

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591

SA-421

FILE NO. 3-1127

AIRCRAFT ACCIDENT REPORT

MARTIN 404, N464M
8 STATUTE MILES WEST OF
SILVER PLUME, COLORADO
OCTOBER 2, 1970

Adopted DECEMBER 24, 1970

E R R A T A

The following changes should be made to the subject report;

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|----------|----------|--|
| Synopsis | Line 21 | Change "30" to "29" |
| Page 7 | Line 5 | Insert "a" following "in" |
| Page 8 | Line 27 | Insert "*" following "9" |
| Page 8 | Line 28 | Delete third "0" under "Others" column |
| Page 8 | Line 28a | Insert: "*Part 430.2 of the Safety Board's Procedural Regulations defines "fatal injury" as that which results in death within 7 days of the accident. Therefore, the passenger who died October 28, 1970, was not listed as a fatality whereas the passenger who died on October 5, 1970, was listed as a fatality for purposes of this tabulation. |
| Page 31 | Line 29 | Change "5,190" to "5,165" |

REPORT NUMBER: NTSB-AAR-71-4

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TABLE OF CONTENTS

	Page
Synopsis	1
Probable Cause	2
1. Investigation	3
1.1 History of the Flight	3
1.2 Injuries to Persons	a
1.3 Damage to Aircraft	a
1.4 Other Damage	a
1.5 Crew Information	9
1.6 Aircraft Information	9
1.7 Meteorological Information	10
1.8 Aids to Navigation	10
1.9 Communications	10
1.10 Aerodrome and Ground Facilities	10
1.11 Flight Recorders	10
1.12 Wreckage	10
1.13 Fire	17
1.14 Survival Aspects	17
1.15 Tests and Research	18
1.16 Other Information	18
2. Analysis and Conclusions	23
2.1 Analysis	23
2.2 Conclusions	31
(a) Findings	31
(b) Probable Cause	32
3. Recommendations	32
Appendices	

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SYNOPSIS

On October 2, 1970, Martin 404, N464M, was operated for the purpose of transporting the Wichita State University football team from Wichita, Kansas, to Logan, Utah. Following a refueling stop at Denver, Colorado, the flight proceeded via a "scenic" route up Clear Creek Valley, toward Loveland Pass (elevation 11,990 feet mean sea level) and the Loveland ski resort area. The mountains on either side of the flightpath ranged from 12,477 feet m.s.l. to 13,234 feet m.s.l. At approximately 1300 m.d.t., the aircraft crashed into the base of Mount Trelease, 8 miles west of Silver Plume, Colorado. The elevation of the crash site is 10,750 feet m.s.l.

Of the 40 persons on board, 30, including the captain and a stewardess, received fatal injuries. Two of the surviving passengers later succumbed to injuries received in the crash.

Investigation revealed that the aircraft first struck the tops of trees at an elevation of 10,800 feet m.s.l. in a heavily wooded area. The aircraft continued on a heading of 215° magnetic, on a 4° descending flightpath, for a distance of 425 feet from the point of initial tree contact. The aircraft was destroyed by fire and impact.

Subsequent teardown of the engines and examination of the propeller mechanism showed that both engines were producing power at impact.

Weather conditions in the crash area and along the flightpath from Denver, Colorado, to Logan, Utah, were reported to have been clear. There were no known reports of turbulence, or up- and downdraft activity, and none was recalled by the surviving copilot or passengers.

Eyewitnesses located at about the 11,900-foot elevation at Loveland Pass were looking down at the aircraft when it came into view around Mount Sniktau. Angular measurements made from their viewpoint, and the testimony of most other witnesses, indicated that the aircraft was at

approximately 11,000 feet m.s.l. in the vicinity of Dry Gulch. The valley width in the area immediately west of Dry Gulch is 3,000 feet at the 11,000-foot contour.

The Board determines that the probable cause of this accident was the intentional operation of the aircraft over a mountain valley route at an altitude from which the aircraft could neither climb over the obstructing terrain ahead, nor execute a successful course reversal. Significant factors were the overloaded condition of the aircraft, the virtual absence of flight planning for the chosen route of flight from Denver to Logan, a lack of understanding on the part of the crew of the performance capabilities and limitations of the aircraft, and the lack of operational management to monitor and appropriately control the actions of the flightcrew.

1. INVESTIGATION

1.1 History of the Flight

On October 2, 1970, two Win 404 aircraft, N470M and N464M, were to be used to transport the Wichita State University football team and associated personnel to Logan, Utah. Both aircraft were owned by the Jack Richards Aircraft Company, Inc., of Oklahoma City, Oklahoma. The flightcrews for each aircraft were provided by Golden Eagle Aviation, Inc., also with headquarters in Oklahoma City, Oklahoma. The first officer for N464M, Mr. Ronald G. Skipper, was the president of Golden Eagle Aviation, Inc. The captain for N464M, Danny E. Crocker, had been hired by Golden Eagle Aviation, Inc., as a mechanic, and was used only occasionally as a pilot on an "individual contractor" basis, according to Mr. Skipper.

Flight planning for the trip was accomplished by Mr. Ralph Hill, first officer for N470M, and approved by captain Leland Everett. Weather conditions over the entire route were not considered to be a factor. The flight plan provided for a direct heading between Oklahoma City, Oklahoma, and Wichita, Kansas, and from Wichita to Denver, Colorado, under Visual Flight Rules (VFR).

From Denver to Logan, Utah, the proposed route of the flight was via Airway Victor 4 to Laramie, Wyoming, and thence to Logan by way of Rock Springs, Wyoming. This routing would provide an initial flight-path parallel to the mountain ranges, allowing ample time for the aircraft to reach a safe en route altitude prior to turning westward over the mountains. A copy of this flight plan was given to First Officer Skipper for the use of the crew on N464M.

On the morning of October 2, 1970, the aircraft were ferried to Wichita, Kansas, arriving at approximately 0750 m.d.t. 1/ Neither aircraft was serviced with fuel or ADI 2/ fluid there. However, 5 gallons of oil were placed in each engine supply tank on N464M. Catering supplies and football gear were placed on each aircraft, and the passengers boarded.

On departure from Wichita at 0908, there were 36 passengers, a regular crew of three, and a friend of the crew who was to serve as an additional assistant stewardess on N464M. There were 35 passengers and a crew of three on N470M.

1/ All times herein are mountain daylight, based on the 24-hour clock.

2/ AM -- Anti-detonation injection; the use of an alcohol and water mixture to allow the engine to develop additional power for takeoff or climb purposes for up to 2 minutes.

Both aircraft proceeded toward Denver, Colorado, for a planned refueling stop. En route to Denver, the first officer of N464M, while visiting with passengers in the cabin, advised some of them that the flight would take the "scenic route" from Denver to Logan and that he would point out the ski resorts and significant points of interest.

On arrival at Stapleton International Airport, Denver, Colorado, at approximately 1119, both aircraft were serviced with fuel and oil. Neither alcohol nor ADI fluid was added at this stop. N464M received 12 gallons of oil for each engine and 721 gallons of 100-octane gasoline, which filled the tanks and brought the total fuel load to 1,370 gallons.

Minor maintenance involving the servicing of the main landing gear shock struts on N464M with air and oil was performed. During this time, First Officer Skipper purchased aeronautical sectional charts for the contemplated scenic route. He made the decision to purchase these charts after departure from Wichita. According to First Officer Skipper, the decision to proceed via the scenic route was made without benefit of any discussion with Captain Crocker. Captain Crocker, however, was aware of the intention to depart from the previously prepared flight plan and to proceed on a southwesterly course from Denver. While on the ground at Denver, he had advised Captain Everett and one of the passengers that they were planning a scenic flight via Loveland Pass.

On departure from Denver, N470M proceeded northbound according to the original flight plan and subsequently landed safely at Logan, Utah.

N464M, with First Officer Skipper at the controls and occupying the left side pilot seat, departed from Runway 35 at Stapleton International Airport at 1229.

When N464M was approximately one-fourth to one-half a mile beyond the departure end of Runway 35, the Air Traffic Control Specialist who cleared the flight for takeoff observed that it appeared to be at a fairly low altitude and that an unusual amount of black smoke was coming from the right engine. He advised N464M of his observation and asked if there was a problem. The reply was "No, we're just running a little rich, is all." This was the last communications contact with N464M. The aircraft was last observed by the air traffic control specialist approximately 4 miles north of the departure end of Runway 35, still on a northerly heading.

With respect to the flightpath after departure from Stapleton International Airport, Mr. Skipper testified that there was no specific conversation with Captain Crocker concerning the route, and that there was no flight planning as to routing other than the intention "to go to Logan direct, or as direct as possible." He stated that after takeoff, the flight proceeded north until they intercepted the airway between Denver and Kremmling, Colorado, at which point they made a turn to the

west on the airway. Thereafter he was given heading directions by Captain Crocker. He did not recall the exact route, but recalled that the aircraft was turned slightly south, off the airway, to go through a pass in order to follow a valley. He believed that the flight proceeded past Nevada ville and intercepted the valley in the vicinity of Idaho Springs, Colorado. This flight path was confirmed by eyewitnesses on the ground who observed the aircraft at various stages in the flight. 3/ First Officer Skipper stated that the flaps were retracted after takeoff and that a climb had been maintained continuously at about 165 RMEP 4/ power setting on each engine and an indicated airspeed of approximately 140 knots. He did not recall the rate of climb.

After intercepting Clear Creek Valley, the flight proceeded along U. S. Highway 6, slightly south of it, past Georgetown and Silver Plume, Colorado, toward Loveland Pass. The elevation at Georgetown is 8,512 m.s.l. 5/ and at Silver Plume is 9,118 feet m.s.l. Thereafter, the valley floor continues to rise, reaching an elevation of 11,990 feet m.s.l. at Loveland Pass.

In the area west of Georgetown, the mountains on either side of Clear Creek Valley range from 12,477 feet m.s.l. to over 13,000 feet m.s.l.

Across the end of the valley at the Loveland ski resort area, the ground rises rapidly from the valley floor at 10,600 feet m.s.l. to 12,700 feet m.s.l. at the Continental Divide, directly ahead on a westward flight path.

Pilots of an aircraft proceeding westward along Clear Creek Valley at an altitude of 11,000 feet or less would not have a view of the end of the valley until in the vicinity of Dry Gulch, since it would be cut off by Mt. Snihtau (elevation 13,234 feet).

Mr. Skipper testified that in the vicinity of Dry Gulch, "We were in the valley. It began to look to me as if we were not going to climb so as to have clearance, sufficient clearance, over what I now know to be the Continental Divide ahead of us. I said something to the effect to Captain Crocker that maybe we should reverse course and gain some

See Appendix G -- "Flightpath As Described By Witnesses."

4/ Brake Mean Effective Pressure— equivalent to approximately 1,400 horsepower at 2,400 r.p.m. The Martin 404 Airplane Flight Manual lists 2,400 r.p.m. for climb purposes en route.

5/ Mean sea level.

altitude. I initiated a turn to the right. We were to the left side slightly of the valley." In continuing testimony, **M.** Skipper said: "I initiated a turn of approximately 45° change in heading, a medium bank turn which in my mind is somewhere between 20 and 30 degrees, and as I was rolling out of this turn, Captain Crocker said 'I've got the airplane.' He initiated a left turn, the aircraft began vibrating, he put the nose down, and shortly thereafter we crashed." He also testified that to his knowledge the aircraft was operating properly UP until the moment the vibration occurred.

The aircraft first struck trees at the 10,800-foot level on Mount Trelease (elevation 12,447 feet m.s.l.), and came to rest on the ground some 425 feet beyond the point of initial impact at an elevation of 10,750 feet m.s.l. Ten persons and First Officer Skipper survived the impact and fire, and were subsequently transported to hospitals in Denver, Colorado. The time of the crash was approximately 1300 according to eyewitnesses and one of the surviving passengers.

Twenty-six eyewitnesses who saw the aircraft at various places along the flight path provided statements concerning their observations. Most describe the altitude as low or very low. Many were concerned that the aircraft was in danger because of the low altitude over the mountainous terrain. All who observed the aircraft along the last 10 miles of flight in Clear Creek Valley stated that the aircraft was below the mountaintops at all times. A pilot employed by a major airline as a flight engineer observed the aircraft as it passed over Georgetown, Colorado. He estimated that the aircraft altitude was between 1,000 and 1,500 feet above Georgetown, and that it appeared to be climbing at a slow airspeed. The engines appeared to be operating normally.

An engineer for the Martin Marietta Corporation also observed the aircraft as it passed over Georgetown, Colorado. He stated: "I had been a military pilot of multi-engine aircraft during World War II and was awed by the aspect of such a large aircraft cruising up the valley at approximately 500 to 1,000 feet above the terrain. The engines sounded as though they were throttled back and not at high r.p.m., a condition not in keeping with what would be expected if the aircraft was attempting to clear the Continental Divide. When the plane made a turn to the right, I noticed a mushiness to its flight characteristics. Both engines appeared to be running normally, no smoke, fire or sounds of missing or backfiring." He also stated: "After studying the power curves of this aircraft in the Martin 404 Airplane Flight Manual dated September 10, 1951, it appears the plane was well above the critical engine altitude, and it didn't appear to be much above the minimum control speed of 110 mph."

Another witness, a pilot familiar with the Loveland Pass area, observed the aircraft as he was driving eastward on U. S. Highway 6

about 2 miles east of Dry Gulch. He stated, "Thinking it must be in trouble, I stopped the car to get out and look and listen. My initial and firm feeling was that the plane was in serious trouble as it was below the level of the mountains on either side that form the valley, and I didn't see how it could possibly turn around. Also, it was in nose high attitude and flying at a low rate of speed, obviously straining to gain altitude, but barely keeping up with the rise of terrain. I have driven over this route countless times and know that the steepness of the slope increases radically in only 3 or 4 miles from where he was and that the plane could never make it." He also said that both engines sounded good as the aircraft passed over him, and he did not observe any sign of smoke from either engine.

