

NATIONAL TRANSPORTATION SAFETY BOARD

REPORT NUMBER:

NTSB-AAR-70-12

AIRCRAFT ACCIDENT REPORT

MOHAWK AIRLINES, INC.
FAIRCHILD HILLER FH-227B, N7811M
NEAR GLENS FALLS, NEW YORK
NOVEMBER 19, 1969



NATIONAL TRANSPORTATION SAFETY BOARD
Bureau of Aviation Safety
Washington, D. C. 20591

11/19/69

NATIONAL TRANSPORTATION SAFETY BOARD

DEPARTMENT OF TRANSPORTATION

WASHINGTON, D.C.--20591



Safety Information

For Release:

SB 70-62
(202) 382-7273

Office of the Chairman

ADVANCE For

AM Newspapers
Thursday, Aug. 20, 1970

The National Transportation Safety Board released today its report on the fatal crash of a Mohawk Airlines Fairchild-Hiller FH-227B during a descent for landing at Glens Falls, New York, last November 19. All 11 passengers and 3 crewmembers aboard died in the accident.

Mohawk Flight 411 from Albany had been cleared for an approach to Glens Falls' Warren County Airport, and had reported its position over an airways check point 14 nautical miles south of the airport. The aircraft continued north at its 3,000-foot en route altitude, overflying the field. It reversed its course over Lake George and was headed back toward the airport when it crashed and burned 200 feet below the summit of 2,180-foot Pilot Knob Mountain nine nautical miles north of the field.

The Safety Board determined that the probable cause was . . .

" . . . the captain, while conducting an approach, exceeded his clearance limits and, thereafter, flew the aircraft into a severe 'lee of the mountain downdraft' at an altitude insufficient for recovery. No evidence was found to explain why this particular approach was attempted. "

The Board's investigation showed that Flight 411 had been cleared for "a VOR approach at the Warren County Airport, "

(over)

and had been given the Glens Falls weather and runway -- measured overcast at 2,100 feet visibility seven miles in light rain, wind from 180 degrees at 12 knots and gusting to 22 knots, Runway 19 in use. Ground observers at Lake George described "a dark, windy rainy night;" the crash occurred at about 8:20 p. m.

Under the Air Traffic Control clearance given the crew, the Board said, two approaches could have been made -- either an approach for any runway which would be started with a descent from the Miller Intersection -- the airways check point south of the airport -- or from above the airport's VORTAC navigation aid, or an approach from north to south employing Distance Measuring Equipment (DME) for proper descent to a landing on Runway 19. The DME approach for Runway 19, however, was prohibited by Mohawk because Glens Falls was not equipped with other navigation aids by which DME readings could be verified, the Board noted.

The Board concluded from its investigation that "the causal factors . . . were directly related to Mohawk 411 operating north of the Glens Falls VORTAC at 3,000 feet while operating on an Instrument Flight Rules flight plan." Possible reasons, the Board said, included an in-flight emergency or distraction, possible misinterpretation of the approach clearance, or the fact that an approach from the north would be faster and would involve less turbulence.

In any in-flight emergency near the VORTAC, the Board held, the crew could have descended immediately to the airport rather than continuing its flight to the north. The Board also found "no indications of problems associated with ground-based navigational aids or recovered airborne instrumentation," and concluded from ground observers' statements that "at least intermittent ground reference" was possible for the crew.

The approach chart the crew was using, the Board said, "did not specifically warn the pilot" that the procedure turn often made in such an instrument approach was not authorized for the DME approach to Runway 19. This, coupled with the flight's clearance for "a VOR approach," the Board found, "could have led to a misunderstanding on the part of the crew."

As for the possibility of turbulence influencing the crew, the Board noted that flight recorder data showed a reduction in airspeed short of the Miller Intersection, and a steady, 165 to 170-knot airspeed during the aircraft's flight past the airport. The Board concluded that this was "for the purpose of attaining turbulence penetration airspeed . . . and not in preparation" for an

approach descent over the airport.

The Board's investigation was hampered by the loss of Cockpit Voice Recorder evidence in the crash. In the fierce, 40-minute fire which destroyed much of the aircraft wreckage, the CVR magnetic tape was melted and rendered unreadable. The flight data recorder metal tape was retrieved and read, but the device had not been recording acceleration forces which would indicate turbulence encountered by the flight.

