. They were recovered slightly sooted but with no significant damage.

All FDR parameters had been recorded clearly and actively with no evidence of recorder malfunction or abnormality. The last 1:36.3 minutes were read out and the altitude data were corrected to a barometric pressure of 29.59 in.Hg to convert the recorded pressure altitude to mean sea level. No other corrections were made.

The CVR tape was transcribed in its entirety and comments in Japanese were translated by members of the CVR group. (See Appendix F.)

1.12 Wreckage and Impact Information

The aircraft first struck the ground about 1,031 ft past the departure threshold of runway 24L and about 179 ft left of the extended runway centerline at an elevation of 124 ft. After initial impact, the aircraft continued to travel on a southwesterly heading which diverged to the left of the extended runway centerline. The aircraft crossed the airport access road without marking it and struck rising terrain at an elevation of about 140 ft. The aircraft broke up at that point.

The initial impact mark was V shaped which widened to about 12 ft before it lost definition. A short distance past that point a ground scar had been made by the No. 4 engine. A mark made by the No. 3 engine appeared, followed successively by marks from the No. 1 engine, No. 2 engine and the left wingtip. The magnetic bearing of the centerline

of the ground marks was about 230°. The wreckage area was about 1,670 ft long and 390 ft wide. No aircraft components or wreckage were found outside this area.

The fuselage and wings broke into several major sections; the engines separated from the wings; and the landing gears separated from the attaching structures. The flaps were extended 21° to 23°; the leading edge slots were open; the spoiler panels were locked down; the stabilizer was set 4.44° aircraft noseup; the rudder was displaced 7.5° to the right; and the landing gears were retracted.

The cockpit section was damaged by impact but there was no fire damage. The cockpit floor was displaced upward and the entire occupiable area was disrupted. The cockpit seats were damaged and detached from their attachments. Some occupants were still held in the seats by the restraint systems.

The main fuselage was broken into three major sections that were damaged and burned. The cattle pens and cattle were scattered throughout the fuselage wreckage.

The tail section separated from the fuselage and remained intact. It had been damaged by impact but had little fire damage. The tail cone was bent up with compression buckles on the top surface. The measurement between fuselage stations 1730 and 1791 was 51.25 ins. rather than the nominal 61 ins. The tail cone was bent up 7°. The horizontal stabilizer jackscrews measured 6.75 ins. between the bottom of the jackscrew upper stop serrations to the top of the stop serrations on the sprocket. There was a strike mark on top of the tail cone 9 ins. right of the tail cone centerline. The tail cone was displaced to the left and the end of the left elevator inboard closure rib had hit the tail cone and had made a crease, the crease corresponded to an elevator trailing edge "up" position.

All flight control surfaces, wing flaps, and spoiler panels were found. The measurements of flap actuators ranged from 4 3/8 ins. to 9½ ins., equivalent to flap extension of 21° to 23°. The integrity of the flight control system could not be established but all the cables examined displayed evidence of tensile failure.

The cattle restraint web and holding pens were examined and the web was found installed and intact. The eight pens were torn free of the floor attachment fittings and were found in the vicinity of the fuselage wreckage. The sides of the pen on the left side of the fuselage were damaged only slightly. However, the sides of the pens from the right side of the fuselage were heavily damaged and some were fragmented. The end panels, or gates, of the pens were intact. None of the gates showed any severe bends. The damage pattern was consistent with forceful movement of the cattle forward and to the right.

The engines were examined and the damage sustained was consistent with high engine rotation at impact. Ten of the 12 installed engine anti-ice valves were open. The other two were damaged and the position at impact was not determined.

Samples of fuel and oil were taken from each engine and analyzed. All samples tested were normal except the oil sample from No. 4 engine, which had a slightly high chrome content. Examination of the recovered system components gave no indication of preexisting system failure or malfunction.

The pitot heads were recovered and the inlets were free of foreign material. The static ports were not recovered. The captain's static selector was in the "normal" position. The rudder power control mechanism and the yaw channel computer were tested; they both operated satisfactorily.

Three "bugs" on the captain's airspeed indicator were set at 134, 148, and 160 kns and the speed command set at 170 kns. Three "bugs" on the first officers airspeed indicator were set at 130, 158, and 160 kns. and the speed command was set at 170 kns. The calculated reference speeds for this flight with 23° flaps were V_1--137 kns; V_R--152 kns; V_2--161 kns.

The engine pressure ratio (EPR) instrument "bugs" were set at 1.87, 1.86 to 1.87, 1.88 and 1.88 for engine Nos. 1 through 4, respectively. Takeoff EPR was 1.86 and climb EPR was 1.84. The fuel flow instruments all indicated a flow between 624 and 669 lb/hr.

The pitch trim compensator was "normal." The pitch trim indicator was disconnected and the stabilizer trim handle was in a nose-down position. The autopilot function selector was set at "vertical speed" and the pitch knob indicated a descent of 500 fpm. The rudder trim indicator was full left and the aileron trim indicator was set at "3R."

The windshield heat was "off," the captain's anti-ice heater was set at "capt pitot," all the engine anti-ice switches were "on," and the scoop anti-ice was "on."

The instrument light switches were on and a mixture of red and white lighting had been selected. The fuel quantity gauges indicated a laterally balanced fuel load. The airfoil anti-ice selector was "off" and the tail de-ice switch was in the "normal" position.

The aileron and rudder hydraulic power shutoff levers were in or near the "on" detent. All the engine anti-ice circuit breakers were closed.

There was no evidence of preimpact fire, explosion, or structural malfunction.

The stall warning system computer was recovered and checked; it operated within limits.

1.13 Medical and Pathological Information

Autopsies indicated that the five persons aboard the aircraft died of multiple impact injuries. There was no evidence of any pre-existing disease that could have contributed to the accident.

Toxicological studies conducted on the five persons were negative for drugs. The carbon monoxide concentrations were 7.3 percent saturation or less. No ethyl alcohol was found except in specimens taken from the captain's body.

The initial blood alcohol level of the captain was 298 mgs percent and a vitreous alcohol level of 310 mgs percent recorded in tests conducted within 12 hours after the accident by the Alaska Medical Laboratory. Additional tests were conducted on specimens from the captains's body by the Civil Aeromedical Institute and they found a blood alcohol level of 210 mgs percent and a vitreous level of 281 mgs percent.

A blood alcohol level of 100 mgs percent is considered to be legally intoxicating for drivers in the State of Alaska. The National Safety Council Committee on Alcohol and Drugs has determined that a blood alcohol level of 180 to 300 mgs. percent would result in mental confusion, disorientation, dizziness, exaggerated emotional state (fear, anger, grief, etc.), disturbance of sensation (diplopia, etc.) impaired perception of color, form, motion, or dimensions, decreased pain sense, impaired balance, muscular incoordination, staggering gait, and slurred speech.

A number of persons who were in contact with the captain during the 20 hours he was in Anchorage were interviewed. The witnesses' statements conflicted when they were asked if the captain had been drinking or showed evidence of drinking.

Of the 13 persons interviewed regarding the captain's activities before reporting to the airport, 5 close acquaintances said that he showed no signs of drinking or that he had not had a drink in their presence. Six persons who were not closely acquainted with the captain stated that he had been drinking or showed signs of being under the influence of alcohol within the 12 hours before the scheduled flight.

1.14 Fire

Although some witnesses stated that the aircraft was on fire before impact, no evidence was found during the wreckage examination to support their statements. Scattered ground fires erupted between the point of initial impact and the access road. There was also a major ground fire in the primary wreckage area.

The airport fire department dispatcher was notified of the crash about 0636. There was a delay in finding the wreckage because of the fog and because the controller did not specify the end of the runway where the crash was located. Response time was estimated to be about 5 minutes.

In addition to three firetrucks from the airport fire department, the city fire department and the Alaskan Air National Guard responded. An Alaska State Police helicopter was also called. Water was transported to the fire area by two tanker trucks and about 9,000 gallons of extinguishing agent and 250 gallons of light water were expended by the airport fire department. Ambulances, heavy equipment, and lighting vehicles were also used in the firefighting and rescue operations.

1.15 Survival Aspects

This accident was not survivable for the five aircraft occupants because the cockpit area was too severely deformed.

1.16 Tests and Research

1.16.1 Performance Evaluation

The performance group attempted to define the aircraft's takeoff performance and to compare that performance to other DC-8's in similar conditions to determine whether JA 8054's performance was standard. In addition, the group examined the possibility of an accretion of airframe ice on JA 8054 and the effects of ice accretion on the aircraft's performance.

The flight recorder readouts of load factor, heading, and altitude were plotted in engineering units and the equivalent airspeed was estimated. The calculated equivalent airspeed was derived by correcting a fairing of the recorded indicated airspeed for alternate static system position error and for takeoff rotation effects. The point of liftoff from the runway was selected to coincide with the minimum altitude recorded in the typical dip on the altitude trace.

The altitude profile was prepared by fairing a line through the midpoints of an envelope, which enclosed the datum points read from the altitude trace. This was corrected for alternate static system position error and for ground effect. The effects of transient variations in static pressure sensed in the stall made it difficult to use the poststall altitude data for any purpose other than trend analysis.

The vertical acceleration profile was established by connecting the datum points by straight lines. Integration of the vertical acceleration resulted in several different altitude curves, all of which showed considerable deviation from the altitudes recorded by the FDR--even when corrected for roll and pitch angles. The integration results are sensitive to the assumed rate of climb at the point where the integration was begun. In addition, a deviation of +0.05 G was recorded throughout the takeoff roll and had to be accounted for. Vertical acceleration is recorded every 0.1 second and altitude is recorded every 1.0 second. Therefore, the performance group decided that short-term deviations of 1 to 2 seconds in the rate of climb might be apparent on the vertical acceleration trace but not apparent on the altitude trace. As a result of these studies, however, the performance group concluded that only trends in altitude changes could be established by use of these data.

All the traces deviated significantly during the last few seconds of the recording, and the spacing between data points on all traces indicated that the foil did not move constantly.

The CVR transcript was reviewed and pertinent comments and sounds were extracted and timed. The timing of the callouts at 80 kns, V_1, V_R, and V_2 were compared to a CVR tape of another JAL DC-8 which took off under similar conditions. Frequency spectrum diagrams of the event times were made from the CVR tapes of both aircraft. Eighty knots, V_1, and V_R occurred in both cases near the same elapsed times. But the time between the call for rotation and V_2 was about 1.5 seconds longer in the transcript of the tape from JA 8054, when compared to the other DC-8 takeoff tape.