A witness, located on U. S. Highway 6 west of the crash site, first observed the aircraft at Dry Gulch. The distance from his location to Dry Gulch was approximately 5,000 feet. A sight line bearing from his point of observation (elevation 10,650 feet m.s.l.) to where he saw the aircraft measured $4\ 1/2^\circ$ upward.

Two witnesses at the 11,900-foot altitude level on the east side of Loveland Pass were looking down at the aircraft when they observed it make a right turn across the highway just east of Dry Gulch, and a left turn while over the timber on the northwest side of the highway, before crashing into the mountain. A sight line bearing taken from their point of observation to the point of the turn near Dry Gulch measured $4\ 1/4^\circ$ downward. One of these witnesses believed that the propellers stopped revolving immediately prior to contact with the trees. The other believed both propellers were turning slowly.

Two other witnesses, who were on U. S. Highway 6 almost directly opposite the subsequent crash site, estimate; that the aircraft was only about 100 feet above the highway as it was coming toward them, and seemed to be losing altitude.

The aircraft made a steep turn in front of them, with a bank angle that permitted them to see the tops of the plane's wings and the top of the fuselage. Seconds later, this couple observed the aircraft strike the trees. According to them, there was no smoke coming from the engines. The propellers were turning slowly.

Two witnesses, one in Georgetown and one located approximately 1-1/2 miles east of the crash site, reported hearing the engine(s) make a sound similar to backfiring. One of these witnesses testified that when he was halfway between the Bethel and Silver Plume campgrounds, he first saw the aircraft as it passed over the highway. He stopped his car and observed the aircraft through a pair of binoculars. He stated

that he read two of the numbers on the aircraft as "4" and "M" when the aircraft was 3/4 to 1 mile past his position, and that these numbers were on the side of the aircraft, on the fuselage, directly forward of the tail section. He testified that he called the FAA Flight Service Station (FSS) in Denver to inform the FAA of his observation. However, the telephone logs in the FAA FSS do not reflect that such a call was received.

Eight of the surviving passengers were interviewed. All confirm that the aircraft was continuously below the mountaintops while flying up Clear Creek Valley. None recalled any indications that the engines were not running normally. Several recalled that the aircraft was banked sharply just before impact. The banks upset a stewardess who was serving refreshments to the passengers. Three described the aircraft as shaking or vibrating coincident with, or immediately following, the initiation of the rapid banks. One survivor, who had been standing in the doorway to the pilot's compartment and immediately behind the two pilots, stated that the vibration felt like "a boat slapping water." While he was standing in the doorway, he overheard the pilots discussing the elevation of the mountain peak ahead, and about that time the quick right turn and left turn were made. He did not recall any conversation between the two pilots other than this. The engines sounded normal to him and, until the right turn was initiated, it did not seem to him that the pilots were overly concerned about the flight.

1.2 Injuries to Persons

<u>Injuries</u>	<u>Crew</u>	<u>Passengers</u>	<u>Others</u>
Fatal	2	28	0
Nonfatal	1	9	0
None	0	0	0

Post-mortem examination of the captain did not reveal any evidence of pre-existing disease or physical impairment that would have adversely affected the performance of his duties.

1.3 Damage to Aircraft

The aircraft was destroyed by impact with trees and the ground, and the fire which occurred after impact.

1.4 Other Damage

A number of trees up to 2 feet in diameter were destroyed.

1.5 Crew Information

The crewmembers were properly certificated to conduct this flight. (For detailed information, see Appendix B.)

1.6 Aircraft Information

N464M, serial No. 14151, was one of 14 Martin 404 aircraft purchased in "as is" condition by the Jack Richards Aircraft Company on February 16, 1968, pursuant to a purchase agreement with the Fairchild Hiller Corporation. Prior to the acquisition by Fairchild Hiller Corporation, N464M had been owned and operated in airline service by Ozark Air Lines, Inc. According to Ozark Air Lines records, N464M was last operated in airline service on a flight terminating in St. Louis, Missouri, on June 7, 1967. Total airframe time then was 38,593:26 hours; time since overhaul was 13,586:14. The time since overhaul on the left engine was 1011:05 hours and on the right engine 1747:14 hours.

N464M subsequently was ferried to Las Vegas, Nevada, where it was to be maintained in operational, or fly-away, status. This fly-away storage procedure consisted of regular inspections and engine runups at approximately 2-week intervals. The aircraft remained in storage status at Las Vegas until August 30, 1970, at which time an "annual" ^{6/} inspection was partially completed by Mr. Donald R. Sizemore, who held an Inspection Authorization issued by the Federal Aviation Administration (FAA). Mr. Sizemore signed the aircraft logbooks on September 8, 1970, indicating completion of the annual inspection. However, at that time, a required X-ray inspection of the engine mounts had not been completed. Because of this, he held the logbooks in his possession until the X-ray examination could be accomplished. Accordingly, on September 14, 1970, the aircraft was flown, pursuant to a ferry permit, from Las Vegas, Nevada, to the Jack Richards Aircraft Company's facilities in Oklahoma City, Oklahoma.

The captain who flew N464M on this ferry trip testified that in his opinion, " . . . this airplane appeared to be as good as the ones I have been flying every day for an air carrier. It was in good condition."

On September 15, 1970, the X-ray inspection was accomplished and the X-rays submitted to Mr. Sizemore for examination. He testified

^{6/} An "annual" inspection is required by Part 91 of the Federal Aviation Regulations (FAR) in order for an aircraft to be operated in passenger-carrying activities. The inspection must be accomplished in accordance with Part 43 of the FAR's and the aircraft approved for return to service by a person authorized by the FAA.

that following his examination, he made appropriate entries in the logbooks. On September 20, 1970, he released the logbooks to the Jack Richards Aircraft Company. He testified that at that time, he considered the aircraft airworthy and duly licensed for passenger travel.

Since the seat location of all passengers and the location of all baggage could not be determined, the precise center of gravity of the aircraft at impact could not be computed. The gross weight computations are contained in Appendix C to this report.

1.7 Meteorological Information

The weather was clear in the vicinity of the crash site. There was no evidence of turbulence or up- or downdraft activity. Witness estimates of the outdoor temperatures in the vicinity of the crash site ranged from 55° F. to 65° F. The wind condition at the crash site was estimated to be 10 knots from a true bearing of 350'. Weather conditions are not considered to be a factor in this accident.

1.8 Aids to Navigation

Not applicable. This flight was conducted under Visual Flight Rules and a flight plan was not filed.

1.9 Communications

There were no communications with the flight after its departure from the vicinity of Stapleton International Airport.

1.10 Aerodrome and Ground Facilities

Not applicable.

1.11 Flight Recorders

Neither a flight recorder nor a cockpit voice recorder was installed on N464M, nor were these required by Federal Aviation Regulations.

1.12 Wreckage

The crash occurred in a heavily wooded area. The trees were up to 2 feet in diameter. Many were more than 50 feet high.

The first tree struck by the aircraft was at an elevation of approximately 10,800 feet m.s.l. Continuing along a magnetic heading of 215°, trees were cut off on a descending slope of 4 to 4 1/2°. The

swath path indicated a left bank angle of approximately 31° . The distance between the first tree strike and the tail of the wrecked aircraft was 425 feet. First evidence of fire was discovered on the ground at approximately 185 feet from the first tree contact. The area of tree wreckage and burnout was approximately 350 feet in width at the widest point and 525 feet in length from the first tree strike. The slope of the terrain was 29° to 31° 7/

a. Airframe

Many pieces of the aircraft were torn off as it descended through the trees. The wings were broken off at their attach points. They were torn apart and pieces were found along the tree swath path.

The fuselage was entirely burned down to molten aluminum and twisted longerons and stringers. It lay on its left side. The empennage was severed from the fuselage, 2 feet forward of the aft pressure bulkhead. The vertical stabilizer leaned downhill at an angle of approximately 25° . The rudder frame rained, burned out. Portions of the elevator remained with the empennage. Elevator trim and spring tabs were found attached to the remaining elevator. The elevator tab was positioned 3° up.

Control cables lay along the span of the wrecked fuselage. No breaks were discovered.

A portion of the horizontal stabilizer rained with the empennage. The measurement of the horizontal stabilizer jackscrew was 1-1/2 inches or equivalent to 3' of leading edge up. The horizontal stabilizer adjustment is a function of the selection of takeoff or 12.5' of flaps. The interacting mechanism, which causes the stabilizer to move up when 12.5° of flaps are selected, was totally destroyed by fire.

A flap actuator was found, minus all connecting hydraulic hoses. It was fully compressed. A second flap actuator minus all hoses was found, measuring 3-3/4 inches extension. The flaps selector was in the takeoff position. The landing gear handle was in neutral (up) position. The throttle quadrant lay burned out in the wreckage. No control cables remained attached to it. The right mixture control was in auto rich. The left mixture control was free to move to any setting.

b. Systems

Ground fire was of such duration and intensity that virtually no meaningful information could be obtained from the aircraft systems.

7/ See Appendix H -- Wreckage Distribution Chart..

Except for a burned out altimeter, and a few battered instruments found separately away from the main wreckage area, no instruments, panels, or any other components were recovered with any pertinent information. The barometric setting on the altimeter was 30.27 inches Hg.

c. Powerplants

1. On-Site Investigation

The propellers and engines were found on the side of a mountain and were resting on an incline in excess of 30°.

The left and right engines were found separated from their respective propellers. The front section cases of both engines were attached to the propellers. The engine/propeller separations occurred at the front accessory support plate and case.

(a) Left Propeller

Two of the three blades remained attached to the propeller assembly. These blades were subsequently identified as Nos. 1 and 3 blades. The other blade, which was subsequently identified as No. 2 blade, was broken away from the propeller assembly, 18 inches out from the hub. The blade was found about 50 feet below and in line with the separated propeller blade assembly. The blade separations were typical of impact fractures. All blades were accounted for.

The blade tips of the attached blades were broken. All of the blades were twisted and bent rearward. The separated blade was intact. The propeller assembly was not damaged by the ground fire. The two attached propeller blades were cut off by hand, and the propeller/reduction gear assembly was removed from the accident site.

(b) Right Propeller

Two blades remained attached to the separated propeller/reduction gear assembly. These blades were subsequently identified as Nos. 1 and 2 blades. The No. 3 blade was separated at the blade shank. A section of the separated blade was found about 150 feet to the rear of, and in line with, the separated right propeller assembly. One attached propeller blade was intact; the second propeller blade had a section near the tip broken away. All three blade assemblies were bent rearward and twisted to varying degrees.

All blades were accounted for, and the blade separations were all indicative of impact-type fractures.

The propeller and separated reduction-drive gear housing bore some evidence of heat damage in the vicinity of the barrel halves.

The two attached blades were cut by hacksaw from the propeller hub, and propeller assembly was removed from the accident site.

(c) Propeller Governors

Only one propeller governor was recovered from the wreckage area. The governor was found approximately 12 feet to the rear of the propeller assembly. The data plate part number was 5U1849F2; the serial numbers were WH51213 and OZA5. The governor was not damaged except for some slight heat discoloration. A section of reduction-drive gear housing was attached to the governor. It was determined (by matching the section of drive gear housing attached to the governor to the remains of the front accessory section housing) that this governor was attached to the right engine.

(d) Left Engine

The power and accessory sections were intact. The accessories mounted on the rear accessory case were all intact and did not appear to be damaged by impact forces. The only apparent component damage occurred to the carburetor and generator. The mixture control housing was broken away from the carburetor, and the rear of the generator housing was heavily burned.

The power and accessory sections of this engine evidenced indications of ground fire and heat damage, primarily in the area of the reduction gear area of the power section. The rear accessory case and attached components evidenced indications of heat damage to a generally lesser degree than the power section.

The cowling for this engine was separated and extensively broken up and fragmented. A few cowl flap actuators attached to small sections of cowl flap were found and were retracted or in the cowl closed position.

(e) Right Engine

The engine was identified through a partially attached section of supercharger which comprises the pressurization system that is mounted on the right engine accessory pad of this model aircraft. The power section was basically intact except for some separated cylinder heads. The accessory section was almost totally destroyed by ground fire. The impeller drive shaft remained attached to the power section and was extensively damaged by ground fire. Several burned components were found adjacent to the right engine accessory area. These accessories included several rear accessory drive gears and a separated main oil screen. The housing of this screen was burned away. A separated generator was also found. The generator was completely burned and would not rotate. A blower clutch drive, starter clutch, three valves with the valve springs

attached, and a section of cylinder head were found in the area adjacent to the engine. The engine cowlings were separated and were almost totally destroyed. Some small sections of cowl flap, with the flap actuators still attached, were found. These actuators were in the retracted position.

Only one valve related to either the fuel or engine hydraulic system was found. The valve serial number was C-41-9788, part number was 4-1846-2. The valve was removed from a 3/4-inch line and was found closed.

2. Investigation of Engines and Propellers at the Maintenance Base at Frontier Airlines.

The engines were removed from the accident site on October 4, 1970, and were transported to Denver on October 5, 1970, for disassembly and examination. The propellers were also disassembled and examined.

(a) Left Propeller, S/N A4929

The reduction gear assembly rotated freely when turned at the propeller shaft. The visible portion of the blade bushings were all intact and did not display any evidence of damage. The bushing attaching screws and locating dowels were broken, which allowed the bushing assembly of each propeller to be displaced beyond its normal position. The degree of displacement was not determined. The blade shank radius of the three blades displayed circumferential gouges from contacting the blade chafing ring at impact.