According to the flight recorder data available, however, Mohawk 411 held its 3,000-foot altitude and its northerly course for some seven nautical miles north of the airport. The aircraft then made a looping right-hand turn, and had nearly reached a return heading for the airport when it began a descent. The Board held that this descent "was intentional." One minute and eight seconds later the aircraft struck trees and was thrown against the near-vertical face of Pilot Knob Mountain. At impact, the aircraft was descending at a 12-degree angle in a 12-degree right bank.

The "lee of the mountain downdraft" cited by the Safety Board often is encountered on the downwind side of a mountain ridge as wind from the upwind side spills over the ridge top. Noting that winds in the accident area were 60 to 65 knots at 3,000 feet, the Board concluded that Mohawk 411 in the last moments of flight "encountered severe turbulence and wind shear . . . which resulted in an uncontrolled descent into Pilot Knob Mountain.

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SA-None

File No. 1-0026

AIRCRAFT ACCIDENT REPORT

MOHAWK AIRLINES, INC.

FAIRCHILD HILLER FH-227B, N7811M

NEAR GLENS FALLS, NEW YORK

NOVEMBER 19, 1969

Adopted: June 25, 1970

NATIONAL TRANSPORTATION SAFETY BOARD
Bureau of Aviation Safety
Washington, D. C. 20591

For sale by Clearinghouse for Federal Scientific and Technical Information, U.S. Department of
Commerce, Springfield, Va. 22151. Annual subscription price \$12.00 Domestic; \$15.00 Foreign;
Single copy \$3.00; Microfilm \$0.65.

Report Number: NTSB-AAR-70-12

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NEAR GLENS FALLS, NEW YORK
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NATIONAL TRANSPORTATION SAFETY BOARD
DEPARTMENT OF TRANSPORTATION
AIRCRAFT ACCIDENT REPORT

Adopted: June 25, 1970

MOHAWK AIRLINES, INC.
FAIRCHILD-HILLER FH-227B, N7811M,
NEAR GLENS FALLS, NEW YORK
NOVEMBER 19, 1969

SYNOPSIS

Mohawk Airlines, Inc., Flight 411 of November 19, 1969, while en route to Glens Falls from Albany, New York, crashed about 2020 e.s.t. in mountainous terrain approximately 9 nautical miles north of the Warren County Airport, Glens Falls, New York.

The flight had been cleared for a VOR approach to Runway 19, since the surface wind was from 150° at 12 knots with gusts to 20 knots. The ceiling at Glens Falls was given as 2,100 feet overcast, and the visibility was 7 miles in light rain.

The flight overflew Glens Falls at 3,000 feet and proceeded north for about 1 minute and 15 seconds at which time a left turn was initiated preparatory to return to the airport to land on Runway 19. During the last portion of this turn, the aircraft contacted trees on the northwest slope of Pilot Knob Mountain on a heading of about 180°, approximately 1 nautical mile east of Kattskill Bay, New York. It then impacted the face of a rock cliff, after which it dropped approximately 38 feet, became lodged between trees and the side of the mountain, and burned.

The elevation of the initial impact with the rock face of Pilot Knob Mountain was approximately 1,960 feet. The three crewmembers and 11 passengers received fatal injuries, and the aircraft was destroyed.

The Board determines that the probable cause of this accident was that the captain, while conducting an approach, exceeded his clearance limits and, thereafter, flew the aircraft into a severe "lee of the mountain downdraft" at an altitude insufficient for recovery. No evidence was found to explain why this particular approach was attempted.

1. INVESTIGATION

1.1 History of the Flight

Mohawk Airlines Flight 411 (MO-411), a Fairchild-Hiller FH-227B, N7811M, departed Albany, New York, on an Instrument Flight Rules (IFR) flight plan for Warren County Airport, Glens Falls, New York, about 2003 ^{1/} on November 19, 1969. Flight 411 was a scheduled passenger/cargo flight.

At 2006:24, Albany Departure Control gave MO-411 the following weather report: "And Mohawk four eleven, the Glens Falls weather measured ceiling two thousand one hundred (feet) overcast, visibility seven, light rain, wind one eight zero at one two, peak gusts two two, and altimeter two nine eight zero, Runway one nine in use."

At 2007:16, the Glens Falls temperature of 54° was relayed to and acknowledged by MO-411.