Sounds recorded in the cockpit of JA 8054 have been identified as aircraft buffet associated with an approach to a stall. These sounds were first recorded shortly after the call of V_2 and increased in frequency and intensity until masked by the louder sounds of the stall warning system and impact. The stall warning system first sounded about 1.2 seconds before the sounds of impact and these latter sounds lasted about 0.2 seconds before electrical power was removed from the CVR.

The CVR and FDR data were correlated to provide a timed event profile of the accident from the beginning of the takeoff roll to the final impact and a profile of the flight after liftoff. (See Appendix G.) The correlation was corrected by a factor of 3 percent for a

difference in elapsed times between events on the FDR tape and the CVR tape. Initial impact, as recorded on the FDR trace, was assumed to have been 0.6 second after the last reliable data points on the airspeed, altitudes, and heading traces and within 1.0 second before the initial recorded sounds of aircraft breakup. The Safety Board concluded that initial contact of the tail cone with the ground may have been masked by the sound of the stall warning system and that the subsequent impact of the right wing and engines was the first recorded sound of impact.

This correlation indicated that V_1, V_R, and V_2 were called when those airspeeds should have been displayed on the airspeed indicators in the cockpit. Aircraft rotation appeared to have been within 1 second of the call, and the aircraft lifted off, as defined by the dip in the alititude trace, within 3 seconds after rotation began. (See Appendix G.)

The initial rate of climb after liftoff appeared to be higher than that normally achieved by other DC-8's in similar conditions.

JA 8054 reached a maximum recorded airspeed of about 164 kns; the airspeed began to decrease when the sound of buffet was recorded on the CVR. A maximum altitude of 284 ft (160 ft above the runway) was reached and, as the sound of buffet increased, the heading trace indicated a turn to the left; the vertical acceleration trace indicated a decrease in vertical loading; and the airspeed continued to decrease. The airspeed trace became erratic as though there was a disturbance in the airflow sensed by the alternate pitot static system. During the 3 to 4 seconds before impact, buffet sound increased, the vertical load factor increased rapidly, and the rate of descent decreased suddenly.

The recorded airspeed was converted to groundspeed and the groundspeed and heading were used to calculate a ground track from liftoff to impact. Estimated sideslip angles provided by the manufacturer for prestall and poststall flight were incorporated into the ground track calculations. The derived impact point compared favorably with the actual impact point, indicating that the corrected FDR data were substantially correct.

1.16.2 Computer Simulations

The Safety Board reviewed computer simulations conducted by the manufacturer and the operator, and although the assumptions used were different, the conclusions were similar. Both studies indicated that aircraft acceleration to near V_R was normal but that acceleration from V_R to V_2 was less than normal. Both studies indicated that the aircraft must have been rotated to an excessive pitch angle

just before it reached V_2 in order to have produced the FDR recorded data. Finally, both studies concluded that the aircraft stalled just after V_2 was called and that the stall continued and deepened to an angle of attack of at least 18° until impact.

The group noted that by using a normal coefficient of lift to analyze the flightpath of the aircraft, the aircraft reached a higher peak altitude than that recorded by the FDR. Various assumptions regarding vertical acceleration, engine thrust levels, angle of attack, and control manipulations were applied to computer-generated flightpaths. Calculations showed that, in order to approximate the recorded flightpath, the maximum coefficient of lift had to be reduced about 15 percent and that the aircraft stalled at an angle of attack about 2° less than normal.

In view of the normal performance of the aircraft at Moses Lake and in view of the meterological conditions at Anchorage, the possibility of airframe icing was examined.

Conditions were favorable for the accretion of rime icing from the time the aircraft approached Anchorage until the crash. While glaze ice was also possible, rime ice would likely have predominated where airflow impinged on the structure, mainly around the stagnation point of airflow on the leading edge of the airfoils.

The temperature of the fuel remaining in the wing tanks after landing was calculated to be about -8.3°F and the temperature of the fuel added at Anchorage was about 32°F. Calculations show that the temperature of the fuel in the wing tanks after refueling ranged from 20 to 25.5°F. Because of the fog at 20°F and the below-freezing temperature of the skin above the fuel tanks, the supercooled water droplets in the fog could have accumulated on the wing and formed rime ice. Although no such icing was reported by either a crewmember or a ground crewman, there was sufficient time between the preflight check and the takeoff for enough ice to form to degrade the takeoff performance of JA 8054. However, the exact amount of icing could not be determined.

Typically, roughness on the upper wing surface, such as rime ice, which begins at the leading edge and extends toward the trailing edge, will reduce the maximum lift coefficient and consequently the angle of attack at which stall occurs. Roughness also will increase poststall drag. These effects will become more severe as the surface roughness extends farther chordwise and may be accompanied by an increase in both the angle of attack for zero lift and the wing parasite drag. Deflection of trailing edge flaps tends to increase these effects.

Roughness elements of about 1/10,000 of the wing chord can adversely affect the maximum lift coefficient. Scaling the data to the DC-8-62 indicates that if roughness elements of 1/32 in. are closely

distributed along the leading edge of the wing and some portion of its upper surface, the maximum lift coefficient would be reduced by as much as 20 percent. A surface roughness element of about 1/72 in. distributed on the upper surface of the full span of the DC-8-62 wing would degrade the maximum lift coefficient by as much as 15 percent.

1.17 Additional Information

1.17.1 Stall Warning System

The stall warning system induces vibrations into the control columns if the airplane approaches a stall condition during flight and provides a positive stall warning which cannot be confused with other warning systems in the cockpit. The system consists of a lift transducer, lift computer, control column shaker, test relay, and test switch.

The lift transducer is the sensing mechanism for the stall warning system and is located in the right wing leading edge. The transducer is electrically heated for icing protection whenever the "anti-icing meter" selection switch is in any position other than "off." The vane of the lift transducer protrudes through the lower surface of the wing leading edge so that when the airplane is in flight, aerodynamic forces on the vane activate an electrical signal which is transmitted to the lift computer. The computer processes the signal from the transducer and, when appropriate, completes a circuit to the stickshaker on the captain's control column. The stickshaker warns the crew of a stall when it shakes and knocks the control column; the warning can be felt and heard on both control columns. The system is disengaged when the aircraft is on the ground and the nose gear oleo strut is compressed.

Although the test switch is used to check the continuity of the electrical circuits, including the stickshaker, it does not test transducer operation.

In flight, the transducer will normally initiate a stall warning at an airspeed about 3 to 6 percent above stall speed. In this case the stall speed was about 140 kns, and the stickshaker would have been expected to operate at an airspeed between 144 to 146 kns.

1.18 New Investigation Techniques

None

2. ANALYSIS

The crewmembers were certificated, trained, and qualified for the flight in accordance with Japanese and ICAO regulations and standards.

All flight crewmembers had adequate rest periods before reporting for duty.

The aircraft was certificated, maintained, and equipped in accordance with Japanese and ICAO regulations and standards. There was no evidence of in-flight fire, structural failure, or flight control or powerplant malfunctions.

The performance studies indicated that normally the stall warning system should have activiated when the aircraft stalled at, or just after reaching, V_2 instead of about 1 second before impact. Although all the system components were not recovered, and, therefore, could not be examined, the CVR indicated that the system was checked during the pretakeoff checks and the crew was apparently satisfied with the test. There were several reasons why the system may not have functioned, including changes in performance caused by airfoil ice, ice on the transducer, or improper calibration. The Safety Board was unable to determine why the stall warning system did not activate earlier in the accident sequence.

The weight and balance of the aircraft were within limits and there was no evidence to indicate that the cargo shifted either during or after takeoff. The cattle pens effectively restrained the cattle's movements until impact. Damage to the cattle pens indicated that the cattle were ejected forward and to the right by impact, which was consistent with the aircraft attitude at impact. There was no evidence of preimpact damage to, or failure of, the pens; the left and aft panels were essentially undamaged, and the net between the cabin and the cockpit was intact.

The settings of the stabilizer trim, landing flaps, and slats were appropriate for the takeoff.

The aircraft performance studies indicate that the takeoff roll was essentially normal. However, acceleration from V_R to V_2 was slower than normal, and the aircraft stalled at, or shortly after reaching, V_2. The maximum altitude reached was about 160 ft above the airport, or about 284 ft. m.s.l. After the stall began, the aircraft descended at an average sink rate of 3,000 fpm which was reduced slightly shortly before impact. The tail cone hit the terrain first which indicated a relatively nose-high attitude. Then, the right wing dropped and the aircraft apparently rolled wings level and the nose dropped. Final impact with rising terrain resulted in destruction of the aircraft.

Rotation was probably initiated when the first officer called V_R. Based on the performance evaluation and the computer simulations, the Safety Board believes that the subsequent slow acceleration resulted from rotation to about 15° after liftoff, a higher-than-normal pitch attitude. As aircraft performance deteriorated, the situation was

probably worsened when the angle of attack was increased to about 18^{o}. The subsequent loss of altitude and airspeed, and reduction in aircraft pitch attitude were typical of the performance characteristics of the DC-8-62F in a stalled condition.

Icing of the leading edge or the upper surface of the wing would have lowered the angle of attack at which the aircraft would have stalled. The net effect, assuming that all other inputs remained the same, would have been a reduction of the angle of attack required to stall the wing.

In view of the above, the Safety Board concludes that the recorded aircraft performance resulted from the pilot's control inputs aggravated by airframe icing.

The pilot was well qualified and experienced in this operation. There was no evidence to indicate that the pilot was not able to perform his duties except for the evidence regarding his drinking before the flight. The pilot's performance while the aircraft was on the ground also supports a conclusion that he was not capable of using all his faculties. The results of the toxicological studies indicate that the captain's ability to function was impaired by a high level of alcohol in his system. At various times before takeoff, the captain manifested most of the symptoms of alcohol impairment. On the way to the airport in the taxi, the captain exhibited mental confusion, dizziness, impaired balance, muscular incoordination, staggering gait, and slurred speech. There is evidence of slurred speech and mental confusion on the CVR tape, and he became disoriented regarding his location on the airport and went to the wrong runway where he reported that he was ready for takeoff. This behavior would be expected of a person who was operating with the alcohol level found in the toxicological samples taken from the captain.

In view of the overwhelming evidence of the captain's condition, the Safety Board must consider the lack of action by the other crewmembers. The captain's actions between the hotel and the airport must have been apparent to the first and second officers, and his activites after boarding the aircraft were known to them.

The captain's physical and mental states were such that he could not effectively control the aircraft. The amount of alcohol in his system would have severely hampered his reactions, coordination, and reasoning ability. These conditions were demonstrated by his: Getting lost while taxiing to the active runway; initially selecting the wrong runway for takeoff; faster-than-normal rotation; rotation to a higher-than-normal pitch attitude after takeoff; failure to recognize aircraft buffet as a stall warning; and his failure to take normal corrective action to correct the stall.