The three blade spider shim plates were removed from the propeller assembly. The No. 1 blade shim plate was broken into two pieces and was cracked at the dowel pin hole. The fracture was parallel to the propeller spider shoulder. The No. 2 blade shim plate was intact except for a crack which was parallel to the propeller spider shoulder. The No. 3 blade shim plate was cracked into three pieces and bore an impact mark that was parallel to the propeller spider shoulder. These impact marks and/or fractures were determined to correspond to a propeller blade angle of approximately 32°. The dome angle was also measured and computed to be 32.9°. The scavenge pump was removed. The pump was intact and contained an extensive amount of dirt and small parts of tree limbs. No foreign metal was found within the pump cavity area.

(b) Right Propeller, S/N A3696

The condition noted for the right propeller was similar to that noted for the left propeller. The oil scavenge pump was removed and evidenced impact damage. The pump vanes were exposed and the drive shaft was broken. No evidence of foreign metal was observed. An extensive amount of mud and debris was found in the pump cavity area.

The blade spider shim plates were removed from the propeller. The No. 1 and No. 2 blade shim plates were broken into two pieces. The fracture was parallel to the propeller spider shoulder. The No. 3 spider shim plate was broken into four pieces, and an impact mark was visible which was parallel to the propeller spider shoulder. The fractures and/or impact marks corresponded to a propeller blade angle of approximately 32°. The dome angle was also measured and computed to be 32.9°.

(c) Right Propeller Governor, Woodward Part No. 5U1849F2,
S/N WH51213 and/or OZA5

The governor was disassembled to determine the selected speed of the engine. The distance from the head mounting surface to the rack spring seat measured 0.925 inch. This distance corresponds to a governor speed of 2,400 r.p.m.

(d) Engine Examination

Both engines were disassembled by conventional means, with the exception that a cutting torch was used in order to expedite the removal of the impact-damaged exhaust collector rings of both engines. A number of other non-engine structural parts, such as cowl rings and sections of the firewall, were also removed by this method.

The cylinder barrels of both engines were securely attached to their respective crank cases. All of the intact cylinders from both engines were borescoped after spark plug removal. There was no visible evidence of any internal damage or pre-existing distress noted to the cylinder barrel walls, piston heads, valves, etc.

After removal of a representative number of cylinders, the internal components of the power section of both engines were examined visually. This examination revealed that the link rods, master rods, and piston skirts were not damaged by this impact, nor did these components display any evidence of pre-existing distress. The left engine master and link rods all moved freely, with no evidence of binding noted. The master rod cylinder for the right engine was crushed and damaged by the ground fire, thus seizing the engine. However, the link rods could be rotated on their respective link pins.

Nine cylinders were removed from each engine. The walls of all of these cylinders bore piston skirt and ring markings characteristic of storage in a stationary position for an extended period of time. The piston rings were not "feathered" as in a normal engine; rather, the

rings were rounded and displayed both polished and dull finished areas, characteristic of rings that have not seated properly during engine operation after an extended storage period.

Many of the spark plugs were fouled with oil and heavy carbon deposits. The intake and exhaust ports and pipes on the right engine had a heavy coating of oil, distributed uniformly throughout the port cavities and pipes. The blower section on the left engine displayed a uniformly distributed, heavy coating of oil.

There was no evidence in either engine to indicate that the engines were not capable of producing power up to the point of impact.

In order to assess to what extent, if any, the oil deposits found in the engines (and an oil consumption of approximately 6 gallons per hour per engine) might indicate a potential power loss, questions were asked of Pratt & Whitney CB3 engine specialists. Testimony concerning the oil consumption was that there is no maximum specified or permissible amount per hour if the engine is otherwise operating normally, nor is high oil consumption an indication of potential or existing power loss. High oil consumption and the oil coating found in the intake and exhaust ports and the blower section could result from seized piston rings, causing blow-by, and from leakage around the impeller seals. In turn, these conditions could exist as the result of inadequate, long-term storage practices. One indication of potential high oil consumption is piston ring markings on the cylinder walls. One expert testified, I would certainly be inclined, in fact I'd be strongly urged to remove a couple of the jugs and have a look, because I would suspect possibly that this is there, that this particular ring is making this mark, may possibly be seized where it wouldn't function properly when it (the engine) did start operation."

Mr. Skipper testified that on takeoff at Denver, the manifold pressure on the engines of N464M was about 1 inch below the maximum allowable, or about 58-1/2 inches. With respect to this statement, a Pratt & Whitney performance engineer testified that 58-1/2 inches of manifold pressure would be normal at the Stapleton International Airport elevation, and from that he would conclude that the engines were developing normal take-off power. He further stated that at a power setting of 165 BMEP and 2,400 r.p.m., the engines would be at, or very near, full throttle at 12,030 feet m.s.l. on a standard day. If the temperature were higher than that for a standard day, full throttle would be reached at some altitude below 12,000 feet. 10/

10/ The altitude at which full throttle is reached, or the supercharger is no longer capable of supplying more air than is necessary to achieve a given brake horsepower is known as the engine's "critical altitude."

In normal climb, additional power can be achieved after full throttle is reached by increasing the engine r.p.m. from 2,400 to 2,600.

1.13 Fire

Fire occurred after ground impact. First evidence of fire was discovered on the ground approximately 185 feet from the first tree contact. The burned out area measured 350 feet wide and 525 feet long. The aircraft fuselage was reduced to molten aluminum from the aft pressure bulkhead forward, except for a small section of the nose cone.

1.14 Survival Aspects

N464M was configured as a single-class service aircraft. The passenger compartment seated 40 passengers in 10 rows of two double seats each. The seats in row one were aft facing; the other seats faced forward.

Ten passengers and one pilot survived the initial impact and fire. One of the passengers had been seated in Row 4; two in Row 7; two in Row 8; and three in Row 9. One survivor was standing in the doorway to the cockpit and jumped into the forward baggage compartment when he recognized that a crash was imminent. The surviving first officer was occupying the left pilot seat at the time of impact.

All but one of the surviving passengers had their seatbelts unfastened. They were thrown forward and to the left at impact. Escape from the aircraft was through a hole in the left side of the fuselage and a hole in the right side of the cockpit.

Rescuers first arriving at the scene stated that the fuselage was relatively intact, with a small hole on the right side and a large hole on the left. One rescuer related that he observed fire in the forward baggage compartment area. He was about to step inside the fuselage to assist any survivors when an explosion occurred, and flames traveled aft into the cabin.

It is believed that many of the persons fatally injured initially survived the impact conditions. This is based on statements from the seriously injured copilot who saw and talked to passengers lying in the forward baggage compartment through the partially opened cockpit door, albeit the opening in the door was too small to reach them. One of the first rescuers on the scene of the accident related also that he saw passengers on the floor in the forward section of the cabin. They were moving but making no effort to extricate themselves. This rescuer noted that the seats in the aircraft resembled "broken furniture" and that many

seats were pushed together in the forward section of the cabin. One of the survivors mentioned having to free himself from a seat which was on top of him in order to make his escape.

1.15 Tests and Research

Studies of the performance charts in the Martin 404 airplane flight manual (AFM) were made to determine the operating capabilities of the aircraft at a gross weight of 48,165 pounds on departure from Denver at a field elevation of 5,300 feet m.s.l., and at a gross weight of 47,565 pounds 11/ at an indicated altitude of 11,000 feet m.s.l. with a free air temperature (FAT) of 50° F. Since these charts do not present information for weights in excess of the 44,900 maximum certificated gross takeoff weight of the aircraft, extrapolations from the climb performance data were necessary. The studies were accomplished by an FAA aeronautical engineer who had been responsible for determining the Martin 404 performance satisfied certification requirements at the time of original certification of the aircraft for use in airline passenger-carrying activities. (The general information used for the purpose of calculations in this instance, and the results obtained are contained in Appendix D to this report.)

Concerning the climb performance capability, the AFM notes that best climb is obtained with METO 12/ power at 130 knots and the flaps retracted.

Stall buffet on the Martin 404 begins at approximately 6 knots above stall speed. Testimony adduced during the public hearing held in connection with this accident was that the buffet can "take the form of anything from a noticeable shake in the steering column, which, generally speaking, is not audible or noticeable to passengers, to a very pronounced shaking of the airplane which almost anyone would observe. My recollection of the Martin 202-404 series is, that in its certification configuration, it had a very pronounced stall buffet. There was no mistaking it when you got into the stall."

1.16 Other Information

Aircraft of United States registry, having a maximum certificated takeoff weight of 12,500 pounds or more, may be operated in passenger-carrying activities in the United States under more than one part of the FAR's. The determining factors generally relate to the intended use of the aircraft, the responsibility for its operation, and whether the flights are for compensation or hire. It became apparent in the early stages of this investigation that there was a disagreement among the three interested parties concerning the designation of "operator." In the

11/ Calculated weight of the aircraft at time of impact based upon fuel burnoff.

12/ METO--Maximum Except Takeoff, or the maximum continuous power.

course of the public hearing, an FAA witness testified that the FAA considered Golden Eagle Aviation, Inc., to be the operator, and as such **did not** have the proper authority for the operation of Martin 404 aircraft. Both the Jack Richards Aircraft Company and Golden Eagle Aviation, Inc., contended that the Wichita State University was the operator. **It was** the position of Wichita State University officials that they had chartered the aircraft and Wichita State University was not the operator. The testimony of the three parties concerning the contractual relationships may be summarized as follows:

a. Jack Richards Aircraft Company, Inc.

Mr. Joseph H. Richards testified that he was the president and sole stockholder of the Jack Richards Aircraft Company, Inc. The company's business involved aircraft sales and both long- and short-term leasing of aircraft. The company **did not** solicit short-term leases (about 5 percent of the total company business), and it was necessary for such potential customers to come to **Mr.** Richards, rather than the company seeking such customers. He testified "I'm really not looking for their business, but while my aircraft are sitting there, I will lease them out at times. . . ." With respect to the manner in which the short-term leases were accomplished, he stated "Usually, whoever they send to pick up the aircraft, I have them sign it if they are an officer, or, you know, an agent of the lessee. If they are not, I usually send the lease along (with the pilots) with my signature on them and with a return envelope, stamped, that when the people arrive, they can have them sign it, drop it in the mail, and return it to me." A sample of a lease (involving a Martin 404 aircraft, N461M) to Wichita State University (WSU) for a trip from Wichita, Kansas, to College Station, Texas, and return was submitted as an exhibit in the public hearing. This lease did not specify any payment for the use of the aircraft, and was undated.

All agreements as to price and availability of aircraft were accomplished verbally, and no agreements in writing concerning the basis for any charges were ever made. With respect to the leasing of Martin aircraft for the Wichita State University 1970 football season, **Mr.** Richards stated, "During the summer of 1970 I spoke with **Mr.** Bert Katzenmeyer concerning the leasing of airplanes for the coming football season. Although **Mr.** Katzenmeyer wanted to lease an airplane for the entire season it was agreed that if the company had planes available, we would lease to them on a single-trip basis. I explained to **Mr.** Katzenmeyer that this was the only way that I could do it because the company was primarily interested in selling airplanes and could not possibly tie up a plane for an entire season at the price the University was willing to pay. **Mr.** Katzenmeyer stated that he understood and agreed to lease planes from us when available at an hourly rate of \$125.00."

Mr. Richards testified that all of his contacts were by telephone, that he had never visited Wichita State University, that no officers

of the University had called on him in Oklahoma, and that he had never met **Mr. Bert Katzenmeyer** (who was the Athletic Mrector of WSU and an officer in the WSU Physical Education Corporation (WSU/PEC)). **At** contacts by telephone were initiated by **Mr. Katzenmeyer**, one in November 1969, and one in July 1970, at which time verbal agreements were reached for the use of Jack Richards Aircraft Company aircraft. Initially, **Mr. Richards** intended to supply a DC-6 aircraft. However, this aircraft was damaged in July 1970 during a windstorm. Since it was not repaired in time, two Martin 404 aircraft were substituted.

No payment was ever made by the WSU/PEC to Jack Richards Aircraft Company, nor was WSU ever billed for the use of any Jack Richards Aircraft Company aircraft. Instead, all payments to the Jack Richards Aircraft Company for use of aircraft in the transportation of WSU athletic teams were made by Golden Eagle Aviation, Inc.

b. Golden Eagle Aviation, Inc.

Golden Eagle Aviation, Inc. (Golden Eagle) was incorporated on November 26, 1969, by **Mr. John P. Kennedy**, **Mr. Bruce Danielson**, and **Mr. Ronald G. Skipper**. The company business included consulting services to potential users of large aircraft, the supplying of flight crewmembers to operators of large aircraft, and airmail operations in small aircraft pursuant to an air taxi certificate issued in accordance with part 135 of the Federal Aviation Regulations.

In a letter dated April 3, 1970, addressed to **Mr. Robert Kirkpatrick**, Business Manager of WSU/PEC, Golden Eagle offered to provide services for the transportation of the WSU football team during the 1970 season. This letter stated, "The total adjusted maximum price including all standard Gold Carpet services and aircraft lease is \$19,388.60 (nineteen thousand, three hundred eighty-eight and sixty cents)."

On April 24, 1970, **Mr. Bert Katzemeyer**, Athletic Mrector of WSU/PEC, advised Golden Eagle, "May this letter serve as acceptance of the Golden Eagle Aviation, Inc., bid for charter service for the Wichita State University football team travel for five games in the fall of 1970 at the price quoted of \$19,388.60. Terms of this contract are based upon your bid, dated April 3, 1970, as submitted by letter to **Mr. Robert Kirkpatrick**, Business Manager."