At 2007:32, Departure Control issued the following clearance to the flight: "Mohawk four eleven, you are cleared to the-for a VOR approach at the Warren County Airport." MO-411 acknowledged.

At 2010:48, MO-411 reported at Miller Intersection (see Appendix C) as follows: "Albany, ah Mohawk Four Eleven's at Miller going to Glens Falls Radio." The Flight Service Station (FSS) agent at Warren County Airport stated the flight then contacted him requesting the weather. He stated he gave the current weather information and informed the flight that the landing runway was 19.

There are two VOR approaches to the Warren County Airport at Glens Falls, New York. They are the VOR-1 and the VOR DME Runway 19 (see Appendix C). Distance measuring equipment (DME) is required on an aircraft in order to use the VOR DME Runway 19 approach. Company regulations prohibit the use of DME as a primary navigational instrument. This means that if the aircraft DME is to be used, it must be in conjunction with a fan marker, a radar fix, etc.

The VOR-1 approach applies to any runway. It can be initiated either at Miller Intersection or over the Glens Falls VORTAC. According to the Jeppesen Approach Charts, used by Mohawk Airlines, an immediate descent can be initiated at the Miller Intersection to descend to 1,800 feet mean sea level. ^{2/}

^{1/} All times in this report are eastern standard times expressed in the 24-hour clock.

^{2/} All altitudes will be expressed in feet above mean sea level (m.s.l.) unless otherwise indicated.

Upon reaching the Glens Falls fan marker (5.1 nautical mile (NM) from the VORTAC), a straight-in approach can be made if the landing is to be made on Runway 1. When the landing runway is 19 and visual conditions are attained, the VOR approach can be discontinued and a visual approach made to Runway 19.

The pilot may elect to proceed to the Glens Falls VORTAC at en route altitude rather than initiate the descent from Miller Intersection. When he so elects, he makes an immediate right turn over the VORTAC to intercept the 186° radial of the Glens Falls VORTAC outbound. Descent can be made to 2,500 feet as long as the procedure turn is completed within 25 NM of the VORTAC. Descent can then be continued to cross the Glens Falls fan marker at or above 1,100 feet, after which the same procedure as given for the VOR-1 approach can be followed.

MO-411 did not descend at Miller Intersection. The flight data recorder shows that MO-411 continued on to Glens Falls VORTAC at an altitude of 3,000 feet and on a 006° ^{3/} heading. Over the airport, the aircraft make a slight right followed by a slight left turn. During the left turn, the airspeed reduced from 164 knots to 152 knots. The aircraft then returned to and continued on the 006° heading for approximately 1 minute and 15 seconds (7 NM DME), at which time a reversal in course was initiated.

Witnesses stated that the flight passed over the Warren County Airport on a northerly heading about 2015. Shortly thereafter, other witnesses saw the aircraft over Lake George, between Diamond Point and Bolton, and in the vicinity of Pilot Knob, New York (see Appendix D). Witnesses also said the tops of the mountains were discernible. The mountaintops were 2,180 to 2,350 feet m.s.l. in this area. One witness who saw the impact flash said, "...there seemed to be thin clouds between the fireball and me." The witnesses also stated there was light rain at the time with moderate winds between Bolton and Diamond Point and heavy rain with strong winds at Pilot Knob and Kattskill Bay.

About 2020, the aircraft struck the cliff and burned. Impact was about 200 feet below the top, on the northwest slope of Pilot Knob Mountain, approximately 1 NM east of Kattskill Bay, New York. The 11 passengers and three crewmembers received fatal injuries and the aircraft was destroyed by impact and the ensuing fire.

The point of impact was at latitude 43°29'30"N., longitude 73°36'39"W., at an elevation of 1,960 feet. The accident site was located on the 016° radial of the Glens Falls VORTAC at a measured distance of 9 NM from the station.

3/ All indications of aircraft heading are in degrees magnetic.

First impact was with evergreen trees then, approximately 20 feet farther along the flightpath, the aircraft impacted the near-vertical face of Pilot Knob Mountain. Damage to the evergreens indicated the track of the aircraft was 176°. This damage also indicated the aircraft had a 12° right-wing-down attitude and was descending at a 12° angle at impact.

1.2 Injuries to Persons

<u>Injuries</u>	<u>Crew</u>	<u>Passengers</u>	<u>Other</u>
Fatal	3	11	0
Nonfatal	0	0	0
None	0	0	

1.3 Damage to Aircraft

The aircraft was destroyed by impact and the ensuing fire.