It is extremely difficult for crewmembers to challenge a captain even when the captain offers a threat to the safety of the flight. The concept of command authority and its inviolate nature, except in the case of incapacitation, has become a pratice without exception. As a result, second-in-command pilots react indifferently in circumstances where they should be more assertive. Rather than submitting passively to this concept, second-in-command pilots should be encouraged to affirmatively advise the pilot-in-command that a dangerous situation exists. Such affirmative advice could result in the pilot-in-command's reassessing his actions.

The Safety Board has previously stated [4/], and continues to believe, that the second-in-command is an integral part of the operational control of a flight, is a fail-safe factor, and has a share of the duty and responsibility to assure that the flight is operated safely. Therefore, the second-in-command should not passively condone any operation of the aircraft which might compromise safety. He should affirmatively advise the captain whenever, in his judgment, safety of flight is in jeopardy, particularly when the safety problem is detected before the flight is airborne. The Safety Board could not determine what transpired between the crewmembers before they boarded the aircraft, but there is little or no evidence that the second-in-command or the flight engineer expressed any concern about the safety of the flight. In addition, there is no evidence that they took any action to prevent the flight from proceeding as planned.

The Safety Board has on two previous occasions addressed recommendations regarding need to emphasize the dangers of unprofessional performance by flightcrew members. On August 28, 1972, the Board recommended that the Air Line Pilots Association and Allied Pilots Association implement a program to provide means for peer group monitoring and disciplining any air carrier pilot who may display any unprofessional traits. No response has been received to these recommendations.

On October 8, 1974, the Safety Board recommended to the Federal Aviation Administration (FAA) that they develop an air carrier pilot program, similar to the General Aviation Accident Prevention Program, that would emphasize the dangers of unprofessional performance in all phases of flight. The FAA agreed with the recommendation and reported that many airlines have established accident prevention programs and periodically conduct seminars on this subject. The FAA participates in these seminars and will continue to do so. The FAA also reported

4/ Aircraft Accident Report: Allegheny Airlines, CV340/440, New Haven, Conn., June 7, 1971, (NTSB-AAR-72-20).

that they had met with the Air Transport Association to discuss the problem and possible solutions. Finally, the FAA initiated a program of emphasis during en route flight checks of crew discipline, professionalism, and flying techniques.

3. CONCLUSIONS

3.1 Findings

1. The icing that accumulated on the airfoil significantly affected the performance of the aircraft.

2. The cattle remained constrained by the pens and there was no evidence of preimpact failure of the pens.

3. The weight and balance were within limits, and the aircraft was properly trimmed for takeoff.

4. The performance of the aircraft was normal until rotation was begun.

5. After liftoff the aircraft was overrotated to an angle of attack exceeding that required to stall the wing with the existing accretion of ice.

6. Because of the high pitch attitude, the aircraft accelerated to V_2 at a slower-than-normal rate.

7. The aircraft was rotated to an angle of attack of about 18^{o} after the stall began.

8. The aircraft reached a maximum altitude of about 160 ft above the ground and began a descent that averaged about 3,000 fpm to impact.

9. The performance of the aircraft was a result of the misuse of the flight controls by the captain aggravated by the existence of airframe icing.

10. The captain was under the influence of alcohol and was not physically or mentally capable of conducting the flight.

11. The other crewmembers must have been aware of this condition, but took no effective action to prevent the captain from initiating the flight.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was a stall that resulted from the pilot's control inputs aggravated by airframe icing while the pilot was under the influence of alcohol. Contributing to the cause of this accident was the failure of the other flightcrew members to prevent the captain from attempting the flight.

4. RECOMMENDATIONS

As a result of this accident and a second accident 5/ involving a cargo of live cattle, the Safety Board forwarded two recommendations to the FAA. The Board recommended that the FAA establish criteria for the design, installation, and use of livestock restraining systems, and that the FAA conduct an engineering analysis to determine the adequacy of existing livestock restraining systems.

The FAA replied that they would reissue an FAA order which would establish the criteria for the design, installation, and use of livestock restraining systems and that they were auditing engineering approvals of livestock restraining systems.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PHILIP A. HOGUE
Member

January 16, 1979

5/ Aircraft Accident Report: (Brief of Accident) Air Trine Corp. CV 800, Miami, FL., December 16, 1976.

5. APPENDIXES

APPENDIX A

INVESTIGATION

The National Transportation Safety Board was notified of the accident at about 1400 e.s.t., January 13, 1977. Investigators were dispatched immediately to Anchorage, Alaska. Working groups were established for operations, weather, structures, powerplants, systems, human factors, flight data recorder, cockpit voice recorder, and maintenance records.

Parties to the investigation who assisted the Board included: Japan Air Lines; Federal Aviation Administration; McDonnell-Douglas Aircraft Co.; Pratt and Whitney Aircraft Division, United Aircraft Corp., and International Federation of Air Line Pilots.

This investigation was conducted in accordance with ICAO Annex 13 to the Convention on International Civil Aviation. The Japanese Government furnished an accredited representative who participated in the investigation.

APPENDIX B

CREW INFORMATION

Captain Hugh L. Marsh

Captain Marsh, 53, was employed by Japan Air Lines June 24, 1969. He was rated as a DC-8 captain February 9, 1970. He held a JCAB airline transport rating No. 001168, issued October 30, 1969, and a second class navigator rating No. 000563, issued September 10, 1970. Captain Marsh was type-rated in the DC-8 October 30, 1969. His JCAB first-class medical certificate was issued September 18, 1976, and would have expired March 17, 1977. A restriction on his medical certificate required him to wear corrective glasses for near vision while exercising the privileges of his certificate. Captain Marsh had logged 23,252 hours flying time, including 4,040 hours in DC-8's. He had also logged 1,186 hours night time and 187 hours instrument time. His last line check and route check were completed July 8, 1976 and his last proficiency check on September 4, 1976. He had logged 153 hours including 83 hours night time and 10 hours instrument time in the preceding 90 days. He had been on duty 5.5 hours in the 24 hours before reporting for duty on January 13, 1977. His duty time on the date of the accident was 1.5 hours.

Copilot Kunihika Akitani

Copilot Akitani, 31, was employed by JAL May 6, 1970. He was rated as a DC-8 second officer December 26, 1972, and as a DC-8 copilot August 1, 1976. He held JCAB commercial license No. 004100, dated January 25, 1972; flight engineers certificate No. 000947, dated December 16, 1970; and instrument certificate No. 002297, dated May 10, 1972. He also held a DC-8 flight engineer rating issued December 26, 1972, and a DC-8 pilot rating issued June 4, 1976. His medical certificate was issued September 27, 1976, and would have expired September 26, 1977. Copilot Akitani had logged 1,603 hours, including 1,207 hours in the DC-8. He had 461 hours night time and 90 hours instrument time. His last line check and route check were completed August 1, 1976. His last proficiency check was completed May 21, 1976, and his last simulator check on November 15, 1976. He had been on duty 2.8 hours in the 24-hour period before reporting for this flight. He had flown 38 hours instrument time in the preceding 90 days.

Flight Engineer Nobumasa Yokokawa

Flight Engineer Yokokawa, 35, was employed by JAL April 1, 1960. He was rated as a flight engineer in DC-8's on November 20, 1960. He also held flight engineer ratings in CV-880 and B-747. His flight engineer certificate No. 000306, was issued August 5, 1966. He had logged a total of 4,920 hours as a flight engineer, including 2,757 hours in the DC-8. His medical certificate was issued January 1, 1975, and would have expired January 25, 1977. His last route check was completed February 11, 1976. He had been on duty 5 hours during the 24 hours before reporting for this flight. He logged 89 hours in the 90 days preceding the accident.

APPENDIX C

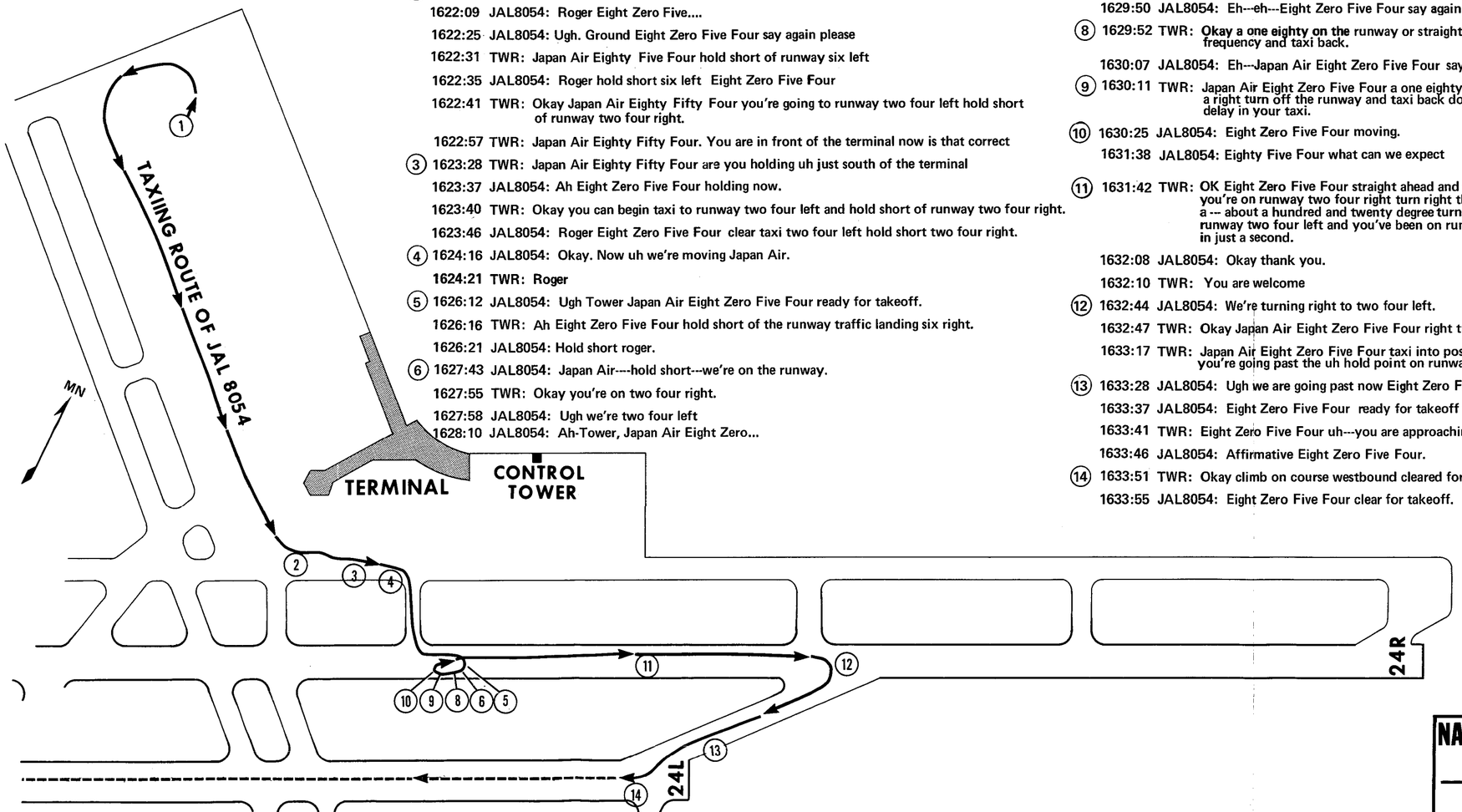
AIRCRAFT INFORMATION

The aircraft was a McDonnell-Douglas DC-8-62F, JA 8054, serial No. 46148, manufactured December 2, 1971. The aircraft had accumulated 19,744 hours flying time on the date of the accident, including 8,708 hours since the last major inspection and 45 hours since the last check.