Subsequently, a sixth game was added to the WSU schedule, and Golden Eagle was asked to submit a bid for the extra game. To this request, Golden Eagle responded, "Our computed Price, all things included and considered, on the September 12, 1970, football flight to College Station, Texas, is \$5,000."

On July 21, 1970, an "Aviation Service Agreement" ^{13/} was signed by Mr. Bruce Danielson for Golden Eagle, and by **M Bert Katzenmeyer** for Wichita State University. **Mr. Danielson** testified that it was his understanding that the DC-6 mentioned in the agreement had been secured by WSU from the Jack Richards Aircraft Company.

When the DC-6 was damaged in a windstorm, Golden Eagle did not consider it necessary to negotiate a new contract, but instead simply provided two crews for the replacement Martin 404 aircraft at no additional cost.

With respect to the agreement, **Mr. Danielson** testified that approximately \$5,000 of the \$24,388.60 contract price was for the lease of the aircraft. By verbal agreement between him and **Mr. Katzenmeyer**, WSU would write one check to Golden Eagle, who in turn would forward the lease payment to **Mr. Richards**. According to **Mr. Skipper**, this arrangement was for the purpose of "simplifying the bookkeeping."

With respect to the operational control of the aircraft, **Mr. Danielson** testified, "But in particular, we wanted to make sure that there was no misunderstanding that Wichita State was the operator of the aircraft, that we were acting only as pilots, and we would advise them as best we could, because we had been knowledgeable in the aviation industry, and we were in the consulting business, and if there was any way I could find out for him or help him we would do this." In response to this advice, **Mr. Kirkpatrick** informed him that he was aware of the regulatory requirements and displayed a copy of the Federal Aviation Regulations.

On the trip from Wichita to Logan in **N464M** on October 2, 1970, **Mr. Skipper** had a copy of the lenses on **N464M** and **N470M** in his possession at the time of the crash. The leases had been signed by **Mr. Richards**, but had not been signed by any official of WSU or the WSU/PEC because, according to **Mr. Skipper**, "It had not become convenient for me to have **Mr. Katzenmeyer** sign them yet."

c. Wichita State University

Since intercollegiate athletic activities were not supported by state appropriations, a separate, independent, nonprofit Wichita State University Physical Mucation Corporation was organized to manage WSU's intercollegiate athletic program. **Mr. Bert Katzemeyer** was the athletic director. **Mr. Robert Kirkpatrick** was the assistant athletic director and assistant business manager of the athletic corporation. **Mr. Floyd Fanner** was originally employed by the corporation as ticket manager. Upon the death of **Mr. Kirkpatrick** in May 1970, **Mr. Farmer** became the assistant athletic director and assumed some of the business management

responsibilities previously performed by **Mr** Kirkpatrick. These were the persons in **WSU/PEC** who entered into the several agreements with **Golden Eagle**, and other organizations before them, for the transportation of **WSU** athletic teens. They were the only officials having direct contact with **Golden Eagle** officers. **Mr** Katzemeyer and **Mr** Farmer were among the passengers who did not survive the crash of **N454M**.

According to **Dr.** Clark D. Ahlberg, President of **WSU**, the details of the contracts entered into with **Golden Eagle** by **Mr.** Kirkpatrick and **Mr.** Katzemeyer were not discussed with him or other officers of **WSU**. He testified that his understanding of the arrangements with **Golden Eagle**, based upon brief discussions with **Mr** Katzemeyer, was that **WSU/PEC** had entered into an arrangement with an organization that provided airplanes and pilots for a fee to perform certain services, and that the organization operated and owned the aircraft. Prior to the accident, he had never heard of the **Jack Richards Aircraft Company**. He stated that **Mr.** Katzemeyer could execute contracts for services to the **WSU/PEC**, but did not have any authority to sign for or bind **WSU** to any contract. He advised that prior to the 1969 season, when an agreement was entered into between **WSU/PEC** and **Four Winds, Inc.**, that **Mr** Katzemeyer had informed him of difficulties in arranging a satisfactory contract with a scheduled air carrier for charter services. The difficulties related to commitments to cover all games, and the inability to schedule departures that would permit the team to practice prior to a game. He was not aware of any dissatisfaction with the subsequent agreements entered into with **Four Winds, Inc.**

Following the accident, the records of **WSU/PEC** were examined, and several pieces of correspondence between **Messrs.** Katzemeyer, Kirkpatrick, Farmer, and **Golden Eagle** were found. Two copies of a lease between **Jack Richards Aircraft Company** and **WSU** for a trip to **College Station, Texas**, were in the records. These lease agreements did not specify any payment for the use of the aircraft. There were no other lease agreements located. **Dr.** Ahlberg testified that following the accident he talked with personnel in the **WSU/PEC** offices and stated, "It is my assumption, and the assumption of others here at the University that **Mr.** Katzemeyer was simply agreeing to accept planes which **Mr** Richards' company would furnish **Golden Eagle Aviation, Inc.**, as they were unable to supply their own aircraft at the time." With respect to that statement, **Dr.** Ahlberg testified, "Well, since the accident occurred, I have talked with **Mrs** **Hammon** and other people who made trips, and discovered that there was a good deal of displeasure on the part of **Mr.** Katzemeyer and **Mr.** Fanner that the **DC-6** which they thought they had contracted for was not available, and that the team had to travel in two planes rather than one. I had not been aware of that until after the accident. Looking at

a contract which carried no provision for payments to **Mr. Richards**, it is hard for me to believe that, **Mr. Katzenmeyer** was doing anything more than agreeing to accept these two Martins instead of a DC-6. I could not prove that, but that would be my assumption, knowing **Mr. Katzemeyer**."

Mrs. Dorothy Harmon was the executive secretary of the WSU/PEC when bids were requested for the transportation of the WSU football team for the 1970 season. She sent identical letters to several airlines, Four Winds Travel Club, Golden Eagle, and others. On the basis of the bids received, the contract for charter services for the original five "away games" was awarded to Golden Eagle. She testified that she had never seen a copy of any Federal Aviation Regulation in the offices of WSU/PEC.

d. Additional Information

1. A search of the long-distance telephone calls from the Wichita State University, or charged to the WSU/PEC credit card held by **Mr. Katzemeyer**, did not disclose any telephone calls to the Jack Richards Aircraft Company or to **Mr. Richards**' home phone.

Mr. Katzemeyer A search of the offices occupied by **Mr. Kirkpatrick** and **Mr. Katzemeyer** did not locate a copy of any Federal Aviation Regulation.

3. **Mr. John Kennedy** and **Mr. Bruce Danielson** were crewmembers on the DC-6 leased to WSU/PEC by Four Winds, Inc., for the 1969 football season. In the course of this activity they became well acquainted with **Mr. Katzemeyer**.

Mr. John Kennedy was put in contact with Four Winds, Inc., by **Mr. Jack Richards**, who recommended him as a pilot, well qualified on the DC-6.

2 ANALYSIS AND CONCLUSIONS

2.1 Analysis

Examination of the wreckage disclosed no evidence of mechanical failure of the airframe or the aircraft control systems. Although ground fire destruction precluded examination of some of the aircraft components, it is noted that both pilots appeared to be satisfied with the aircraft's performance until after the right turn was executed by First Officer Skipper. The only concern in the cockpit, according to **Mr. Skipper** and to the passenger standing behind the crew until seconds before impact, was the elevation of the terrain ahead.

Most ground witnesses and the surviving passengers thought that the engines were operating normally. However, two witnesses described a backfiring sound from the aircraft. In considering their testimony, the Safety Board notes that one witness who reported the backfiring was situated in Georgetown. Five other witnesses in the same location, including the father of the witness in question, and a pilot employed as a flight engineer by a major airline, all stated that the engine sounds were normal.

The other witness, located 1-1/2 miles east of Dry Gulch, stated that the backfiring sound was so loud that passengers in the aircraft definitely should have been able to hear it. However, none of the surviving passengers recalled anything unusual about the operation of the engines. This witness also testified that as the aircraft proceeded away from his position, he observed the entire aircraft fuselage was dark green and the markings "4" and "M" were visible on the fuselage directly forward of the tail section. Registration numbers on small aircraft are painted on the fuselage in the position described by this witness. However, they are seldom found in that location on airline aircraft. On N464M, the registration numbers were located on the vertical stabilizer, not on the fuselage, and would be nearly unreadable from behind the aircraft at the angular bearing described by the witness. So far as the fuselage is concerned, the top was painted white, there was a green stripe in the center, and the bottom was unpainted. The Board concludes, therefore, that this witness also may have been mistaken in the source of the sounds he heard, and that the backfiring may have come from large trucks or road construction machinery that was being operated in the vicinity.

while some witnesses reported a small amount of black smoke coming from the right, engine, those familiar with large aircraft did not consider it excessive, and most described it as similar to a "rich" mixture but not of any great concern. The fact that a rich mixture existed on take-off at Denver was acknowledged by the crew. However, there is no evidence that the rich mixture condition seriously affected the engine performance. Examination disclosed that on both propellers, the blades were off the low-pitch stops, indicating that both engines were turning and producing power at impact.

The vibration of the aircraft described by First Officer Skipper and the survivors occurred concurrent with the attempt to execute a 180° reversal, of course. The severest vibration occurred during the left bank, described by surviving passengers as "very, very steep" and "awful sharp." One of them stated that the bank was reduced greatly just before the aircraft struck the trees. The swath cut through the trees indicated a bank angle of 31°. Ground witnesses located on U. S. Highway 6, only a few hundred feet from where the aircraft crossed the road in front of them, stated that the entire top of both wings and

aircraft fuselage was visible to them. At an altitude of 11,000 feet m.s.l., with a left turn initiated just before the aircraft starts to cross U. S. Highway 6 (see Appendix G), a bank in excess of 60° will be required for terrain avoidance at an indicated airspeed of 140 knots. If an attempt is made to maintain altitude and power is ~~not~~ increased, the airspeed will decrease. In a 60° bank, with flaps extended 12.5°, prestall buffet will be encountered at 134 knots calibrated airspeed, and the aircraft will be stalled at 128 knots. If flaps are not extended, the stall speed would be approximately 137 knots. Accordingly, the Board believes that the vibration was the result of abrupt maneuvers and a steep bank which induced prestall buffet, and was not the result of malfunction of the aircraft, aircraft engines, or control systems. The 12.5° flap setting found on the aircraft could have been selected by Captain Crocker to reduce the stall speed. It is also possible that they may have been extended previously to improve maneuvering stability in the valley.

In considering the operational factors in this accident, the lack of adequate flight planning for the alternate route segment from Denver to Logan is immediately apparent. Mr. Skipper testified that at the start of the trip, he had in his possession a flight plan prepared by the first officer of the other crew. This flight plan called for a northbound departure from Denver, on established airways, via Laramie, Wyoming. This route parallels the mountain ranges and offers ample time to climb to a safe altitude before turning westward over the mountains. The distance over this route is virtually the same as it is over the "scenic route" flown by Mr. Skipper. The change in routing, therefore, was purely for sightseeing purposes. Mr. Skipper several times testified that Captain Crocker was the pilot-in-command of the trip and that it was Captain Crocker who made the decisions relating to the flight. However, with respect to the route between Denver and Logan, Mr. Skipper also testified that after the flight departed from Wichita, it was he who made the decision to purchase charts at Denver to be used in pointing out landmarks and points of scenic interest to the passengers. Accordingly, while Captain Crocker may have been distinguished as the pilot-in-command by virtue of the fact that he held a type rating on the aircraft and Mr. Skipper did not, it is the Board's opinion that Mr. Skipper, in his capacity as president of Golden Eagle, was in fact the person who decided the route to be traveled.

The manner in which the route from Denver was flown is worthy of comment.

All ground witnesses describe the aircraft as being extremely low over the mountainous terrain, and many described engine sounds as being similar to cruising power rather than to climb power. From Idaho Springs to the point of crash, the aircraft was continuously below the mountain-tops. Operation at such a low altitude could have been for sightseeing

purposes only, since the aircraft was capable of climbing at a much greater rate than was actually accomplished. By best estimates, the total time from departure at Denver to the time of crash was 25 to 30 minutes.

In one-half that time, the aircraft was capable of reaching an altitude of 15,000 feet m.s.l., or more, if maximum continuous power had been used. 14/ In the event that the crew did not wish to use any setting higher than the regular en route climb parer that Mr Skipper testified he was maintaining, a climb maneuver could have been executed which would have produced a safe altitude before the flight proceeded westbound toward the Continental Divide. Either procedure not only would have resulted in ample clearance over the mountain ranges along the flightpath, but would have provided the capability to reach a safe landing place in the event of an engine failure.

Mr Skipper, by his own testimony, was aware of the "drift down" 15/ safety practice employed by airlines and most operators of large aircraft when operating over mountainous terrain. Notwithstanding, he flew the aircraft in the mountain valley below the mountaintops at an altitude higher than the aircraft was capable of maintaining in the event of an engine failure.

It must also be presumed that neither Mr Skipper nor Captain Crocker spent any time examining the charts for the route to be flown, since Mr Skipper did not return to the aircraft after he purchased them until approximately 15 minutes before takeoff and, at that time, engaged in conversation with the passengers. If the charts had been studied, the pilots could have known that the minimum altitude necessary to clear Loveland Pass at the end of Clear Creek Valley, was 12,000 feet m.s.l. Mr Skipper was flying the aircraft at reduced power at approximately 11,000 feet m.s.l. when the flight reached Dry Gulch and the crew first discovered that Clear Creek Valley was ending in what has been described as a "box canyon."