1.4 Other Damage

The only other damage caused by impact and fire was done to several large trees.

1.5 Crew Information

All crewmembers were properly certificated and qualified for their positions. (For details see Appendix B.)

1.6 Aircraft Information

The aircraft maintenance records reviewed (the last log sheet available was No.54-247 which indicated a total aircraft time of 7553:36 hours) showed the aircraft was maintained in accordance with FAA and company procedures.

During our normal records check, it was found that some navigation instrument problems began to appear in the aircraft log book on September 10, 1969. Further investigation, however, revealed that these problems did not constitute a trend in navigation instrument problems.

The captain who flew the aircraft immediately prior to Captain Hourihan stated, in part, as follows: "...Captain Kertz indicated to me that the aircraft was at the time of crew change without any mechanical discrepancy. The log book of Aircraft N7811M contained no writeups at the time and none were added by me."

The weight and center of gravity were within the prescribed limits for landing.

1.7 Meteorological Information

Synoptic Situation

The 1900 surface weather chart showed a strong cold front oriented north-south across eastern New York, west of Glens Falls.

Surface Weather Observations

Glens Falls (Glens Falls is located 9 NM south of the accident site).

1956 - Measured 2,100-foot overcast, visibility 7 miles, light rain, temperature 53° F., dew point 48° F., wind 150° at 12 knots, gusts 20 knots, altimeter setting 29.80 inches. Rain began at 1819.

Burlington (Burlington is about 60 NM north of the accident site).

2000 - Measured 4,000 feet broken, 7,000 feet overcast, visibility 7 miles, light rain showers, temperature 49° F., dew point 44° F., wind 140° 15 knots, gusts 22 knots, altimeter setting 29.76 inches, rain began at 1902.

2100 - Measured 3,600 feet overcast, visibility 7 miles, light rain, temperature 50° F., dew point 44° F., wind 150° 17 knots, gusts 24 knots, altimeter setting 29.74 inches.

The 1843 winds aloft observation at Albany, 48 NM south of the accident site, was in part as follows:

<u>Heights</u> (1,000 ft. m.s.l.)	<u>Direction</u> (Degree true)	<u>Velocity</u> (Knots)
Surface	160°	20
1	160°	28
2	155°	44
3	160°	41
4	170°	51

Weather Bureau Forecasts

The aviation terminal forecasts issued by the Forecast Office at New York at 1745, valid 1800 to 0600, were in part as follows for Glens Falls and Albany.

Glens Falls

1800-2100, ceiling 2,500 feet broken, 5,000 feet overcast, wind 190° 15 knots and gusty.

Albany

1800-2100, ceiling 2,000 feet broken, 5,000 feet overcast, wind 140° 12 knots.

Winds Aloft

The winds aloft forecast issued by the National Meteorological Center at 1245, valid at 1900, for use from 1300 to 2200, was in part as follows:

Albany

3,000 feet m.s.l. --170° 32 knots.

Plattsburg (Plattsburg is about 70 NM north of the accident site).

3,000 feet m.s.l. --170° 33 knots.

Turbulence was forecast to be light to moderate below 8,000 feet east of Connecticut Valley and mostly moderate with a chance of local severe turbulence below 12,000 feet west of Connecticut Valley, especially within 100 miles of the front and across higher ridges.

The Albany 1843 radiosonde ascent showed the freezing level was near 9,900 feet m.s.l.

It was a dark, windy, rainy night according to observers on the ground but they said that they were able to discern the mountain peaks when they looked east from Lake George.

The total rainfall at Glens Falls for the 24-hour period from 0000 to 2400 on November 19, 1969, was 0.27 inches.

The captain who flew N7811M immediately prior to Captain Hourihan stated in part as follows concerning the weather: "After completion Flight 402, I entered our operation office at LaGuardia and spoke with Captain Hourihan, who was, at that time (1800 hours), signing his flight plan and working over weather sequences. Captain Hourihan and I discussed briefly three points: (1) condition of aircraft - good no writeups, (2) altitude between points - smooth between layers for me, (3) winds (Surface) at destination and departure - strong but acceptable for me."