The aircraft was equipped with 4 JT3D-3BDL Pratt and Whitney engines.

Engine No.	Serial No.	Total Time	Time Since Heavy Maintenance
1	669362	26,057	8,574
2	669385	23,415	6,242
3	669766	19,801	5,935
4	669413	21,513	727

The maintenance records were reviewed for the period of January 14, 1976, through January 13, 1977. No discrepancies were discovered that could be associated with the accident mechanism.



(1) 1617:47 TWR: Japan Air Eight Zero Five Four as Ten Forty Five Heavy taxi runway two four left.

1617:53 JAL8054: Roger Eight Zero Five Four, two four left.

(2) 1622:05 TWR: Japan Air Eighty Fifty Four. Hold short of runway two four left

1622:09 JAL8054: Roger Eight Zero Five....

1622:25 JAL8054: Ugh. Ground Eight Zero Five Four say again please

1622:31 TWR: Japan Air Eighty Five Four hold short of runway six left

1622:35 JAL8054: Roger hold short six left Eight Zero Five Four

1622:41 TWR: Okay Japan Air Eighty Fifty Four you're going to runway two four left hold short of runway two four right.

1622:57 TWR: Japan Air Eighty Fifty Four. You are in front of the terminal now is that correct

(3) 1623:28 TWR: Japan Air Eighty Fifty Four are you holding uh just south of the terminal

1623:37 JAL8054: Ah Eight Zero Five Four holding now.

1623:40 TWR: Okay you can begin taxi to runway two four left and hold short of runway two four right.

1623:46 JAL8054: Roger Eight Zero Five Four clear taxi two four left hold short two four right.

(4) 1624:16 JAL8054: Okay. Now uh we're moving Japan Air.

1624:21 TWR: Roger

(5) 1626:12 JAL8054: Ugh Tower Japan Air Eight Zero Five Four ready for takeoff.

1626:16 TWR: Ah Eight Zero Five Four hold short of the runway traffic landing six right.

1626:21 JAL8054: Hold short roger.

(6) 1627:43 JAL8054: Japan Air----hold short---we're on the runway.

1627:55 TWR: Okay you're on two four right.

1627:58 JAL8054: Ugh we're two four left

1628:10 JAL8054: Ah-Tower, Japan Air Eight Zero...

1629:45 TWR: Japan Air Eight Zero Five Four did you copy

1629:50 JAL8054: Eh---eh---Eight Zero Five Four say again.

(8) 1629:52 TWR: Okay a one eighty on the runway or straight ahead down to the next intersection a right turn off this frequency and taxi back.

1630:07 JAL8054: Eh---Japan Air Eight Zero Five Four say again please

(9) 1630:11 TWR: Japan Air Eight Zero Five Four a one eighty on the runway or straight ahead to the next intersection a right turn off the runway and taxi back down to the approach end of runway two four left and no delay in your taxi.

(10) 1630:25 JAL8054: Eight Zero Five Four moving.

1631:38 JAL8054: Eighty Five Four what can we expect

(11) 1631:42 TWR: OK Eight Zero Five Four straight ahead and you're approaching an intersection for your information you're on runway two four right turn right the intersection you're just approaching it'll be uh --- about a --- about a hundred and twenty degree turn back to your right and then up to and hold short of runway two four left and you've been on runway two four right, and uh should be able to get you off in just a second.

1632:08 JAL8054: Okay thank you.

1632:10 TWR: You are welcome

(12) 1632:44 JAL8054: We're turning right to two four left.

1632:47 TWR: Okay Japan Air Eight Zero Five Four right turn back to runway two four left.

1633:17 TWR: Japan Air Eight Zero Five Four taxi into position and hold runway two four left and advise when you're going past the uh hold point on runway two four left.

(13) 1633:28 JAL8054: Ugh we are going past now Eight Zero Five Four.

1633:37 JAL8054: Eight Zero Five Four ready for takeoff two four left.

1633:41 TWR: Eight Zero Five Four uh---you are approaching runway two four left at this time.

1633:46 JAL8054: Affirmative Eight Zero Five Four.

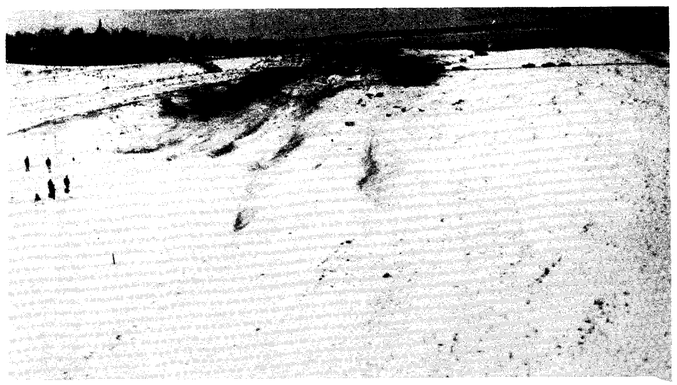
(14) 1633:51 TWR: Okay climb on course westbound cleared for takeoff.

1633:55 JAL8054: Eight Zero Five Four clear for takeoff.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D·C·

TAXIING ROUTE OF JAL 8054
ANCHORAGE INTERNATIONAL AIRPORT
JANUARY 13, 1977

VIEW OF WRECKAGE SITE

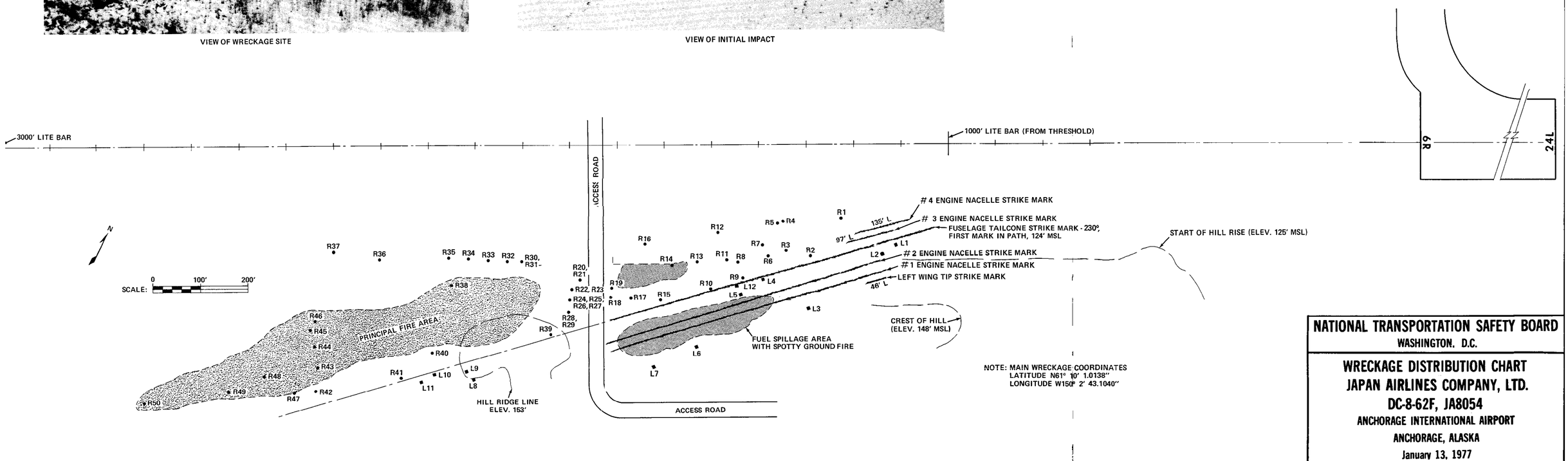


VIEW OF INITIAL IMPACT

LEGEND:

L1 PIECE OF FUSELAGE FRAME ASSY. FS-1400 (P/N 5773257-26)
L2 MAIN LANDING GEAR DOOR LATCH MECHANISM
L3 BROKEN RED GLASS
L4 SECTION OF FAN DUCT (P/N 5757511-503)
L5 WING TRAILING EDGE (P/N 5648687-21)
L6 FAN TRANSITION DUCT (P/N 5757513-50), (S/N 008, POS.#1)
L7 OUTER WING PANEL (P/N 5616121)
L8 ENGINE PYLON (JAL S/N 063, POS.# 2
L9 LEFT WING SLOTTED SECTION
L10 POS. NO. 2 ENGINE (S/N 669365)
L11 RIGHT INBOARD WING ROOT, LE
L12 LEFT HAND OUTBOARD AILERON (P/N 5763132-511)