The altitude of the aircraft as it passed over Georgetown was approximately 9,800 feet m.s.l., based upon witness observations and measurements made therefrom. At this point, the aircraft was approximately 1,200 feet above the valley floor. At the 140 knots indicated airspeed testified to by Mr. Skipper, the aircraft would have been capable

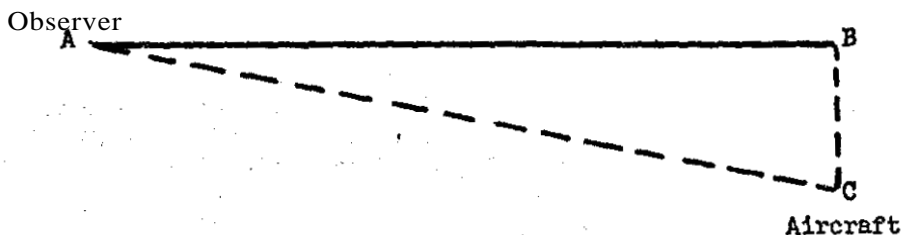
14/ See Appendix D.

15/ "Drift down" relates to the planning of a flight at an altitude sufficiently high so that in the event of engine failure, the excess altitude can be used to provide clearance over terrain ahead as the aircraft proceeds to a suitable landing area in descending flight.

of a climb of approximately 240 feet per mile at maximum continuous power, or an altitude of approximately 12,000 feet at Dry Gulch. Mr. Skipper testified, however, that lesser power was used throughout the climb, which would result in the aircraft's being at a lower altitude at Dry Gulch. In this regard, calculations using the angular bearings taken from observation points of two witnesses who observed the crash serve to establish a reasonably precise altitude, as follows:

- (1) Two witnesses who observed the aircraft from above at Loveland Pass provided a sight line with a depression angle of $4-1/4^\circ$ as measured by an Abney level. The aircraft was first observed when it was east of Dry Gulch. The distance was approximately 12,000 feet.

Diagrammatically:



Angle A = $4-1/4^\circ$
Line AC = 12,000

$$\text{TAN } A = \frac{BC}{AB}, \quad \text{or} \quad .0745 = \frac{BC}{12,000}, \quad \text{or}$$

$$BC = 894 \text{ feet}$$

$$\begin{array}{r} \text{Elevation of Observer} \\ \text{Elevation of Aircraft} \end{array} \quad \begin{array}{r} = 11,900 \text{ feet} \\ - 894 \text{ feet} \\ \hline 11,006 \text{ feet} \end{array}$$

- (a) Another witness, located on U. S. Highway 6 approximately 5,000 feet from Dry Gulch observed the aircraft opposite Dry Gulch at an upward angle of $4-1/2^\circ$,

By his observations:

Angle A = $4-1/2^\circ$
Line AB 5,000 feet

$$\text{TAN A} = \frac{\text{BC}}{\text{AE}} \quad \text{or} \quad .0787 = \frac{\text{BC}}{5,000} \quad \text{or,}$$

$$\text{BC} = 394 \text{ feet}$$

$$\begin{array}{r} \text{Elevation of Observer} = 10,650 \text{ feet} \\ \text{Elevation of Aircraft} = \underline{+ 394 \text{ feet}} \\ \hline 11,044 \text{ feet} \end{array}$$

(3) Two other witnesses, located almost opposite the crash site at an elevation of 10,600 feet, estimated the height of the aircraft as 100 feet above them as it turned across U. S. Highway 6.

(4) Another witness, a pilot, stated that when the aircraft was 2 miles east of Dry Gulch, it was below the level of the mountains on either side of the valley. In his opinion, the aircraft could not have turned around, nor could it have climbed over the rising terrain ahead.

Based upon the foregoing evidence and computations, the Board concludes that N464M was at, or very near, an altitude of 11,000 feet m.s.l. when the reversal turn at Dry Gulch was attempted.

With respect to the ability of the aircraft to climb over the mountains ahead, a review of the performance data (Appendix D) shows that if maximum continuous power had been applied when the aircraft was at Dry Gulch, a climb gradient of 4.57 percent could have been achieved. This translates into a climb capability of 240 feet per each mile traversed. Since the distance from Dry Gulch to Loveland Pass was only 2 miles, and the distance to the other lowest point (12,517 feet m.s.l.) on the Continental Divide ahead was approximately 3 miles, it would have been impossible for the aircraft to clear the terrain ahead. (See Appendix I.)

Concerning the aircraft's ability to execute a reversal turn, reference to Appendix D indicates that at 140 knots indicated airspeed, a 60° bank will produce a turn radius of 1,400 feet. However, in a 60° bank, even at maximum continuous power, altitude would be lost at a rate of about 340 feet per minute.

At 130 knots, the turn radius in a 60° bank would be 1,300 feet. However, this would require the aircraft to be operated constantly at only 2 knots above stall speed, and well into the stall buffet range. Entry into the stall buffet boundary would result in an increase in the rate of sink because of the drag induced by flow separation.

Even if the pilot had possessed sufficient skill to operate the aircraft within such extremely small tolerances, there would not have

been sufficient space available to execute the turn. At the 11,000-foot contour, the valley width at ground level is about 3,000 feet in the area immediately beyond Dry Gulch. At the 10,800-foot contour, the valley width at ground level is only 2,400 feet. Trees extending upward from the ground would reduce the available turning space at the 10,900-foot level also to 2,400 feet. Accordingly, the Board concludes that once the aircraft had reached the Dry Gulch area, it was no longer possible to have executed a course reversal. If the crew had been concerned about the aircraft's ability to clear the terrain ahead less than 1 minute sooner, when the aircraft was still 1-1/2 to 2 miles east of Dry Gulch, a successful turnaround could have been executed with use of maximum continuous power and a bank angle of only 33". However, at that point on the flightpath, the crew would have been unable to see that the valley ended at Loveland Pass, and thus they proceeded into an area from which an escape was not possible.

At the point where First Officer Skipper executed the right turn toward **by** Gulch, Captain Crocker could not be sure of Skipper's intentions since there had been no discussion in the cockpit concerning any specific procedure. The only conversation overheard by the survivor, standing immediately behind the crew, was a discussion of the height of one of the mountains. It is likely therefore that Captain Crocker may have believed that First Officer Skipper's intention was to fly up Dry **Gulch**

Since he had a good view of Dry Gulch out of his window, he could see that its floor extended only a few thousand feet before rising rapidly toward the Continental Divide. Also, on completion of the turn, the aircraft was proceeding toward the rising ground of Mount Trelease. Any decision that was to be made, had to be made immediately. It is likely, therefore, that this is what induced Captain Crocker to take over the controls. The steep left bank was, then necessary to avoid the mountain. In the process, the aircraft was stalled, resulting in a loss of altitude, and contact with the trees.

Since resistance of modern aircraft structure to abrupt deceleration is generally assumed to be equal to or less than the resistance or tolerance of humans to such deceleration, 16/ the post-impact conditions of aircraft structure can therefore be applied as a practical means to establish survivability of an accident. The apparent intactness of the passenger cabin in this accident indicates such a survivable condition. However, two other criteria must be met to insure survival: (1) the occupant becomes involved in the deceleration of his environment and (2) immediate access to a means of escape.

16/ Preston G and Pesman G., "Accelerations in Transport Airplane Crashes," NACA Technical Note 4158. Eiband, A., "Human Tolerance to Rapidly Applied Accelerations" NACA Memo 5-19-59E, June 1959.

According to rescuers, the seats in this aircraft were pushed together in the forward section of the aircraft, indicating that failure of seat tiedowns occurred at some point during the crash sequence. Depending on the failure mode and the moment of failure in the crash sequence, such seat failures may make the difference in the survival or non-survival of occupants in an otherwise totally survivable accident.

The seat, as the occupant's supporting structure, the restraint system in the form of a seatbelt and the underlying floor structure and seat anchorages are the media through which the occupant becomes involved in the deceleration of the total aircraft structure. Failure of any one of these will allow the occupant to accelerate in relation to his environment and strike objects or structure with a force exceeding the overall crash deceleration.

Although the peak magnitude and duration of the main crash force cannot be calculated with any degree of accuracy, the forces were considered to be fairly moderate in view of the intactness of the fuselage, the low velocity with which the aircraft struck the ground and the fact that many occupants survived the Impact. Additionally, the fact that all but one of the survivors who escaped did not have their seatbelt fastened attests to the low velocity at Impact as well as the fact that a lateral force vector prevented them from gaining momentum within the confines of the fuselage.

It is reasonable to assume that more occupants than just those who escaped had their seatbelt unfastened. The ones who escaped were fortunate to remain conscious while others did not or were too stunned to effect their escape. The failure of many occupants to evacuate must nevertheless be directly attributed to the seat failures as being the major injury producer. Indeed, the passengers' not being tied down may have been, in itself, a major triggering force in the seat failures, since passengers as "missiles" can induce failing loads on seats ahead of them.

This accident shows once more that passengers can receive needless injuries inside intact fuselage structure. The Board is aware that the present design "G" levels for transport aircraft seats and their testing criteria have been improved since the original design of the Martin 404. Hence, without continued concern for this problem, needless loss of life can result.

Finally, with regard to the problem in this accident concerning the identification of the operator who had the responsibility for compliance with the regulations applicable to the flight, it is obvious that there was classic disagreement among the parties involved in the flight. As

previously stated in this report, it was the position of the FAA that Golden Eagle Aviation, Inc., was the operator. Both Jack Richards Aircraft Company and Golden Eagle Aviation, Inc., contend that Wichita State University was the operator. It is the position of Wichita State University that they were not the operator but had been merely chartering air service. This question will be fully resolved in a proceeding separate and apart from this accident inquiry and for the purpose of this report the Board does not believe it necessary to resolve this conflict. For present purposes, it is sufficient to conclude from the post accident denial of the parties that they were the operator with the responsibility for the safe conduct of this flight, that they did not acknowledge such responsibility at the time of the flight.

It is the view of the Board that the numerous deficiencies, unsafe practices, and deviations from regulations, involved in this operation, are typical of operations where none of the participants acknowledge responsibility for the safe conduct of a flight. As this Board stated in a prior accident report, "It is not unusual that such operations are characterized by safety problems such as those found to be present in this operation." ^{17/} The Board believes that the management required for a safe operation appears to have been absent and was a significant factor in this accident.

2.2 Conclusions

(a) Findings

1. There was no failure or malfunction of the aircraft, powerplants, or control systems.
2. The crew was properly certificated for the flight.
3. There was a current airworthiness certificate in the aircraft and an annual inspection had been performed.
4. The aircraft was 5,190 pounds over the maximum permissible takeoff weight at Denver, and 2,665 pounds over the maximum certificated takeoff weight at impact.
5. The original flight plan was altered to provide a "scenic route" for sightseeing purposes.
6. The aircraft was operated over Clear Creek Valley at an altitude always below the mountaintops.

^{17/} Aircraft Accident Report - Douglas DC-3, N142D, New Orleans International Airport, New Orleans, Louisiana, March 20, 1969.

7. After the flight reached the Dry Gulch area, it was no longer possible for the aircraft either to climb over the terrain ahead, or to execute a course reversal.
8. None of the participants in this flight, the owner of the aircraft, lessee, or the company providing the crew and other services acknowledged that they were the operator and accepted responsibility for the safety of such flight.

(b) Probable Cause

The Board determines that the probable cause of this accident was the intentional operation of the aircraft over a mountain valley route at an altitude from which the aircraft could neither climb over the obstructing terrain ahead, nor execute a successful course reversal. Significant factors were the overloaded condition of the aircraft, the virtual absence of flight planning for the chosen route of flight from Denver to Logan, a lack of understanding on the part of the crew of the performance capabilities and limitations of the aircraft, and the lack of operational management to monitor and appropriately control the actions of the flightcrew.

3. RECOMMENDATIONS

The testimony given during the public hearing held in connection with this accident indicated a widespread misunderstanding by educational institution and business concern personnel of the problems and regulations involved in the operation of large aircraft, or the responsibilities of lessees of an aircraft. Accordingly, on November 9, 1970, the Board issued a Safety Information release recommending that potential users of large aircraft on a short-term charter basis, question providers of such services as to the type of operations for which they have been certificated. Should there be any doubt as to the proper certification, such users should consult the nearest FAA office for advice. A copy of this release is included in this report as Appendix F.

As noted in this release the Safety Board is aware of the investigation into all charter operations as ordered by Secretary of Transportation Volpe. The Board is in accord with the need for such an investigation, and is hopeful that the results will establish safe practices in all charter or leasing activities.

Concerning the suggested regulatory changes contained in FAA's Notice of Proposed Rule Making 70-41, the Board is in complete agreement with the conclusion in the notice that there is a need for regulatory action in that area. Accordingly, the Safety Board has forwarded comments on the proposal to FAA Administrator Shaffer. These comments are contained in Appendix J to this report.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

December 24, 1970

INVESTIGATION AND HEARING

1. Investigation

The National Transportation Safety Board received notification of the accident about 1330, on October 2, 1970. An investigating team departed from Washington, D. C. at 1930 that evening and arrived at the crash site the following morning. Working groups were established for operations and witnesses, structures and systems, powerplants, and human factors. Parties to the investigation were Golden Eagle Aviation, Inc., Wichita State University, the Federal Aviation Administration, the Rocky Mountain Rescue Group, and the Alpine Rescue Team. There were no assignments to the working groups from the Jack Richards Aircraft Company, since no representatives appeared at the scene.

The on-scene phase of the investigation lasted six days.

2. Hearing

A public hearing was convened October 21, 1970, in Wichita, Kansas, and lasted 3 days.

3. Preliminary Reports

A preliminary report of this accident was not issued.