1.8 Aids to Navigation

The aids to navigation at Warren County Airport were a VORTAC (VOR with DME), a rotating beacon, REIL (Runway End Identification Lights) on the approach end of Runway 01, and high-intensity runway lights (on maximum brightness). The runway lights at the time of this approach were set on maximum brightness. All of the aids were in operation at the time of the accident, and there were no problems indicated by the monitors.

The FAA conducted a flight check of part of the navigation aids within a few hours following the accident, and the remainder on the following day. No discrepancies were found. Subsequent ground maintenance checks revealed no equipment difficulties.

1.9 Communications

Communications made to and by MO-411 were recorded from prior to takeoff through arrival at Miller Intersection. Significant part of these transmissions are: *

0058:21 411 Albany, Mohawk Four Eleven taxi
0058:24 GC Mohawk Four Eleven taxi Runway One Nine, wind one eight zero degrees at one two gusts to two five
0101:00 GC Mohawk Four Eleven is cleared Glens Falls VOR via the Albany zero three nine radial, Glens Falls one eight six radial, maintain three thousand, after departure be a left turn heading zero one zero vectors

* Legends: Mohawk Flight 411.....411
Albany Tower Ground Control.....GC
Albany Tower Local Control.....LC
Albany Tower Departure Control (Radar).....DR

0101:18 411 Four Eleven cleared to ah Glens Falls VOR via the Glens Falls zero three nine Glens Falls one eighty six to maintain three thousand, a left turn zero one zero for vectors, squawk one thousand, departure one twenty-six six

0101:46 411 Albany Four Eleven is ready for takeoff

0101:57 IC Mohawk Four Eleven cleared for takeoff

0106:24 DR Mohawk Four Eleven, the Glens Falls weather measured ceiling two thousand one hundred overcast, visibility seven light rain, wind one eight zero at one two peak gusts two two, and altimeter two nine eight zero, Runway One Nine in use

0106:40 411 Four Eleven, thanks

0106:49 411 Albany ah Four Eleven, do you have the temperature up there please

0107:16 DR Glens Falls temperature five four

0107:19 411 Thank you

0107:32 DR Mohawk Four Eleven, you're cleared to the-for a VOR approach at the Warren County Airport

0107:38 411 Cleared approach, thank you Four Eleven

0110:48 411 Albany Mohawk Four Eleven's at Miller, going to Glens Falls Radio

0110:52 DR Roger, Mohawk Four Eleven, advise Glens Falls to, of your down time or your ah cancellation and radar service terminated

0111:01 411 Roger thank you

An "In Range" call is usually made by each flight when it is about 5 minutes from touchdown. Flight 411 made no "In Range" call.

1.10 Aerodome and Ground Facilities

Not applicable.

1.11 Flight Recorders

The flight data recorder (FDR) and the cockpit voice recorder (CVR) were found loose but on proper station in the aft section of the pressurized

compartment. Both had been exposed to high heat after impact. The CVR tape was melted to the extent that it was unreadable. The FDR was a Model F-542, Serial No. 1616, manufactured by United Control Data Division. The readout of the flight data recorder is attached as Appendix E.

1.12 Wreckage

Impact and the ensuing fire destroyed most of the aircraft so that much of the structure could not be identified positively. However, those parts which were outside the ground fire area showed no evidence of in-flight fire.

Most of the wreckage of N7811M was distributed along and quite close to the base of the rock cliff which the aircraft impacted. The site was located 9 NM from the Glens Falls VORTAC on the 016° radial. The rear fuselage and the tail section were located approximately 70 feet west of the initial impact point. The right engine and propeller, the major components located farthest along the general line of flight, were approximately 100 feet south-southwest of the impact point. The left wingtip was recovered on top of the cliff near the eastern edge of the cut in the trees. Engine parts and parts from the forward fuselage were found wedged into the cliff or lying on ledges along the face of it. The pilot's control column and many of the cockpit instrument remains were also found on these ledges. No aircraft parts were found outside of the impact area described above. All fractures observed were typical of those caused by overload. The preimpact integrity of the control system could not be determined because of the extensive impact and fire damage.

Examination of the wing flap and landing gear components revealed the flaps were extended to a setting of $16\frac{1}{2}^{\circ}$, and the landing gear was extended at the time of impact.

The cockpit area disintegrated during impact, thus precluding accomplishment of any comprehensive cockpit documentation. Although the cockpit area was disintegrated, various cockpit components were thrown free at impact and were recovered from the ledges and from the bottom of the cliff below the initial impact point. Significant data was obtained from these components.