R-1 ENGINE TURBINE BLADES & VANES
R-2 ENGINE COWL ASSY., LH AFT (P/N 5757519-501)
R-3 POS. # 4 DUCT, AFT (ENG. S/N 669413) (JAL S/N 030)
R-4 FAN DUCT (POS. #4)
R-5 FAN DUCT (P/N 5757511-505), (POS. # 3)
R-6 FAN DUCT (P/N 5757511-505)
R-7 AIR CONDITION DOOR PANEL (P/N 5616510-414)
R-8 POS. #3 TRANSITION DUCT, (P/N 5757513-501) (S/N 146 JAL)
R-9 NOSE GEAR GROUND SHIFT MECHANISM
R-10 PIECE OF MLG ACCESS DOOR (P/N 5616307-161)
R-11 THRUST REVERSER SECTION (P/N 53-30-00-10-36)
R-12 PIECE OF AFT ENGINE COWL ASSAY. (P/N 575758-502)
R-13 POS. #3 FAN TRANSITION DUCT
R-14 ENGINE EXHAUST NOZZLE
R-15 ENGINE EXHAUST NOZZLE
R-16 FAN DUCT
R-17 POS. # 1 FAN TRANSITION DUCT (P/N 5757513-501) (S/N 029)
R-18 FAN TRANSITION DUCT (P/N 5757513-5)
R-19 CLAMSHELL DOOR
R-20 PIECE OF PYLON PANEL
R-21 PIECE OF ENGINE COWL
R-22 14 FOOT SECTION OF WING
R-23 ENGINE COWL
R-24 ENGINE NOSE BULLET
R-25 ENGINE NOSE COWL (P/N 5757515-503) (JAL S/N 008)
R-26 WHEEL & TIRE ASSY., OUTBOARD STK 158 (JAL S/N 004)
R-27 HYDRAULIC ACTUATOR (P/N 5715610-5501G)
R-28 LEFT WING (FOLDED)
R-29 INTAKE COWL
R-30 POS. #4 ENGINE PYLON
R-31 REVERSER ASSAY. (S/N 056 OR 058)
R-32 CLAMSHELL ASSY.
R-33 COWL DOOR
R-34 FUSELAGE AIR CONDITIONING PACK
R-35 ENGINE COWL DOOR
R-36 POS. #4 ENGINE (S/N 669413)
R-37 TAIL SECTION
R-38 SECTION OF RIGHT WING
R-39 ENGINE PYLON (JAL S/N 015, POS. # 1)
R-40 POS. #1 ENGINE (S/N 669362)
R-41 RIGHT MAIN LANDING GEAR (S/N R955)
R-42 COCKPIT SECTION
R-43 18 FOOT SECTION OF RIGHT WING ROOT WITH 18 FOOT RIGHT SIDE OF FUSELAGE & TE FLAPS
R-44 LEFT MAIN LANDING GEAR (S/N L953)
R-45 POS. #3 ENGINE (S/N 669766)
R-46 ENGINE PYLON, POS. #3)
R-47 FWD. AUX TANK, LEFT SIDE PALLET FLOOR (25 FOOT SECTION)
R-48 UPPER FUSELAGE SHELL & PIECES OF FLAPS
R-49 14 FOOT PIECES OF RIGHT WING TIP
R-50 SECTION OF OUTBOARD RIGHT WING WITH SLOTS - NO FLAPS



NOTE: MAIN WRECKAGE COORDINATES
LATITUDE N61° 10' 1.0138"
LONGITUDE W150° 2' 43.1040"

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON. D.C.

WRECKAGE DISTRIBUTION CHART
JAPAN AIRLINES COMPANY, LTD.
DC-8-62F, JA8054
ANCHORAGE INTERNATIONAL AIRPORT
ANCHORAGE, ALASKA
January 13, 1977

APPENDIX F

TRANSCRIPT OF A COLLINS COCKPIT VOICE RECORDER, S/N 1610,
REMOVED FROM THE JAPAN AIRLINES DOUGLAS DC-8
AT ANCHORAGE INTERNATIONAL AIRPORT
ANCHORAGE, ALASKA, JANUARY 13, 1977

LEGEND

CAM	Cockpit area microphone voice or sound source
RDO	Radio transmission from accident aircraft
-1	Voice identified as Captain
-2	Voice identified as First Officer
-3	Voice identified as Flight Engineer
-?	Voice unidentified
ANC OCANC	Anchorage Oceanic
ANC TWR	Anchorage Tower
IC	Intercom
ANC GND	Anchorage Ground
ST-1	Sand Truck 1
C-47U	Miscellaneous aircraft
NW-6	Miscellaneous aircraft
ALR102	Miscellaneous aircraft
PU-4	Miscellaneous aircraft
N655MA	Miscellaneous aircraft
ATIS	Airport Terminal Information Service
T:	Translation from Japanese
*	Unintelligible word
#	Nonpertinent word
%	Break in continuity
( )	Questionable text
(( ))	Editorial insertion
---	Pause
Note:	Times are expressed in Grenwich Mean Time.

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1606:34 CAM-2	Okay five nine four zero zero		
CAM-1	Five nine, check		
CAM-2	One seven zero, okay		
CAM-1	Okay		
CAM-2	Number, okay?		
CAM-1	Okay --- number two Bethel is north six zero, ah, --- four seven one		
CAM-2	Check		
CAM-1	West one six one, four nine three		
CAM-2	Check		
		RDO	((Other ATC conversation))
		1606:56 ANC TWR	Speedbird nine eight seven heavy %
CAM-1	Spot north six one, one zero six		
CAM-2	Check		
CAM-1	West, one four nine, five nine one		
CAM-2	Check		
		RDO	((Other ATC conversation))

INTRA-COCKPIT

TIME & SOURCE	CONTENT
CAM-2	North five zero, zero zero zero
1603:39 CAM-2	Check, east one six zero, zero zero zero, check, number seven, north four four, zero zero zero, check east one five zero, zero zero zero, check, number eight, north four zero, one five zero, check east one four five, zero zero zero
CAM-?	*
CAM-2	Check, number nine, north three seven, four eight zero, check east one four two, zero zero zero, check
CAM-1	Number nine
CAM-2	Okay
CAM-1	Okay *, north three seven four eight zero, east one four two zero zero zero
CAM-2	Check
CAM-1	(*) north four zero one five zero, one four five zero zero zero
CAM-2	Check
CAM-1	Number seven north four four north, one five zero east *
CAM-2	Check

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
MAINT GND	T: May I *?
F/E	T: Eh- wait a moment, stand by please
MAINT GND	T: Hai roger

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM	((Sound of cough))		
CAM-1	Six, north five zero, east one six zero		
CAM-2	Check		
1606:06 CAM-1	No problem --- number --- five north five four		
CAM-2	Check		
CAM-1	East one seven two		
CAM-2	Check		
CAM-1	* north five seven zero zero		
CAM-2	Check		
CAM-1	East one eighty		
CAM-2	Check		
CAM-1	(*) keep em happy, north five zero four zero zero		
CAM-1	West		
CAM-2	Captain, five zero? Five nine		
CAM-1	Okay five nine		
CAM-2	What?		
CAM-1	Yah, okay		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1607:10 ANC TWR	Speedbird nine eighty seven, roger, disregard %
CAM-1	Okay		
CAM-2	* *		
CAM-1	Yes please		
CAM-2	T: We've got "before five minutes?"		
CAM-3	T: Eh?		
CAM-2	T: "Before five minutes", please		
CAM-3	T: Hai		
CAM	((Sound of clicks like using a ratchet))		
1607:35 CAM-2	Starting engine		
CAM-1	Yes		
CAM-1	Ah --- let's have the local visibility		
CAM-2	Captain		
CAM-2	Ah --- according ATIS's quarter --- quarter mile fog		
		1607:50 RDO-2	Anchorage Oceanic, Japan Air eight zero five four, good morning

INTRA-COCKPIT

TIME & SOURCE	CONTENT

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
1607:54 ANC OCANC	Japan Air eight zero five four heavy, Anchorage Oceanic, good morning, say requested altitude to Tokyo
1607:58 RDO-2	Ah-, eight zero five four, ah-request altitude three one zero, ah
1608:09 ANC OCANC	Japan Air eight zero five four heavy, clear to Tokyo Airport as filed Jey five oh one Bethel, maintain flight level three one zero, squawk alpha two thousand prior to departure, departure frequency one two zero point four, go ahead
1608:33 RDO-2	Ah Japan Air eight zero, clear to Tokyo, flight plan route Jet five oh one Bethel, three one zero squawk two thousand, departure one two zero four
1608:33 ANC OCANC	Japan Air eight zero five four, read back correct, remain this frequency, advise when starting engine

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM-2	Clear to Tokyo via Jet five oh one Bethel
CAM-1	* ((simultaneous with above transmission))
CAM-1	Three one zero
CAM-2	Three one zero
CAM-1	Okay remaining items
CAM-2	T: Let's start "checklist"
CAM-1	T: Checklist, please
CAM-3	T: yes --- yes
1609:04 CAM	((Sound of pneumatic starter))
CAM-2	Pilot preflight checklist, INS
CAM-1	Checked and load

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT
1608:38 RDO-2	Roger, eight zero five four
1609:00 ANC TWR	Air France two seven three, go ahead
MAINT GND	Cockpit, this is ground, all engine ground clear
RDO-3	Hai, roger

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM-2	Landing gear handle
CAM-1	Down and three green
CAM-2	Hydro, air brake pressure
CAM-1	Checked and normal
CAM-2	Air brake handle
CAM-1	Safetied
CAM-2	Parking brake
CAM-1	Set
CAM-2	Window, windshield heat
CAM-1	Let them warm up
CAM-2	Radios
CAM-1	Checked
1609:28 CAM-2	Weather radar, transponder
CAM-1	Stand by
CAM-2	Gyro compass controller
CAM-1	Checked, set
CAM-2	Navigation lights

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT
RDO	((Other ATC conversation))
RDO	((Other ATC conversation))