CREW INFORMATION

Captain Danny E. Crocker, aged 27, possessed airline transport pilot certificate No. 1625375, with ratings for airplane multiengine land, DC-3, DC-6/7, and commercial privileges for M-202/404 and airplane single-engine land. He also held a flight instructor certificate for airplanes and instruments which expired April 30, 1969, and a mechanic certificate No. 2014532, with airframe and powerplant ratings. His FAA first-class medical certificate was issued on August 21, 1970, with no limitations. The last entry in his logbook is for the WSU trip to Amarillo and return, on September 27, 1970, but there are no flight times listed for that or any subsequent flights. Prior to that time, he had accumulated approximately 2,452 total flying hours, of which 123 hours were in the Martin 404.

Captain Crocker received an M-404 type rating for his commercial pilot certificate on April 4, 1969. At that time, he had 11 hours and 40 minutes in the aircraft. Since that time, he had accumulated 111 additional hours, of which 8 hours and 45 minutes were in the last 30 days prior to making any WSU trips,

First Officer Ronald G. Skipper, age 35, possessed airline transport pilot certificate No. 1429879, with ratings for airplane multiengine land, E-3, and commercial privileges for airplane single-engine land. He also held a flight instructor certificate for airplanes and instruments which expired January 31, 1969. His FAA first-class medical certificate was issued on July 27, 1970, with the limitation, "Holder shall wear correcting glasses while exercising the privileges of his airman certificate." He had accumulated approximately 4,500 total flying hours, of which approximately 30 hours were in the M-404.

Stewardess Judith K. Lane, aged 28, completed a 19-hour training program on September 1, 1970. She had no prior aviation background.

APPENDIX C

WEIGHT AND BALANCE DATA N464M

The supervision and actual loading of N464M was not observed by the first officer, nor did he have any knowledge of the weight and balance computations for any of the three legs flown. He stated that the captain had presumably computed the weight and balance on each leg. In response to the checklist challenge for weight and balance, he had simply acknowledged that they were checked. The first officer had determined the V₁ and V₂ speeds from the placard in the aircraft by using takeoff weights given to him by the captain, but he could not remember what the figures were.

The takeoff gross weight of N464M was computed early in the investigation based on preliminary information. This weight, 48,165.1 pounds, is subject to certain variables, some of which are reasonably evident and others which are more obscure. For example, an inspection of the baggage on N470M revealed that there were 27 player bags, rather than 22 as listed for that aircraft. Presumably five player bags initially scheduled to be loaded on N464M were placed on N470M because of the random method of loading, as a conscious effort to equalize the two loads or by mistake. Another rather obvious omission is the personal luggage of the passengers. Testimony at the hearing indicated that the players carried minimal overnight equipment, but there were reports of handbags being carried by some of the other WSU personnel. Other variables, for which no specific resolution was sought because of their nebulous nature, include the quantities of ADI and anti-ice fluids, the actual weight of the catering materials, and even the individually listed weight of each player or passenger.

The maximum certificated gross weight for takeoff of a M-404 at Denver (5,330 feet m.s.l.) is approximately 43,000 pounds, using ADI.

The maximum allowable Landing weight at Logan (4,453 feet m.s.l.) is also 43,000 pounds. Based on these figures, N464M exceeded the takeoff weight limitation by approximately 5,165 pounds at Denver. Assuming a nominal fuel burnoff of 200 gallons/hour and an estimated time en route to Logan of 2 hours 20 minutes (reported by N470M), the landing weight would have been approximately 45,369 pounds. This weight would have exceeded the maximum landing weight for Logan by 2,369 pounds.

The center of gravity limits for N464M, expressed in inches from the datum point, 87 inches forward of the aircraft nose, are:

<u>Condition</u>	<u>Maximum Weight</u>	<u>Gear Position</u>	<u>C. G. Range</u>
Takeoff	44,900 pounds	Down	440.2 - 461.4
Takeoff and Landing	43,000 pounds	Down	439.2 - 461.4
Flight	All Weight	Up	432.6 - 461.4

The data required to establish the precise c.g. of the aircraft is not available. However, the seating of most passengers was well established, and again working within the framework of the basically reliable information available two computations were made. In the first instance, the 18

player bags and 100-pound weight trainer were assumed to be located in the aft cargo compartment mid-range. This weight was then assumed to be in the forwardmost cargo compartment. The computed center of gravity for each condition respectively was 462.95 and 458.95 inches from datum

WEIGHT AND BALANCE DATA N464M

Basic Empty Weight		31,486.5
Captain Crocker	170 lbs.	
F/O Skipper	165	
Stewardess Lane	120	
Baggage (3 @ 15 lbs.)	<u>45</u> 500 lbs.	500.0
Oil (44 gal. @ 7.5 lbs.)	330	
ADI (12 gal. @ 7.8 lbs.)	93.6	
Anti-Ice (15 gal. @ 7.2 lbs.)	<u>108</u> 531.6	531.6
Fuel (1,370 gal. @ 6 lbs.)		8,220.0
WSU Passengers and Baggage		7,307.0
Passenger Dunn and Baggage		<u>120.0</u>
Takeoff Gross Weight		48,165.1

Martin 404 Performance Information1. General Information

Stapleton Field, Denver, Colo.

Elevation: 5,300 feet.

Takeoff Runway: No. 35; 11,500 feet long.

Atmosphere: FAT 71° F.; wind 030 @ 6 knots; dew point 30° F.

Crash Site

Elevation: 11,000 feet m.s.l.

Ambient Temp.: 50° F.

Standard Temp.: 20° F.

Density Alt.: 12,900 feet m.s.l.

Airplane

Gross weight at takeoff at Denver: 48,165 lbs.

Gross weight at impact: 47,565 lbs.

Wing flap position at impact: 12.5° (Takeoff & SE En route)

Lateral attitude at impact: 31 - degree left bank

Power conditions at impact: 2,400 r.p.m., 165 bmap (1,400 HHP)

2. Maximum Permissible Takeoff & Landing Weights for Field Elevation of 5,300 ft.

	<u>WET</u>	<u>DRY</u>
Max. Takeoff Wt.:	42,975 lbs.	39,500 lbs.
Max. Landing Wt.:	42,500 lbs.	37,975 lbs.

3. Estimated Single-Engine (SE) Takeoff Climb Performance in feet per minute (f.p.m.) at 48,165 lbs., 5300 ft. altitude. V₂ speed. 12.5° flap, International Standard Atmosphere (ISA)

Gear Down:	5 f.p.m.	• 135 f.p.m.
Gear Up :	+ 255 f.p.m.	+ 140 f.p.m.

4. Estimated En Route Climb Performance at 47,565 lbs., 11,000 ft. altitude, Scheduled Wing Flap & Airspeed, ISA, Straight & Turning Flight

	Flap Position	Calibrated Airspeed (CAS) mph/kts					
			0°	15°	30°	45°	60°
All-Engine:		163/141	+ 890	+ 860	+ 760	+ 515	- 240
Single-Engine:	12.5°	142/124	- 40	-	-	-	-

5. Estimated All-Engine En Route Climb Gradient at 47,565 lbs., 11,000 ft. Altitude, 141 kts. CAS, Flaps Up.

<u>Free Air Temperature (FAT)</u>	<u>Rate of Climb</u>	<u>Gradient</u>
20° F. (ISA):	+ 890 f.p.m.	0.0525 (i.e., 5.25%)
50° F. (ISA + 30):	+ 798 f.p.m.	0.0457 (i.e., 4.57%)

6. Estimated Power-Off Stalling Speed at 47,565 lbs., and Various Bank Angles; CAS mph/kts.

<u>Bank Angle</u>	<u>0°</u>	<u>15°</u>	<u>30°</u>	<u>45°</u>	<u>60°</u>
Flaps 0°:	115/100	117/102	124/107	137/119	163/141
Flaps 12.5°:	104/91	106/92	112/98	124/108	148/128

7. Radius of Turn (feet) at Various Bank Angles & Airspeeds (CAS) at 11,000 ft. Altitude & 50° F. Temperature. Flaps 12.5°

<u>Airspeed</u>		<u>15°</u>	<u>30°</u>	<u>45°</u>	<u>60°</u>
<u>M.p.h</u>	<u>Kts.</u>				
115	100	4,930	2,280	(s)	(s)
127	110	5,930	2,760	1,600	(s)
138	120	7,130	3,310	1,910	(s)
150	130	8,360	3,910	2,240	1,300
161	140	9,600	4,490	2,580	1,490
173	150	11,050	5,140	2,970	1,718
184	160	12,600	5,900	3,400	1,970

NOTE: (s) designates a stalled condition

AVIATION SERVICES AGREEMENT

THIS AGREEMENT, made this July 21 day of 1970,
1970, between Golden Eagle Aviation, Inc., a corporation, hereinafter
referred to as "Contractor", and Wichita State University, hereinafter
referred to as "Customer";

WITNESSETH;

WHEREAS, Customer has leased (*or*, prior to the commencement of
the services provided for herein, will have leased), from a third
party, the following described aircraft:

ONE DOUGLAS: DC-6B

hereinafter referred to as "the Aircraft"; and

WHEREAS, Customer desires to have Contractor provide, with
respect to the Aircraft, the services specified below, upon the terms
and conditions hereinafter set forth, and Contractor is willing so
to do;

NOW, THEREFORE, Customer and Contractor do hereby agree as
follows:

1. SERVICES: Contractor shall provide the following services
for the Aircraft during the period of time commencing on September
11, 1970, and ending on November 14, 1970:

(a) A fully qualified flight crew to fly the Aircraft
to and from such points within the Continental United States
as Customer may direct (*or*, if an itinerary is attached hereto,

to fly the Aircraft in accordance with said itinerary), said

flight crew to consist of: Captain

First Officer

Flight Engineer

Two Cabin Attendants

(b) The following specified in-flight catering services
See attached schedule and itinerary titled "1970 - Football
Travel Plans".

(c) All fuel, oil and other fluids necessary for the
operation of the Aircraft pursuant to their Agreement.

(d) Routine maintenance on the Aircraft.

2. COMPENSATION: As consideration for Contractor's providing
the above specified services, Customer shall pay to Contractor a total
sum of \$ 24,338.60

3. PAYMENT: Customer shall pay to Contractor the sum of _____
\$12,194.30 upon signing this Aviation Service
Agreement, this sum to constitute an advance against the total of
\$24,388.30.

In addition, the Customer shall pay to the Contractor on
October 5, 1970, 1970 the sum of \$12,194.30
_____, this sum in addition to the advance to constitute pay-
ment in full of the Aviation Service Agreement.

4. CONTRACTORS PERSONNEL: Contractor's personnel engaged in
the performance of this Agreement shall for all purposes remain employees

of Contractor. All members of the flight crew shall be licensed and fully qualified in every respect to operate the Aircraft.

5. DELAYS OR CANCELLATIONS: Contractor shall not be responsible for delays or cancellations occasioned by labor disputes, weather, acts Of God, mechanical failure or any other factors beyond the control of Contractor.

6. INSURANCE: Customer, at its expense, shall provide for passenger ~~and~~ ^{ack B.M.} liability ^{ack B.M.} insurance with limits satisfactory and in accordance with the FAA and CAB regulations and shall furnish proof thereof to Contractor.

7. ENTIRE AGREEMENT: This Agreement, and any schedules or exhibits attached hereto, constitutes the entire agreement between Customer and Contractor and shall not be modified or amended except by writing signed by both parties.

8. COUNTERPARTS: This Contract may be executed in numerous counterparts, each such counterpart having the same effect as the original contract.

9. CHOICE OF LAW: This Contract shall be construed in all respects pursuant to the Laws of the State of Oklahoma.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement the day and year first above written.

ATTEST:

Thelma Farmer
Secretary

GOLDEN EAGLE AVIATION, INC.

By Bruce L. Dineen
Vice President

WICHITA STATE UNIVERSITY

By Bert Skatzenberger

NATIONAL TRANSPORTATION SAFETY BOARD



DEPARTMENT OF TRANSPORTATION
WASHINGTON, D.C.--20591

Safety Information

For Release:

SB 70-85
(202) 382-7273

Office of the Chairman

ADVANCE For

AM Newspapers
Monday, Nov. 9, 1970

The National Transportation Safety Board today issued a statement regarding its recent public hearing in Wichita, Kansas, which was held as part of its investigation seeking to determine the probable cause of the fatal accident involving a Martin 404 aircraft carrying the Wichita State University football team, that occurred on October 2, 1970, near Silver Plume, Colorado.

The testimony taken at the hearing indicates that the accident was operational in nature and that there were no mechanical failures or malfunctions affecting the performance of the aircraft. Further analysis of this testimony and other related evidence is required before conclusions can be drawn, the Board said.

The Board is now examining in detail the evidence relating to the performance capabilities of the aircraft, the flight planning by the pilots, particularly at departure from Denver and the control, or lack thereof, exercised by various organizations pertaining to safety of the operations.

The Board is aware of the use of large aircraft in passenger-carrying operations by individuals, corporations, and educational institutions which have leased aircraft on an individual trip basis in order to satisfy a requirement for infrequent, short duration air transportation. In certain instances, it would appear that the contractual relationships are designed to make the lessee the operator of the aircraft.

(over)

If the lessee does not possess the necessary knowledge of the Federal Aviation Regulations, he may, through these contractual arrangements, unknowingly become the operator of the aircraft, and thereby be obliged to assume responsibilities beyond his capability.