The instrument panel, which is of one-piece construction, was recovered in six sections from scattered locations. The copilot's side of this instrument panel had been exposed to the ground fire. Sections of this panel contained the flap indicator and copilot's static selector switches. The remains of various other switches, light sockets, and the dual water-methanol quantity indicator were also attached. However, the condition of these panels prevented the obtaining of any usable information.

The DME was tuned to the assigned channel (Channel 39) for the Warren County Airport at Glens Falls and indicated 9 miles to the station on the DME unit located in the radio rack.

Both the No. 1 and No. 2 VHF transceiver units were recovered. Both were damaged by impact and fire. No. 1 had a setting between 123.6 and 123.65 MHz. The Glens Falls Flight Service Station frequency was 123.6 MHz. No. 2 had a setting of 130.0 MHz which corresponds to the Mohawk Airlines receiver frequency at Glens Falls.

The pedestal where the frequency selector panels for the transceiver units are normally mounted was not recovered. One selector panel was recovered but the internal mechanism was broken, allowing the selector drums to rotate freely, and thus preventing the obtaining of valid preimpact settings.

The left engine revolutions per minute (r.p.m.) indicator was recovered. The face glass was missing but the pointers and face, though distorted, were attached. This indicator displayed a 12,280 r.p.m. reading and the pointers were not free to move. The right engine r.p.m. indicator was not recovered.

The right propeller pitch control piston was 3-3/4 inches from the front face of the cylinder which is the setting for a blade angle of 23° 50'. The blade angle for flight fine is 16° and for cruise is 28°.

Rotation of both engines at impact was established by turbine blade bends and rotational rubbing of the blades on stationary parts. Further, it was established that the No. 1 turbine shaft had failed in torsion.

There was no indication of overheat on the turbine assembly of either engine.

The elongated filament of the vertical fin rotating beacon indicated that it was operating at impact.

Other instruments found and their indications:

- | | |
|---|--------------------------------|
| 1. Captain's Flight Director Indicator | 10° nosedown |
| 2. Captain's Course Deviation Indicator | 10° nosedown |
| Course selector | *Between 197° and 208° |
| Heading marker | 352° |
| Compass card | 190° |
| Course arrow | 240° and reciprocal
at 025° |
| 3. First officer's Course Deviation Indicator | |
| Course selector | *Between 198° and 199° |

* More accurate readings were not possible because the needles were bent.

Heading marker	011° and could not be moved
Compass card	138°
Course arrow	196°

4. Turn and bank indicator - both - no valid information.
5. Directional Gyros (2) - All exhibited rotational scoring.
Vertical Gyro (1)
6. Altimeters - two unrelated parts, one of which indicated a setting of 29.70
7. Pitot head - Full of tree bark

1.13 Fire

According to witnesses, the fire that ensued after impact burned fiercely for approximately 40 minutes and then smoldered for an undetermined time thereafter.

There were two distinct areas of fire. One area extended from the point of impact with the rock face over the top of the cliff for approximately 40 feet along the general direction of flight. The other area was concentrated along the base of the cliff in the vicinity of the right engine, right and center section wing remains, and the aft fuselage. Large portions of structure and instruments in this area were entirely consumed or were reduced to solidified molten slag.

1.14 Survival Aspects

This was a nonsurvivable accident.

1.15 Tests and Research

Several test and/or research activities were conducted as follows:

1. Both VOR units and parts of both Radio Magnetic Direction Indicators were recovered. They were taken to their respective manufacturers for disassembly and inspection, but no useful information was obtained.
2. The Board's staff analyzed the FDR information to construct a groundpath for Flight 411. This is attached as Appendix D and F. Their calculations encompassed the entire flight from Albany. They concluded that MO-411 encountered an average wind of 58 knots from 173° magnetic at the cruise altitude.

The Board asked the aircraft division of Fairchild-Hiller to analyze the last 2 minutes of the flight recorder data concerning this accident. Their analysis concluded that MO-411 encountered an average wind of 61 knots from 181° between Miller Intersection and impact. They also stated: "In the time period from 16:40 to 17:05 (time from liftoff at Albany) the aircraft's speed was stabilized on the Flight Manual 16.5° flaps approach speed of 110 knots calibrated according to the flight weight of 39,500 pounds. Subsequent to 17:05, indicated air speed falls below the scheduled approach speed indicating a reduction in headwind was experienced as the airplane entered the wake of Pilot Knob." (See Appendix E)

The difference in calculated winds in the two reports stems from the fact that the Fairchild report considers only the time between Miller Intersection and the accident site, whereas the Bureau Report considers the entire flight from lift-off to impact.