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-1	On		
CAM-2	Seatbelt, no smoking		
CAM-1	Both on *		
CAM-2	Emergency lights		
CAM-1	Armed		
CAM-2	Overspeed warning		
1609:50 CAM-1	Stand by		
CAM-2	Overspeed warning and barber pole selector		
CAM-?	Tested ((following "and" above))		
CAM-1	* okay, charlie, charlie		
CAM-2	Charlie mode		
CAM-2	Static selector, pitot cutoff		
CAM-1	Okay normal		
CAM-2	Anti-skid		
CAM-1	Off		
CAM-2	Kifis		
CAM-1	Tested		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-2	Clocks		
CAM-1	Wound and set, you have the time		
CAM-2	Time, --- now, --- ten minutes		
CAM-1	Okay		
CAM-2	Eh-, radio INS switch		
CAM-1	Ah-, radio *		
CAM-2	Flight instruments		
CAM-1	Check (and) set		
CAM-2	Flight director compass		
1610:30 CAM-1	I have now almost north		
CAM-2	Autopilot servo cutoff switch		
CAM-1	On		
CAM-2	Instrument warning		
CAM-1	Tested		
CAM-2	Spoiler		
CAM-1	Retracted, lights off		
CAM-2	Autopilot controller		
CAM-1	Checked and off		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-2	ATC transponder		
CAM-1	Tested		
CAM-2	Rain removal handles		
CAM-1	Off		
1610:47 CAM-2	Checklist completed ((simultaneously with sound zaaa))		
CAM-3	T: Go ahead		
CAM-2	T: Hai		
1610:51 CAM-2	Before starting checklist		
CAM-2	Ship pouch, passport		
CAM-3	Checked		
CAM-1	I have		
CAM-2	Log book		
CAM-3	Checked		
CAM-1	Checked ((simultaneous with above transmission))		
CAM-2	Preflight check		
CAM-3	Completed		
CAM-2	Oxygen system, mask and interphone		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-3	Checked my side		
CAM-(2)	Check my *		
CAM-2	Circuit breakers and fuses		
CAM-3	Checked and on		
CAM-2	Radio rack blower switch		
CAM-3	T: Radio rack is normal		
CAM-2	Electrical panel		
CAM-3	Set		
CAM-2	Recirculation fans		
CAM-3	Off		
CAM-2	Air-conditioning, pressurization		
CAM-3	Auto and set at three one zero, ah-three two zero T: sorry		
CAM-1	Okay		
CAM-2	Pneumatic switches		
CAM-3	Low position		
1611:24 CAM-2	Cabin compressors		
CAM-3	Off		
CAM-3	Freon compressors		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-3	Off		
CAM-2	Smoke detector		
CAM-3	T: smoke detector is normal		
CAM-2	T: Hai		
CAM-2	Fire warning		
CAM-3	Tested		
CAM-2	Oil system		
CAM-3	Checked		
CAM-2	Ground cooling, blowaway jet		
CAM-3	Out and light on		
CAM-2	Fuel quantity		
CAM-3	Order(ed) one one nine, actual one one nine, freezing point minus forty four		
CAM-1	Forty four, okay that checks		
CAM-3	Yeah		
CAM-2	Fuel system		
CAM-3	Checked and set		
CAM-2	Hydro selector		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1611:50 CAM-3	Number two general		
CAM-2	Rudder, aileron power controls		
CAM-3	Off		
CAM-2	Eh-, engine hydro pumps		
CAM-3	On		
CAM-2	Engine instruments		
CAM-3	Checked my side		
CAM-2	Reverser standby pump		
CAM-3	Checked and off		
CAM-2	INS mode - nav		
CAM-1	Okay stand by		
CAM-2	All warning lights		
CAM-1	Now nav		
CAM-2	Yes		
CAM-1	Check		
CAM-2	Check		
CAM-2	Gear pins		

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM-3	Hah?
1612:19 CAM-2	Gear pin
CAM-3	Gear pin, removed and --- on --- board
CAM-2	Stand by seven items
1612:24 CAM-3	Okay ground already clear to start
CAM-2	Roger, starting engines
CAM-3	Clear three now
CAM-1	Okay T: Hai, go ahead

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT
1612:31 RDO-2	Anchorage Oceanic, Japan Air eight zero five four, starting engine now
1612:36 ANC OCANC	Japan Air eight zero five four, roger, contact ground have a good flight
1612:39 RDO-2	Roger

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM-1	Okay, three, four, two, one
CAM-2	Weight and balance, takeoff data
CAM-2	T: checked takeoff data
CAM-3	Okay
CAM-2	Door warning lights
CAM-3	Eh-, out, off
CAM-1	Okay one three seven, one five one
1613:04 CAM-2	Flight recorder
CAM-3	Set and on
CAM-2	Anti-collision light
CAM-1	On
1613:06 CAM-2	Pneumatic pressure
CAM-3	Requested thirty seven

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT
RDO-3	Ah three, four, two, one
MAINT GND	Roger, ah, all engine ground clear
RDO-3	T: Hai, roger thanks

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM-2	Galley power
CAM-3	Off
CAM-2	Main boost pump
CAM-3	On
1613:12 CAM-2	Checklist all completed
CAM-3	Roger
CAM-?	Okay
1613:15 CAM-1	Takeoff data review please
CAM-2	Eh?
CAM-1	Takeoff data
CAM-2	Takeoff data, three three nine flap two three, four point seven, point eight seven, two eight, one three nine, one five one, one six one
CAM-1	One three nine, one *
CAM-2	One three seven, one five one, one six one
CAM-1	Okay three, four, two, one

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT
ANC GND	Sand truck one %
1613:17 ST-1	Sand truck one %
ST-1	Sand truck one
ANC GND	Sand truck one proceed runway three one and hold short of runway six right, remain clear of the diagonal
ST-1	Ten four
PU-4	Anchorage ground, pick up four

INTRA-COCKPIT

TIME & SOURCE	CONTENT
CAM-1	Rotation
CAM-3	Oil pressure rise
CAM-3	N one rotation
1614:32 CAM-1	Fifteen
CAM-1	Light up
CAM	((Sounds of clicks))
CAM-3	Starter valve close
CAM-1	Two
CAM-1	Rotation
CAM-3	Oil pressure rise
CAM-3	N one rotation
CAM-1	Fuel in, --- fuel flow *
CAM-1	Light up
CAM-1	By ---
CAM-2	Fuel flow stabilize
CAM-1	Thank you
CAM-3	Hai, bypass check okay
CAM	((Two above statements simultaneous))
CAM-1	Okay rudder

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
ANC GND	Okay, there will be a Japan Air
ST-1	Ten four
ANC GND	--- four one heavy taxi north ramp
ATIS	Two zero, wind zero two zero at four, altimeter two nine five niner, ILS runway six right approach in use, landing runway six right, departing runway two four left, advise you have whiskey
ATIS	Anchorage International information whiskey, one five five six greenwich weather, sky partial obscured, visibility one quarter mile, fog, temperature two zero, wind zero two zero at four, altimeter two niner five niner, ILS runway six right approach in use, landing runway six right departing runway two four left, advise you have whiskey

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-3	Okay all engine clear		
1613:40 CAM-(2)	Starting engine		
CAM	((Three above transmissions simultaneous))		
CAM-3	Roger		
		RDO-3	T: number three
		MAINT GND	T: Go ahead
		ANC GND	Pick up four, ground
CAM-1	Rotation		
CAM-3	Oil pressure rise	PU-4	I'm on the north %
CAM-3	N one rotation	1613:53 ANC GND	Pick up four roger that's approved
		PU-4	Thank you
1613:59 CAM-1	Twenty percent		
CAM-1	Rotation	ANC GND	Sand truck one will you be working %
CAM-3	(**) go ahead ((simultaneous with CAM-1 above))	1614:12 PU-4	Affirmative -ah- when I make my %
CAM-1	Light up		
CAM-3	Starter valve closed		
CAM-1	Number four		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-3	Starter valve close		
CAM-1	Aileron power		
CAM-3	Roger, rudder, aileron power on		
1615:13 CAM-1	Number one rotation		
CAM-3	Oil pressure rise		
CAM-3	N one rotation		
CAM-1	Fuel		
CAM-1	Normal		
CAM-1	Light up		
CAM-1	Switch off		
CAM-3	Starter valve closed		
CAM-3	Disconnect		
CAM	((Sound of click)) ((switching sound of external power to engine generator power))	1615:38 RDO-3	Ah- disconnect all ground equipment and interphone, thank you very much
			T: bye bye
CAM-2	Ah- departure runway two four left	MAINT GND	T: have a good flight

INTRA-COCKPIT

TIME & SOURCE	CONTENT
CAM-?	(* *)
CAM	((T: sound of beee, beee)) ((Sounds like autopilot warning))
CAM-1	Okay
CAM-2	T: probably changed to two four
CAM-3	T: Is that right?
CAM-3	Right
CAM	((Sound of stick shaker))
CAM-2	T: two four minimum is
CAM-1	After ah
CAM-2	Yes sir, after starting
CAM-1	Yeah
CAM-3	Roger

AIR-GROUND COMMUNICATIONS

TIME & SOURCE	CONTENT
MAINT GND	Cockpit this is ground, all set, please start turbo compressor
RDO-3	T: Eh- say again please
MAINT GND	T: Eh- you may start- turbo compressor
1616:11 RDO-3	T: Hai, hai thank you so much, we'll start

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-3	Rudder and aileron power controls on		
CAM-3	Gust lock		
CAM-2	Off		
CAM-3	PTC		
CAM-1	Override		
CAM-3	Hydraulic system checked		
CAM-1	Check pressure quantity		
CAM-3	Check hai pressure quantity check okay ((simultaneous with CAM-1 above))		
CAM-3	Pitot, heater		
CAM-1	Captains		
CAM-3	Ground equipment		
CAM-1	Stand by		
CAM-3	Stand by ground equipment		
1617:01 CAM	((Stabilizer in motion, sound seven times))		
CAM-1	One three seven		
CAM-2	One five one, one six one		
CAM-1	One five one		

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM-1	Okay taxi
CAM-2	Roger
1617:33 CAM-1	After start checklist complete?
CAM-2	Ah - ground equipment okay?
CAM-1	Stand by
CAM-2	Stand by ground equipment
CAM-1	Two four left
CAM-1	Brake pressure check
CAM-2	Roger check

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT
ST-1	Sand truck one, holding short of the diagonal on three one
1617:28 ANC GND	Truck one you can hold - you can cross %
ST-1	I see him - thank you
1617:40 RDO-2	Anchorage ground, Japan Air eight zero five four request taxi information whiskey cargo area
1617:47 ANC GND	Japan Air eight zero five four or is it ten forty five heavy taxi runway two four left
1617:53 RDO-2	Roger, eight zero five four two four left

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-2	T: Ground is okay, right?		
CAM-1	Okay clear to taxi		
CAM-2	Taxi clear		
1618:05 CAM-3	Hai - checklist completed		
CAM-2	Ground signal okay?		
1618:07 CAM-1	Ground signal okay		
CAM	((Sound of engine power increase and decrease for 13 seconds))		
CAM-3	Captain, engine anti-ice on		
CAM-3	Because inlet guide vane some ice		
CAM	((Sound of clicks))		
1618:34 CAM-1	Okay, engine anti-ice on		
CAM-3	Yah, okay now		
CAM	((Sound of engine power increase and decrease for 4 seconds))		
CAM-2	Right side clear		
CAM-2	Shall we ask ah - RVR?		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1618:47			
CAM-1	I think ah - no ((sound of laughter))		
CAM-2	Ah - ATIS said ah - quarter mile		
CAM-1	Better we don't ask 'em		
1619:00			
CAM-2	Okay ((Sound of laughter))		
CAM-1	Two - four left		
CAM-2	Two - four left		
1619:20			
CAM-1	East-west taxi		
		1619:29	
		N655MA	Anchorage ground DeHavilland six five five %
		ANC GND	DeHavilland five mike alfa %
CAM-2	Right side clear		
1619:39			
CAM-1	Controls please check		
CAM-2	Aileron - right		
CAM-3	Hai, pressure - cycling		
CAM-2	Left		
CAM-3	Pressure - cycling		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-2	Elevator		
CAM-2	Up		
CAM-2	Down		
CAM	((T: Boo, boo, nine times, sound of takeoff warning)) ((simultaneous with above CAM-2))		
CAM-2	One more time		
CAM-1	Okay		
CAM-3	Hai pressure cycling		
CAM-?	Hai		
CAM	((Sound of engine acceleration for 4 seconds))		
CAM	((Sound of engine deceleration))		
CAM-2	Flaps		
CAM-1	Okay left rudder		
CAM-1	Right rudder		
CAM-3	How about the flap?		
CAM-1	Spoilers and flaps two-five		
CAM-2	Flap two - five okay		
		ST-1	Sand truck one %