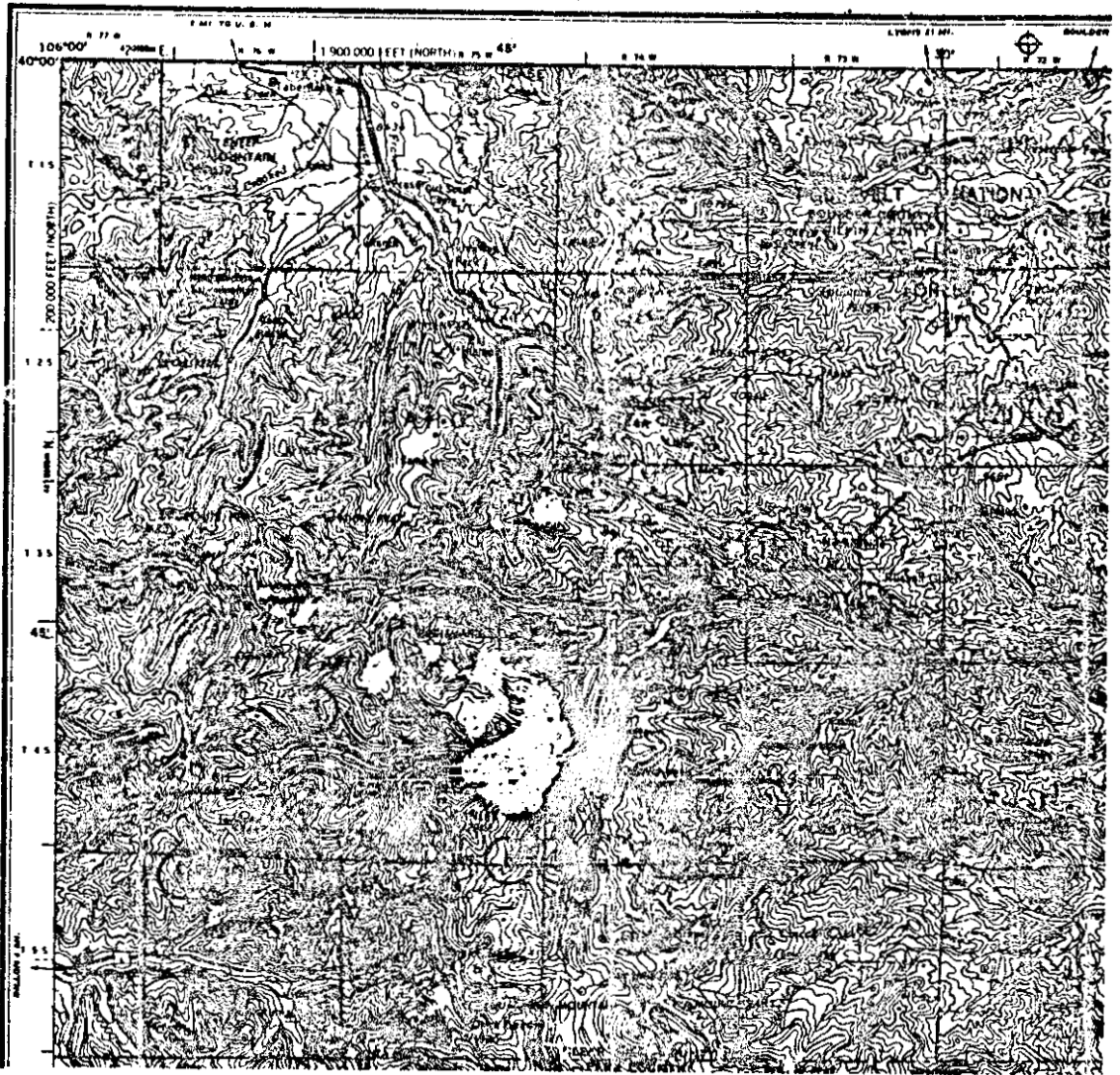
In view of the foregoing, the Safety Board has concluded that the regulations and procedures governing passenger operations of large aircraft should be thoroughly examined with a view in mind of making them more stringent and their applicability more understandable. The Safety Board is pleased to learn that the FAA has already taken action by publishing a Notice of Proposed Rulemaking which would expand the definition of a commercial operator, and which would make Part 123 of the Federal Aviation Regulations applicable to educational institutions engaged in the carriage by airplane of students or other persons affiliated with it.

The Board was also pleased to note that a thorough investigation of all aircraft charter operations has been ordered by the Secretary of Transportation, John A. Volpr, which we understand will not include those carriers regulated by the Civil Aeronautics Board, and that the FAA has taken steps to inform educational institutions of the aviation regulations incident to the operation of large aircraft. The Safety Board believes these actions are steps which will lead to safer operations.

However, the Board is concerned that many other potential users of large aircraft do not have knowledge of the existing Federal Aviation Regulations which have been designed to provide safety in air travel, or that they may not have ready access to competent advice concerning proper methods of securing charter services, aircraft rental, or leasing of aircraft. Accordingly, the Safety Board recommends that all potential users of large aircraft on a short-term charter basis question providers of such services as to the type of Operations for which they have been certificated by the FAA. If at all in doubt as to proper certification, such users should consult the nearest FAA office for advice. In so doing, they will be informed of the proper procedures to insure that the proposed flight can be accomplished with maximum safety.

The Safety Board said it would expedite the issuance of its final report on this tragic accident which would include a formal determination of probable cause and any appropriate recommendations that would help prevent such accidents in the future.

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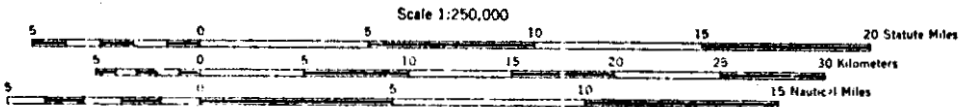


LEGEND

15 WITNESS LOCATION

— FLIGHT PATH AS DESCRIBED BY WITNESS

WITNESS GROUP CHART
APPENDIX G
SILVER PLUME, COLORADO
OCTOBER 2, 1970



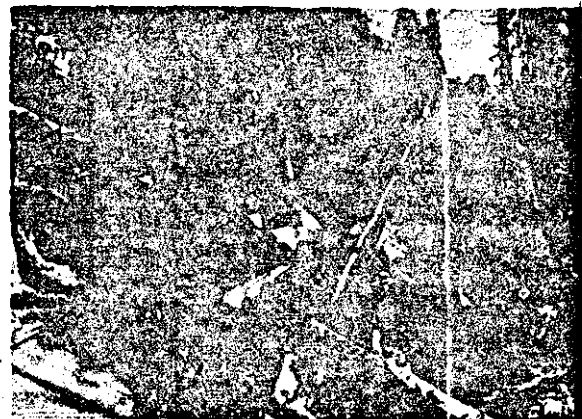
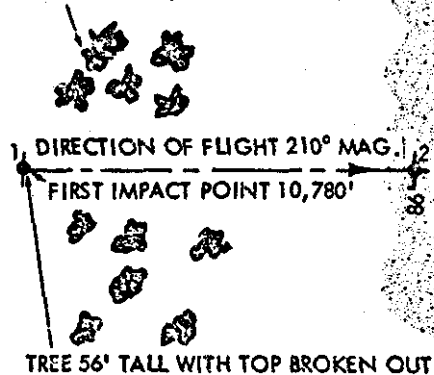
CONTOUR INTERVAL 200 FEET
WITH SUPPLEMENTARY CONTOURS AT 100 FOOT INTERVALS
TRANSVERSE MERCATOR PROJECTION

LEGEND ●

- 1) TREE 56' TALL WITH TOP BROKEN OUT
- 2) SHORT PIECE OF 4" DIA. LIMB WITH CLEAN DIAGONAL CUT
- 3) 14" PIECE OF TRIM TAB (ORIGIN UNKNOWN)
- 4) 20" PIECE OF TAB (ORIGIN UNKNOWN)
- 5) FLAP-SLAT
- 6) OUTBOARD HALF OF LEFT HORIZONTAL STABILIZER & ELEVATOR STABILIZER & ELEVATOR SEPARATED
- 7) PIECE OF 6" DIA. TREE ON GROUND CUT IN 14" LONG YELLOW MARKED SCARF
- 8) PORTION OF WING LEADING EDGE
- 9) 2'x4' PIECE OF WING SKIN AND 2'x2' PORTION OF CONTROL SURFACE (ORIGIN UNKNOWN)
- 10) PORTION OF FLAP ORIGIN UNKNOWN
- 11) FLAP-SLAT
- 12) MAIN LANDING GEAR DOOR
- 13) PORTION OF TIP OF PROP BLADE 12" LONG
- 14) GYRO PORTION OF FLUX GATE COMPASS
- 15) OUTBOARD 13 OF RIGHT STABILIZER & ELEVATOR
- 16) SMALL PIECE OF WING SKIN (ORIGIN UNKNOWN)
- 17) MANY SMALL ALUMINUM SCRAPS IN THIS GENERAL AREA (ORIGIN UNKNOWN)
- 18) MAIN LANDING GEAR DOOR, PORTION OF FLAP & ENGINE COWL (ORIGIN UNKNOWN)
- 19) 4'x6' SECTION OF WING WITH LANDING LIGHT ATTACHED (ORIGIN UNKNOWN)
- 20) RIGHT WING TIP
- 21) 3'x3' SECTION OF WING SKIN (ORIGIN UNKNOWN)
- 22) FUEL CELL DOOR WITH FUEL QUANTITY TRANS.
- 23) AUX CABIN PRESSURE REGULATOR
- 24) BLADE FROM PROP. "B"
- 25) PORTION OF TOP WING SKIN (ORIGIN UNKNOWN)
- 26) 2'x6' SECTION OF WING TRAILING EDGE
- 27) 6'x16' SECTION OF LOWER FUSELAGE SKIN CARGO COMP.
- 29) FUEL CELL DOOR
- 30) MAJOR PORTION OF AIRSTAIR DOOR
- 31) PROP. "A"
- 32) PORTION OF FLAP, FUEL CELL DOOR W/FUEL QUANTITY TRANS. GRND. SUPPORT AIRCOND. ACCESS DOOR
- 33) RCA RADAR ACCESSORY UNIT
- 34) FUEL CELL DOOR W/FUEL QUANTITY TRANS.
- 35) PORTION OF FLAP, FLAPHING UNIT, UNDERWING REFUEL PORT
- 36) SECTION OF ENGINE COWL FLAP
- 37) LANDING LIGHT, FUEL CELL DOOR UNDER WING REFUEL PORT SMALL SECTION OF WING SKIN
- 38) 2'x2' SECTION OF UPPER WING SKIN
- 39) TWO STEPS OF AIRSTAIR DOOR

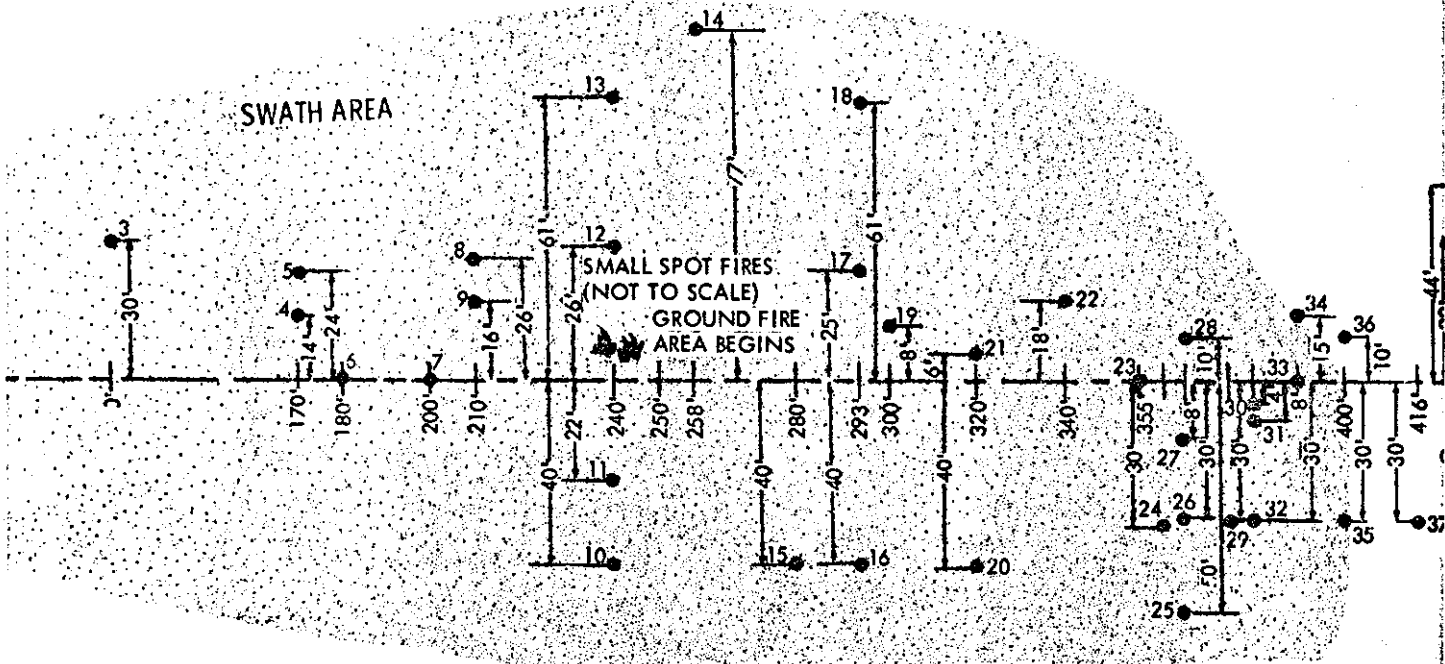


MANY TREES WITH TOPS
KNOCK OUT (NOT TO SCALE)