3. On January 13, 1970, a Mohawk FH-227 flightcrew participated in an experiment utilizing their simulator located at Utica, New York, and using wind directions and velocities obtained by the Fairchild-Hiller analysis of MO-411's flight recorder information. The track that evolved from flying the flight simulator very closely approximated the computed path presented by the Fairchild-Hiller and the Board analyses.

Later the same day, a Mohawk ex-FH-227 captain, who was at the training center taking recurrent jet ground school training and who professed to know very little about the accident, was requested to fly the simulator through several Glens Falls instrument approaches. He conducted more than five approaches from just south of the Miller Intersection, during which time several emergencies were simulated to determine the amount of distraction they would cause.

On the first approach, the captain received instrument and VOR "out" flags over Miller Intersection. He immediately requested the first officer to contact Albany Approach Control for a steer to Albany. On one in which his gyro failure flag showed, he noticed it immediately, switched his attention to the first officer's instrument, and continued the approach. The other three or four runs constituted combinations of instrument and gyro failure, the last of which was an unsuccessful attempt to motor a gyro.^{4/} The captain held his

^{4/} Motoring gyro--one that continues constant precession in one direction.

altitude and a heading in each instance until he had called Center and received a reply, or the run was halted to begin a new one.

4. Several Mohawk pilots listened to the ATC tapes. None of them could positively say it was the first officer talking, but they were all positive that it was not the captain. It is normal practice for the pilot not flying to make most of the radio calls.

1.16 Other Pertinent Information

Witness Information

Five witnesses saw Flight 411. Four of the five also heard the aircraft. Five other witnesses heard but did not see the aircraft. One witness neither saw nor heard the aircraft but saw the explosion of impact.

The witnesses described the weather as rainy and windy, and their estimates of the rain intensity ranged from very light to heavy.

The three witnesses who saw the aircraft in the vicinity of Glens Falls observed the lights to be blinking or flashing normally. One of the three witnesses (witness No. 10, Appendix D) said he observed sparks coming from near the bottom of the aircraft and the aircraft's wings were dipping from side to side. Witness No. 11 said that as he observed the aircraft, he heard a loud noise.

Witness No. 2, who was located on the western side of Lake George, was inside her residence about 2015 when she heard a noise that sounded "like a heavy truck." She said that she opened the door because the noise continued for a short time, then was blanked out by heavy rains. Then she saw a big aircraft appear, coming from the north, traveling over the lake and going south. She stated in part as follows: "It was low much lower than I expected an airplane to be with that big red blinker light. I watched it to a point about East of this position and left to go into the pantry. Well it couldn't have been 30 seconds when I heard a loud thump which caused me to rush out as I knew that something happened. I then looked out and saw a bright ball of light like that of a sunrise where I knew the mountains to be. It was so bright as to silhouette the trees and each individual branch....."

Witness No. 1, who was driving north on Pilot Knob Road, which is along the eastern shore of Lake George, stated as follows:

"On Thursday eve, Nov. 19th @ approximately 8:15 p.m. I was driving north on Pilot Knob Road & when I was about even with the cemetery (E. side of road) my attention was drawn to a

aircraft off to my right on a parallel heading & headed north going away from me. The bright red light (steady) particularly got my attention and as I watched it the aircraft was low and I could see the outline of the Pilot Knob Mountain. The A/C seemed to change heading from time to time and my impression was that it was being buffeted by the gusty wind.

"I continued north on Pilot Knob Road for approx $\frac{1}{2}$ mile to Katskill Bay. I was not able to see the aircraft at all times due to the trees however as I turned in at Katskill Bay (Mayflower Lane) I observed a Bright Flash to the East. The Flash lit up the sky & it appeared to be in back of Spruce Mountain.

"When I first saw the aircraft I thought possibly it was a light aircraft because it was going so slow.

"I recall the weather as being very windy and gusty. At the time it was raining very hard (big drops) and it was a cold rain...."