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-2	Two three flaps	ST-1	Sand truck one, %
CAM-1	Okay		
CAM-1	Spoilers please		
CAM-2	Spoilers		
CAM-3	Pressure cycling		
CAM-2	Lights on		
CAM-1	Okay again left rudder		
CAM-3	Pressure cycling ((simultaneous with above transmission))		
CAM-3	Okay		
CAM-1	Right rudder		
CAM-3	Pressure cycling T: Hai		
CAM-1	Okay		
CAM-1	Taxi before takeoff		
CAM-2	Checklist?		
CAM-1	Hai		
CAM-3	Hai roger	C-47U	Anchorage ground, Cessna %
1620:52 CAM-3	Brakes		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1620:54 CAM-1	Checked		
CAM-3	Flight instrument and altimeters		
1620:58 CAM-1	Okay checked and set		
		RDO	((Other ATC conversation))
CAM-2	Two niner five niner, set and cross checked		
CAM-3	INS		
CAM-2	Check and on		
CAM-3	Auto - ah all warning lights		
CAM-2	Check my side		
CAM-3	Check my side		
CAM-1	Check anti-skid remaining ((simultaneous with above statement))		
CAM-3	Okay		
CAM-3	Takeoff data and EPR bug		
1621:16 CAM-1	Review please		
CAM-2	Eh - three three nine, flap two three, stab four point (six)		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1621:21			
CAM	((Sound of engine acceleration for four seconds))		
CAM-2	One point eight seven, one three nine		
CAM-1	One three nine		
CAM-2	One five one		
CAM	((Sound of engine deceleration))		
CAM-1	Five one		
CAM-2	One six one		
CAM-1	Six one		
CAM-2	Flap up one nine one		
1621:34			
CAM-1	Okay (checked)		
CAM-2	EPR one point eight five checked and set		
CAM-3	Stabilizer setting and trim tabs		
CAM-2	Four point seven zero T: we can't see, eh eh		
CAM-3	T: further, please		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1621:56 ANC GND	Cessna four seven uniform %
CAM-2	T: thank you, I've got it		
CAM-2	Zero zero set		
CAM-1	Check		
CAM-3	Flight controls ((simultaneous with above transmission))		
CAM-2	Free		
CAM-2	Power on		
		RDO	((Other ATC conversation))
CAM-1	Lights off		
CAM-3	Anti-ice, de-ice and rain removal		
CAM-1	Okay we will use engine anti-icing		
CAM-3	Engine anti-ice scoop okay on ((overlapped with captain's "engine"))		
CAM-1	Okay		
CAM-3	De-ice off		
		1622:05 ANC GND	Japan Air eighty fifty four, hold short of runway two four left
CAM-3	Yaw damper		
		1622:09 RDO-2	Roger eight zero five
CAM-1	Off		
CAM-3	Yaw damper off?		
1622:13 CAM-1	What did he say? Yeah off		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-3	Okay		
CAM-1	Clear to cross?		
		1622:16 ANC GND	Cessna four seven uniform %
		ANC GND	Okay will you %
		1622:25 RDO-2	Ah - ground, eight zero five four, say again please
		1622:31 ANC GND	Japan Air eighty five four, hold short of runway six left
CAM-1	Holding		
		1622:35 RDO-2	Roger hold short six left, eight zero five four
CAM-1	Holding short		
		1622:41 ANC GND	Okay, Japan Air eighty fifty four, you're going to runway two four left, hold short of runway two four right
CAM-3	Briefing for takeoff		
CAM-1	Standard procedure		
CAM-2	Yes sir		
CAM-1	Make sure I acknowledge all transmissions, any questions speak up okay?		
		1622:57 ANC GND	Japan Air eighty fifty four, you are in front of the terminal now, is that correct?
CAM-2	Pardon		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-1	Any question, any problems, please speak, okay		
CAM-2	Yes, sir ((simultaneous with above statement))		
CAM-1	Okay, I want you to call eighty knots V - ah		
CAM-2	V-one		
CAM-1	V-one, V-R, rotation		
CAM-2	Okay		
CAM-1	Anything before V-one, we'll abort the takeoff, I have maximum brakes, thrust reverse, you have spoiler after V, V-one		
		ANC GND	Northwest report %
		1623:28	
		ANC GND	Japan Air eighty fifty four, are you holding ah - just south of the terminal?
CAM-2	Ah, affirmative		
CAM-1	Our call sign is		
		1623:37	
		RDO-2	Ah- eight zero five four, holding now
		1623:40	
		ANC GND	Okay you can begin taxi to runway two four left and hold short of runway two four right
		1623:46	
		RDO-2	Roger, eight zero five four, clear taxi two four left hold short two four right

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-2	Clear taxi two four		
CAM-1	Is that aircraft?		
CAM-1	What is that?		
		ANC GND	Cessna four % - cleared for takeoff
		ANC GND	That's runway six
		1624:16 RDO-1	Okay now ah - we are - moving Japan Air
		1624:21 ANC GND	Roger
1624:24 CAM	((Sound of engine acceleration and then deceleration for six seconds))		
CAM-2	Right side clear		
1624:32 CAM-1	Anything, after V-one, we will abort the takeoff; you have wings level		
CAM-2	Okay		
CAM-1	Spoiler - and maybe ah - slippery runway, so I don't think we are going to abort the takeoff roll okay?		
CAM-1	So my - may decision right?		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1624:55 CAM-3	Captain, yaw damper off now okay? Usually on yaw damper		
CAM-1	No		
CAM-3	No, okay roger		
		ANC GND	Cessna four seven %
CAM-1	Not oh *		
CAM-3	Yes sir		
CAM-1	Okay on		
1625:05 CAM-3	Uh- on, okay		
1625:06 CAM-3	F/E panel, electrical system checked, cabin and freon compressor tested and * *		
CAM-1	I've been flying eight zero one eight so long ((Sound of laughter))		
	((Above two transmissions simultaneous))		
CAM-3	Galley okay, stand by remaining item		
CAM-2	Roger		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1625:19			
CAM-1	Cleared for takeoff		
CAM-1	Okay remaining items		
1625:27			
CAM-3	Remaining item		
CAM-1	T: Hai, go ahead		
CAM-3	Roger		
1625:32			
CAM-3	Flap and slats		
CAM-2	Two five set		
1625:37			
CAM-1	Two five, light check (or right check)		
CAM-3	Reverser stand by pump		
CAM-2/3	On ((simultaneously))		
CAM-3	Ignition override		
CAM-2/3	All engines ((simultaneous with CAM-1))		
CAM-3	ATC transponder		
CAM-1	Check it please		
CAM-2	On		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1625:52 CAM-3	Anti-skid		
CAM-2	Stand by		
CAM-3	T: Hai blow-away jet, push		
CAM-2	On		
1625:56 CAM-3	Okay stand by ah Checklist completed		
CAM-2	Switch to tower		
CAM	((Sound of click))		
1626:05 CAM-1	Sometimes we just stay ground control but - okay make sure we have contact		
CAM	((Sound of engine acceleration for approximately 15 seconds))		
		1626:12 RDO-2	Ah- tower, Japan Air eight zero five four, ready for takeoff
		1626:16 ANC TWR	Ah- eight zero five four hold short of runway traffic landing six right
CAM-1	Okay hold short		
		1626:21 RDO-2	Hold short, roger

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM	((Sound of engine acceleration and then deceleration for approximately four seconds))
1627:06 CAM-1	Checklist --- complete
CAM-3	Ah- completed
CAM-2	Runway six right approach outer marker
CAM-2	Tower said, ah hold short - hold short, two four left
CAM-1	Light, small airplane
CAM-2	It's okay?
CAM-1	Yes sir
CAM-2	T: we are already in the runway
CAM-3	T: Eh?

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT
NW-6	Uh- is Northwest six %
ANC TWR	Northwest six is cleared %
NW-6	Roger
1627:13 ALR102	Anchorage tower, aeronautical one oh two %
1627:20 ANC TWR	Aeronautical one oh two %
ALR102	Okay and that's %
1627:43 RDO-1	Japan Air - holding short - ah we are on the runway

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-2	T: we are already in the runway yes we are		
CAM-3	T: what did you say?		
CAM-2	T: we are in the runway, "Hold short: said the tower		
CAM-3	T: Oh yes, we are in the runway, this is runway, two four, isn't it?		
CAM-2	Two four		
		1627:55 ANC TWR	Okay you're on two four right
		1627:58 RDO-1	Ah- we are two four left
CAM-3	T: heading is two four, isn't it?		
CAM-2	T: two four, surely		
		1628:10 RDO-2	Ah- tower, Japan Air eight zero
CAM-1	T: just a second	NW-6	Uh- Northwest ah six has landed
		ANC TWR	Northwest six, turn left %
		1628:25 NW-6	Roger
		1628:31 ANC GND	Five five mike alpha, ground

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM-2	T: even if it's small airplane, it's problem
CAM-3	T: six right is in use so much, before
CAM-?	T: that's true
CAM-?	T: it's problem!
CAM-1	It's okay
CAM-2	Ah-, captain, takeoff minimums
CAM-1	Takeoff minimums okay
CAM-2	Ah-, takeoff minimum two four left is ah
CAM-1	What?