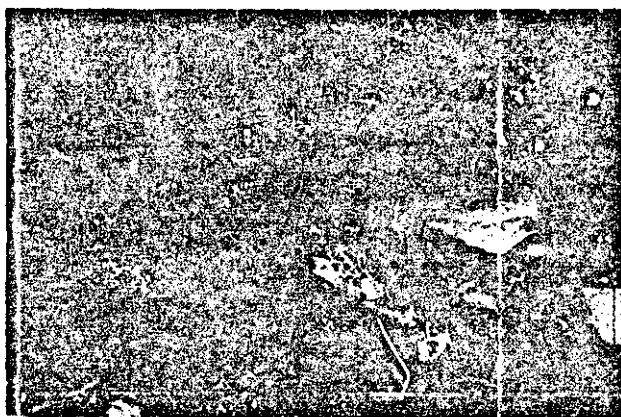


SWATH AREA

SMALL SPOT FIRES
(NOT TO SCALE)
GROUND FIRE
AREA BEGINS



SCALE



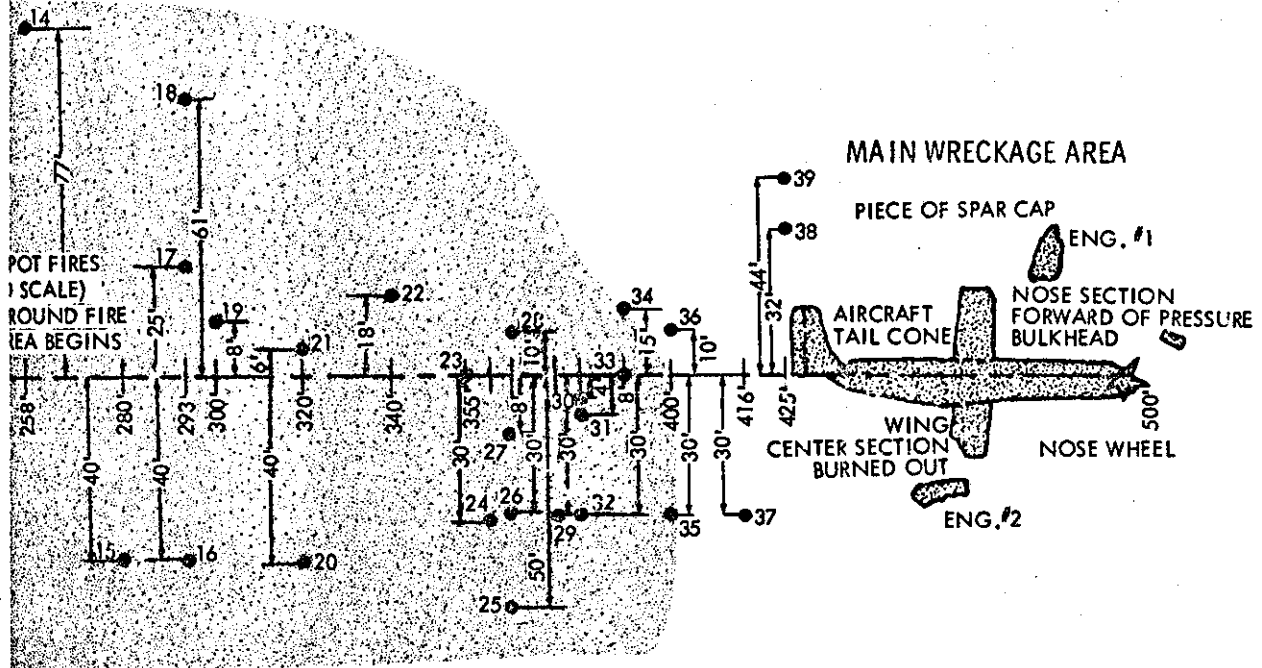
NATIONAL TRANSPORTA

Washingt

WRECKAGE DISTR
GOLDEN EAGLE AVIATION INC
NEAR SILVER PL
OCTOBER

B

APPENDIX H



LONGITUDE: 105°-52'-54"
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NATIONAL TRANSPORTATION SAFETY BOARD

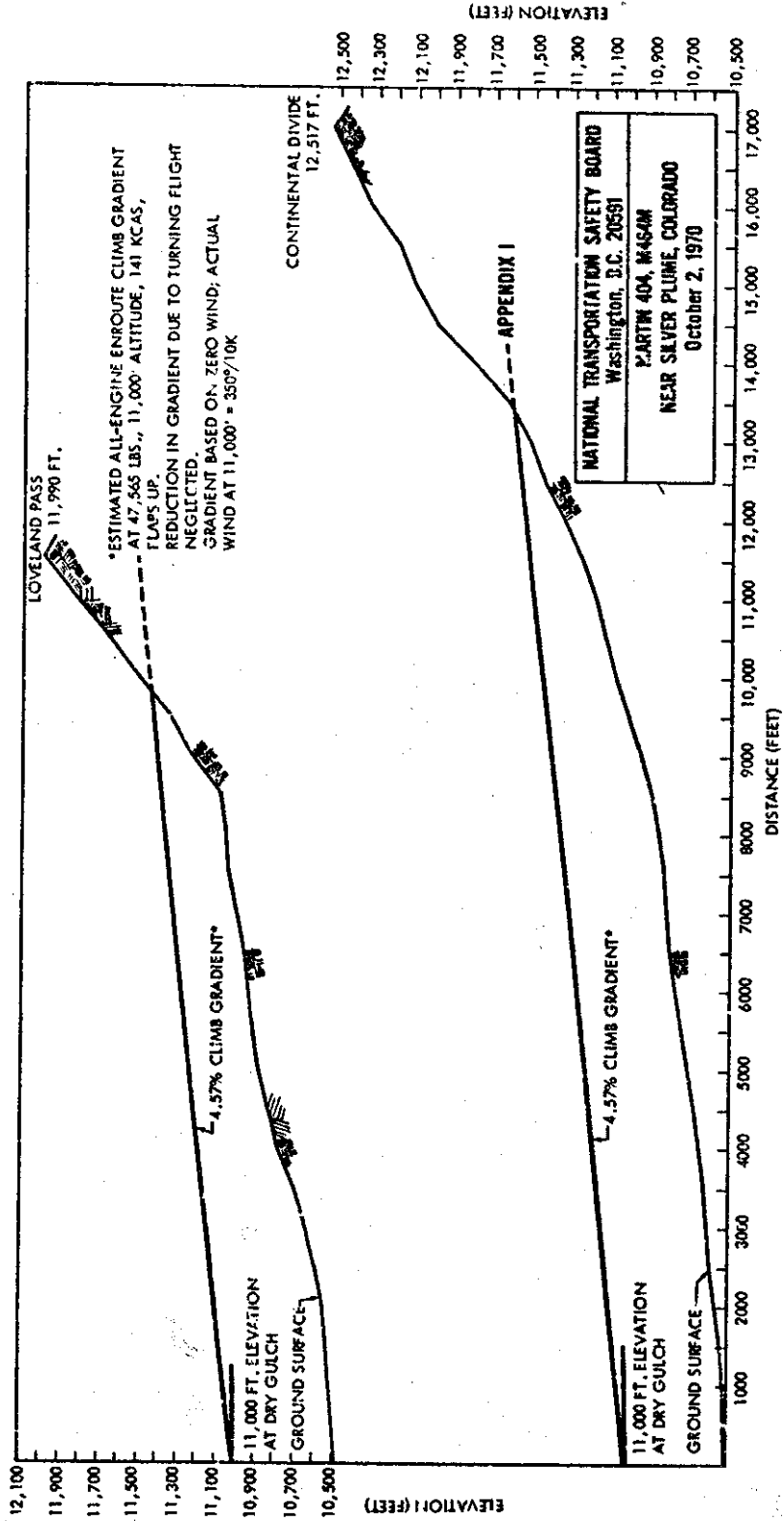
Washington, D.C.

WRECKAGE DISTRIBUTION CHART
 GOLDEN EAGLE AVIATION INCORP. MARTIN 404, N646M
 NEAR SILVER PLUME, COLORADO

OCTOBER 2, 1970



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NATIONAL TRANSPORTATION SAFETY BOARD
 Washington, D.C. 20561
 PART W 404, W445AM
 NEAR SILVER PLUME, COLORADO
 October 2, 1970

APPENDIX J



DEPARTMENT OF TRANSPORTATION
NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D. C. 20591

OFFICE OF
THE CHAIRMAN

Copy

December 28, 1970

Honorable John H. Shaffer
Administrator
Federal Aviation Administration
Washington, D. C. 20590

Dear Mr. Shaffer:

The National Transportation Safety Board has reviewed your NTFM 70-41 concerning aircraft operations conducted by commercial operators, educational institutions and other groups. We are in complete agreement with the conclusion expressed in your notice that there is a need for regulatory action in this area. This need was most recently highlighted by the facts discussed at our hearing on the accident which occurred at Silver Plume, Colorado, on October 2, 1970. However, on the basis of our consideration of this problem, and our review of your notice, we have a question as to whether the proposed amendment of Parts 1.1 and 123 of the Federal Aviation Regulations is a significant step in the solution of the problem.

The problem with the existing regulatory scheme appears to be the fact that it requires a determination as to the type of operation, "for compensation or hire," before one can identify the applicable operating rules. This is basically a legal determination and requires an expertise not present in those charged with the responsibility of surveillance. The enforcement of such a scheme inevitably results in time consuming investigations; a need for legal review; and often requires litigation in the Federal courts to obtain a resolution as to whether the operation was "for compensation or hire."

It is our view that NTFM 70-41 is a continuation of past approaches and may do little to resolve three difficulties. The amendment of Part 1.1 proposes to simplify the surveillance and enforcement problem by including in the definition of "commercial operators" three specific types

of operations. Each appears to be based on past experience with meat haulers, land companies, and Las Vegas hotels. We perceive the following problems in utilizing this approach;

1. It ignores other types of operations and cannot, of course, include new types of subterfuges not yet identified.
2. The proposed Rut 1.1(1) will still require legal interpretation and present the same problem found with the existing regulation.
3. while the proposed part 1.1(1) may have been primarily designed to bring the so-called meat hauler operations within the ambit of "comercial operators," it appears to be so broad that it would extend to the large portion of executive fleets engaged in transporting their owner's products. While such operations conducted in large aircraft may require higher operating requirements, we question whether there is a need for certificatisn of these operations.

With regard to the proposed amendment of Part 123, which would require certification of educational institutions, we question the logic in extending this part now applicable to travel clubs, which are established for the purpose of travel. Educational institutions and other groups generally have no intention of being the operator and are only seeking inexpensive charter transportation. The problem in this area is with those arrangements which result in the educational institutions unknowingly becoming the operator. To our knowledge, there has been no significant problem with institutions which acknowledge that they are the operator. We therefore, question the need for certification.

In light of the above, the Safety Board recommends that the notice be withdrawn or substantially modified. We recognize that this is a very complex problem which has plagued the FAA for many years and that past attempts to define "for compensation or hire," both by your agency and the courts, have not been too fruitful. The requirement of such a legal test as a basis for what operating rules are to be employed has resulted in an excessive expenditure of manpower for surveillance and prosecution, with these efforts always after the fact when safety has already been compromised.

In recognition of the complexity of this matter, we would therefore urge that, before an amendment of the rules, this matter be given further review by the FAA, including any comments recommended on this pending notice and recommendations developed by the Task Force presently studying this problem under the direction of the Assistant Secretary for Safety and Consumer Affairs.

While we doubt that there is any magic formula by which this problem can be fully solved, we believe certain alternatives should be again considered. We would suggest the following alternatives as deserving consideration:

1. Make M change in the regulation but undertake better surveillance and more vigorous enforcement of existing rules.
2. Retain the existing definition of "commercial operator," but include those types of operations which have been found, in the past, to be commercial operations by listing them as examples under the rule.
3. In combination with 2. above, provide for a review by FAA of certain leases and agreements, prior to execution but establish well-defined limits on what type of arrangements should be involved. This review could be limited to agreements pertaining to large aircraft and only those involving wet leases and dry leases when used in combination with crew service agreements, as in a recent case.
4. Amend Part 91 of the Federal Aviation Regulations to require the application of additional operating and maintenance rules to all large aircraft. Complex jets of less than 12,500 pounds could be included, if appropriate. Such an amendment could provide that the operation of any large aircraft by persons other than those certificated under part 121 (or 133 where an air taxi has large aircraft authority) must comply with such additional operating and maintenance rules. The identification of the applicable rule should, of course, be left to your discretion. 1/

1/ Such rules should include an upgrading of pilot proficiency, including a requirement that second-in-command crewmembers be trained to perform assigned duties. Periodic recurrent training and requalification checks should be required.



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Under this proposal, the "for compensation or hire" test would remain for determination as to whether an operator requires certification. However, during the time consumed by an exhaustive investigation, legal review, etc., the public would at least have the assurance that the aircraft, +?respective of the type of operation, is being operated under a higher standard than that presently prescribed by Part 91. Hopefully, the operator/owner of a large aircraft, under these conditions, would have to meet the higher standards, irrespective of the type of operation, and, therefore, would be less inclined to conduct illegal operations. This proposal would be subject to the criticism that it would be applicable to executives fleets and invite their opposition. However, this criticism may be somewhat negated when it is recognized that the cost of certification would be obviated, and a reasonable and practical use of the Administrator's exemption authority is available for unusual cases.

We would invite your particular attention to item 4, above. Although it is one that has undoubtedly been considered in the past, it is a different approach, and one which could raise safety standards for large aircraft, be simpler to monitor and enforce, and would continue the certification of "commercial operators" who are undertaking operations for compensation or hire.

Sincerely yours,

/s/ John H. Reed

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