

emergency exits be constructed to minimize jamming in minor crashes. Obviously in impacts and ground movement of the magnitude of this accident there is no aircraft construction that would prevent fuselage deformation and consequent jamming of exits. (In later model aircraft having a passenger seating capacity of 40 or more persons, Civil Air Regulations require a second floor-level emergency exit on the side opposite the main cabin door. Where the total number of passengers exceed 110, at least two (2) floor-level exits are required on each side of the fuselage. These are in addition to the window-type exits of which the required number will vary according to passenger seating capacity.)

Hindered by Darkness

The absence of lights in the cabin after the aircraft came to a stop undoubtedly hindered the evacuation of many occupants. The normal cabin lights, which were on, went off when electrical connections were separated during the ground slide and the deceleration was not sufficient to actuate the automatic impact lights with their independent source of energy.

The Board is concerned by the difficulties experienced in evacuating passengers after the airplane came to rest. The jamming of the main door and the nonoperation of the automatic lighting system apparently hindered speedy evacuation. The Board is studying this problem from the standpoint of adequacy of the regulations and their application.

Consideration of the wreckage distribution and detailed examination of the airframe wreckage disclosed no evidence of structural failure, control malfunction, or fire prior to ground impact. Testimony of the pilots and flight engineer also reflected no indication of structural failure, control malfunctioning, fire, fire warning, or unusual sounds during the brief time that the airplane was in flight.

The outward displacement and tearing of the left horizontal stabilizer upper and lower skins in the area of stations 129 to 168 are conclusive indications of an explosion having occurred inside the stabilizer. However, the continuous scratch marks across the station 160 tear in the lower skin are equally conclusive indications that the explosion occurred after the stabilizer was sliding across the ground at an average angle of 48 deg. to its normal line of motion. It is evident that the explosive in this case was a gasoline-air mixture. Although it has not been established whether the gasoline came from disruption of the tail anti-icing heater fuel lines on breakup of the fuselage just aft of the main pressure dome, or from breakup of the fuel storage areas of the wings, the specific source is not pertinent since it is obvious that the disruption of the left horizontal stabilizer contour occurred during the ground slide.

Records and documents embracing the entire operational life of this aircraft were reviewed minutely during the investigation. The first impression was that this airplane had experienced a higher than normal rate of electrical and instrument malfunctions. However, absence of a pattern on which to base a comparison invalidates any such conclusion. Absence of a record or report of difficulties of the electrical and instrument systems during the several flights immedi-

ately preceding the accident indicates that the final corrective measures, particularly with respect to the C-2 Gyrosyn compass, were adequate.

Responsibility for the day-to-day airworthiness of N 34954 while operated by Northeast was divided. Major checks had been conducted by both the Flying Tiger Line and Northeast Airlines. There was at least one irregularity in the maintenance of the operation. One item (inverter replacement) on the No. 8 check conducted by the Flying Tiger Line, though signed off, had not been accomplished. Necessary equipment to accomplish the check (voltage was checked but not frequency) was not available nor was the individual assigned to perform this check qualified. Despite these circumstances, based on the investigation in its entirety, it is concluded that maintenance of the aircraft had no bearing on the accident. It is considered pertinent that the crew involved in the accident had no items of an airworthiness nature to report at the termination of the previous trip nor were any noted during the predeparture and departure checks.

In investigating the possibility of an ice or snow-jammed rudder tab as the cause of the accident, the Board explored all areas that would develop information in this regard. Although it appeared unlikely, in view of the existing temperature during the period involved, that sufficient ice or packed snow could accumulate in such a manner to cause jamming of the rudder tab, the Board concluded that it would be reasonable to assume that this could conceivably have occurred. However, the examination and study of the rudder tab and tab control system components and parts, a consideration of aerodynamic design forces involved, and, finally, the results of the flight tests conducted following the accident all lead the Board to the following conclusion: If such a condition had existed Capt. Marsh should have been sufficiently alerted, by his instrumentation, to effect immediate recovery. Accordingly, the Board has rejected this possibility as the cause of this accident.

Pieces of charred wood found in the pitot tubes obviously came from trees struck by the aircraft as it slid over the ground. The charring of the wood and the finding of a tar-like liquid, presumably the product of destructive distillation of the wood, are indicative of residual pitot heater operation. The static vent heating elements were in good condition and, since they operated in conjunction with the pitot heaters, should also have been operating prior to the accident. It must be concluded, therefore, that there was no obstruction of the pitot system or the static system due to ice or foreign material.

Takeoff Normal

Further indication that the pitot and static systems operated normally is the testimony of the crew that the aircraft responded normally to control pressures when lifted off the runway at the V_2 speed as indicated and that a normal rate of climb and normal increase in altitude were observed.

The crew reported seeing normal indications on their ADF indicators while the aircraft was on the ground shortly before takeoff.

The readings obtained from these instru-

ments, after the accident, have been studied at length. They do not represent the indications that would have existed at the time of impact had they been indicating properly. Neither do they represent the indications that would have existed at impact had they ceased operation during the takeoff. One dual pointer indication was only a few degrees from a position that would be normal for a straight climb from runway 4. However, the position of this pointer did not coincide with the positions of the dual pointer of its companion instrument. The head and tail positions of the latter pointer could not be determined but the indication is either one of a turn of approximately 30 deg. having been made to the left after take-off, or of a turn of approximately 150 deg. having been made to the right.

The ADF indicator is so constructed that its pointers are free to rotate in either direction if the instrument is shaken while operating power is removed. The magnitude and direction of movement is a function of the magnitude and direction of the applied load, needle balance, and internal friction. Although the instrument is not overly sensitive to shock loads, a change of pointer position is to be expected under the conditions that prevailed in this accident. During the ground slide the instrument panels would be subjected to greater than normal vibration and electrical power would become interrupted. Later, as fire destroyed the instrument panels, the instruments would fall free.

In consideration of the foregoing, it is believed that the pointer indications of the ADF indicators, as found after the accident, are random and meaningless for the purpose of this analysis.

Azimuth Rings

Two Collins course indicators were installed in the aircraft, one mounted on each pilot's panel. One of the functions of the instrument is the indication of the aircraft's magnetic heading. This is accomplished by means of an azimuth ring which is slaved to the aircraft's compass system. The ring rotates as the aircraft's heading changes and the heading is read beneath a lubber line at the top of the instrument. The azimuth rings of the two course indicators were slaved to separate compass systems. The captain's course indicator azimuth ring was slaved to the Sperry C-2A Gyrosyn compass and that of the first officer was slaved to the Sperry A-12 Gyrosyn compass, a component of the A-12 Gyropilot.

Examination revealed that the heading indication of the unit believed to have been installed in the first officer's panel was 282 deg. A heading indication of 272 deg. was found on the unit believed to have been in the captain's panel. The course indicator is not, in itself, sensitive to heading. Its azimuth ring is slaved to a compass system and repeats the heading information derived from that system.

Examination of these indicators revealed only fire damage and no evidence of damage due to impact forces. Considering the nature of the azimuth ring's driving mechanism and the absence of impact damage, it is felt that the indicated headings are the result of operation of the instrument.

If electrical power is removed from a