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT
ANC GND	Okay runway six right %
NW-6	Uh-Northwest ah- six is now clear
ANC TWR	Northwest six roger, cross runway %
NW-6	Thank you %
ALR102	Tower, Alaska aeronautical %
ALR102	Tower, Alaska aeronautical one oh two's at the marker
ANC TWR	Alaska aeronautical one zero two continue %
ALR102	One oh two and ah %

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-2	Ah, two four left minimum is one six - sixteen hundred feet RVR, so its ah quarter visi- visibility fog	ALR102	Just for your information sir %
		ANC TWR	Roger
1629:45			
CAM-1	So we have it, thank you	1629:45	
		ANC TWR	Japan Air eight zero five four, did you copy?
CAM-2	Go ahead		
		1629:50	
		RDO-1	Eh- eh- eight zero five four say again
		1629:52	
		ANC TWR	Okay a one eighty on the runway or straight ahead down to the next intersection a right turn off this frequency and taxi back
CAM-2	One eighty and straight down		
CAM-1	What's our call sign?		
		1630:07	
		RDO-2	Eh, Japan Air eight zero five four say again please
		1630:11	
		ANC TWR	Japan Air eight zero five four a one eighty on the runway or straight ahead to next intersection a right turn off the runway and taxi back down to the approach end of runway two four left and no delay in your taxi

INTRA-COCKPIT	
TIME & SOURCE	CONTENT
CAM-2	Okay?
1630:24 CAM-1	Moving
CAM	((Sound of engine power increase twice for five seconds each))
CAM-2	One eighty and straight down to the right runway off
1630:36 CAM-3	T: going to two four right, eh- and then to left, again?
CAM	((Sound of goso goso undeterminable in background))
1630:56 CAM-2	My side clear
CAM	((Sound of engine power increase two times for five seconds each))

AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT
1630:25 RDO-2	Ah- eight zero five four moving
1631:38 RDO-1	Eighty five four, what can we expect?

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		1631:42 ANC TWR	Okay, eight zero five four straight ahead and you're approaching an intersection for your information you're on runway two four right, turn right the intersection you're just approaching, it'll be a uh about a - about a hundred and twenty degree turn back to your right and then up to and hold short of two four left, you've been on runway two four right, and uh, should be able to get you off in just a second
		1632:08 RDO-1	Okay thank you
		1632:10 ANC TWR	You are welcome
		ALR102	Air one oh two's on the ground %
		ANC TWR	One oh two roger turn left %
		ALR102	One oh two
1632:31 CAM-1	We're cleared to two four right? Left?		
		1632:44 RDO-1	We're turning right to two four left
		1632:47 ANC TWR	Okay Japan Air eight zero five four right turn back to runway two four left

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
		ANC TWR	Aeronautical one zero two report when %
		1632:59	
CAM-2	This side two four left	ALR102	Aero one oh two's clear
CAM	((Sound of engine power increase for approximately five seconds))		
CAM	((Sound similar to aircraft running over ice ruts with nose gear, noise undistinguishable))	ANC TWR	One oh two roger, cross runway %
		ALR102	One oh two
1633:12			
CAM-2	T: we were just at the middle of two four right		
1633:15			
CAM-3	T: yah, we were there		
CAM-2	T: made a turn from there		
		1633:17	
		ANC TWR	Japan Air eight zero five four taxi into position and hold runway two four left and advise when you're going past the uh hold point on runway two four left
CAM-1	Okay - we are going past now, the hold point		
		1633:28	
		RDO-2	Eh, we are going past now eight zero five four

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1633:35 CAM-2	Ready for takeoff		
1633:36 CAM-1	Right		
		1633:37 RDO-2	Eight zero five four ready for takeoff two four left
		1633:41 ANC TWR	Eight zero five four - uh - you're approaching runway two four left at this time
CAM	((Sound of engine power increase))		
CAM-1	Affirm, affirmative		
		1633:46 RDO-2	Affirmative eight zero five four
		1633:51 ANC TWR	Okay climb on course westbound cleared for takeoff
CAM-1	Cleared for takeoff		
		1633:55 RDO-2	Eight zero five four clear for takeoff
1633:58 CAM-1	Okay, remaining items again, again		
CAM-3	Roger, okay, - flaps and slots		
1634:03 CAM-2	Two five checked		
CAM-3	Reverser standby pump		
CAM-2	On		

INTRA-COCKPIT		AIR-GROUND COMMUNICATIONS	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
CAM-3	Ignition override		
CAM-2	All engine		
CAM-3	All engine		
1634:07 CAM-3	ATC transponder		
CAM-2	On		
CAM-3	Anti-skid	ALR102	Tower one oh two
CAM-2	Arm		
CAM-1	Arm		
CAM-3	Blow-away jet push		
1634:15 CAM-3	Checklist completed		
		ANC TWR	One oh two, go
CAM-2	Last time at ah - two four right middle position	1634:19 ALR102	Yeah that fog doesn't start 'till about eight hundred feet down uh the approach end of six right, everything else is beautiful from there all the way out to the outer marker
1634:23.3 CAM-1	Cleared for takeoff		

AIR-GROUND COMMUNICATIONS

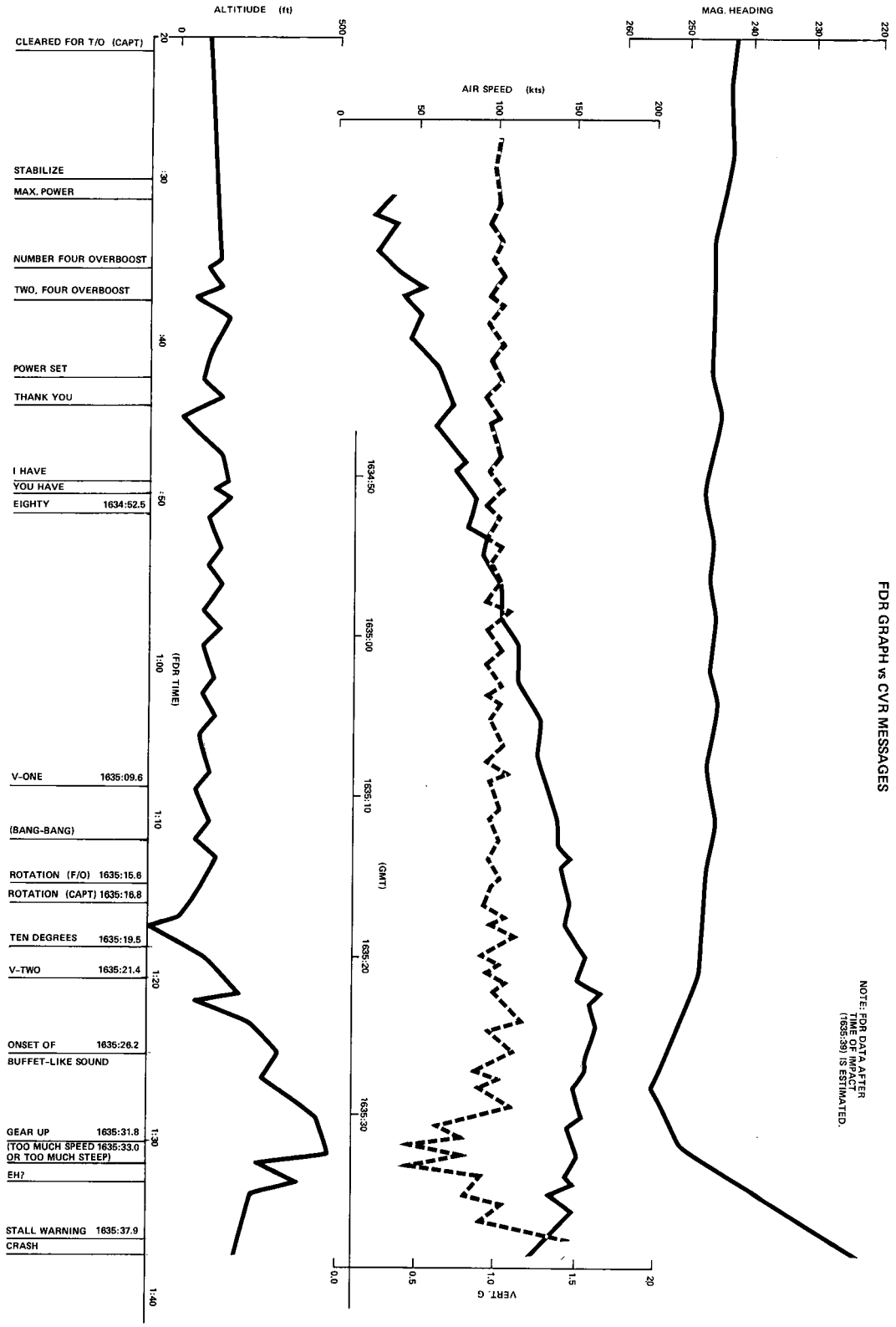
TIME & SOURCE	CONTENT
CAM	((Sound of engine power increase))
1634:31.4 CAM-3	Stabilize
1634:32.8 CAM-1	Maximum
1634:36.9 CAM-3	Number four overboost
1634:39 CAM-2/3	Two four overboost
1634:43.8 CAM-2	Power set
1634:45.6 CAM-1	Thank you
1634:50.4 CAM-1	I have
1634:51.1 CAM-2	You have
1634:52.5 CAM-2	Eighty
CAM	((Background sound begins to get quieter starting here))
1635:09.6 CAM-2	Vee one

INTRA-COCKPIT

TIME & SOURCE	CONTENT
ANC TWR	Thank you
1634:31 ANC TWR	How extensive uh does it appear to be laying around to us to the uh northeast
1634:36 ALR102	Eh actually it's ah just right over the lakes and uh the airport and everything else is beautiful
1634:43 ANC TWR	Nice place to build an airport
1634:45 ALR102	Oh yeah they thought it out real well

AIR-GROUND COMMUNICATIONS		INTRA-COCKPIT	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1635:13 CAM	((Two bang bang heard in background))		
1635:15.6 CAM-2	Rotation		
1635:16.8 CAM-1	Rotation		
CAM	((The background noise is changing to the airborne))		
1635:19.5 CAM-1	Ten degrees		
1635:21.4 CAM-2	Vee two		
1635:26.2 CAM	((Sound similar to aircraft buffeting)) ((This sound grows more frequent and ends at the crash))		
1635:31.8 CAM-2	Gear up		
CAM-?	(* *)		
1635:33.0 CAM-3	Too much (speed) ((The word "speed" could be "steep"))		
1635:34.2 CAM-2	Eh!		
1635:37.9 CAM	((Sound of stick shaker))		

AIR-GROUND COMMUNICATIONS		INTRA-COCKPIT	
TIME & SOURCE	CONTENT	TIME & SOURCE	CONTENT
1635:38.1 CAM-3	Stall!		
1635:39.3 CAM	((Sound of crash and end of recording))		



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FDR GRAPH vs CVR MESSAGES

APPENDIX G