Witness No. 5 neither saw nor heard the aircraft. He said that he was watching television when he became aware of a large red fireball in the picture window located behind the television set. He described the weather as light rain and moderate wind. He stated in part as follows: "...there seemed to be thin clouds between the fireball and me."

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

Investigation disclosed that the causal factors involved in this accident were directly related to MO-411 operating north of the Glens Falls VORTAC at 3,000 feet while operating on an IFR flight plan. The following are a few possible reasons that MO-411 was north of the airport: (1) It would be the best approach from the standpoint of time, after descent was not initiated at Miller Intersection. (2) Since it would be faster, it would be better for passenger comfort and less turbulent than at lower levels. (3) There might have been a misinterpretation of the clearance given by Albany Center. (4) An emergency might have occurred. (5) Some distraction might have occurred as the flight approached or was over the Glens Falls VORTAC.

The only VOR instrument approach procedure authorized into Warren County Airport from the north required utilization of DME equipment, which was not authorized for use as a primary procedure for

MO-411 due to Company Policy. Therefore, when Albany Departure Control cleared MO-411, "...for a VOR approach at the Warren County Airport," the VOR-1 approach was the only one that should have entered the captain's mind. However, possible misunderstanding might have been created in two ways:

(1) The Jeppesen Manual is used by Mohawk Airlines and contains two approaches to the Warren County Airport at Glens Falls, New York: the VOR-1 and the VOR DME-19 (see Appendix C). The latter approach uses the 019° radial as the approach radial and uses three different NM distance fixes to control altitudes (i.e., 10 NM DME - 4,200 feet m.s.l., 7 NM DME - 2,700 feet m.s.l., 4 NM DME - 1,400 feet m.s.l.). A procedure turn is not depicted on the approach chart. The explanation for this nonappearance is carried in the Legend Section of the Jeppesen Approach Charts Manual. This discussion explains that when a procedure turn is not authorized, it will not be depicted. If a pilot were unaware of this explanation, or if he were under stress, he might overlook the significance of the nonappearance of a procedure turn on the chart, and/or he might refer to the plan and profile views of the approach chart and conclude that a procedure turn could be executed, provided the minimum altitude for his distance from the VORTAC was maintained.

(2) The second area of possible misunderstanding involved the approach clearance received by the flight. The clearance as delivered by the controller was as follows: "And Mohawk Four Eleven, you're cleared to the - for a VOR approach at the Warren County Airport."

As stated earlier, there are two VOR approaches to the Warren County Airport. The VOR DME to Runway 19 was not authorized for use by this flight as stated previously. However, this clearance, coupled with the facts that Runway 19 was in use, and the letdown plate did not specifically warn the pilot that the procedure turn was not authorized, could have led to a misunderstanding on the part of the crew.

The VOR-1 approach may be initiated either at the Miller Intersection or from over the Glens Falls VORTAC. (See pages 2 and 3.) Seven flight recorder tapes (all that were available), covering 14 flights into Glens Falls by Mohawk pilots during the months of October and November, were perused. It was found that 11 of the flights initiated descent at Miller Intersection and three began the approach from overhead the VORTAC.

The FDR readout of MO-411 indicates a reduction of airspeed commenced shortly after receipt of the approach clearance, which would lead one to believe the captain was slowing his aircraft to begin a descent at Miller Intersection. However, during the turn from 046° to 010°, the indicated airspeed stabilized between 165 and 170 knots, and the aircraft continued on at 3,000 feet. Turbulence considerations might account for such action.

The acceleration trace on the FDR was inoperative but the airspeed and heading traces indicated moderate turbulence ^{5/} throughout most of the flight, with the more marked turbulence in the lower flight levels.

Since the crew of Flight 411 was talking to Albany Departure Control immediately prior to reaching Miller Intersection and to Glens Falls FSS for a short time after Miller, with no indications of an emergency, and since there were indications of turbulence, the Board concludes that the reduction in airspeed was for the purpose of attaining turbulence penetration airspeed (174 knots for light to moderate, 140 knots for severe) and not in preparation for a VOR-1 approach.

MO-411 then continued to the Glens Falls VORTAC at an altitude of about 3,000 feet and heading of about 006°. Over the airport, the aircraft made a slight right followed by a slight left turn, then returned to and continued on an average heading of 006° for approximately 1 minute and 15 seconds (7NM DME), at which time a reversal in course was initiated.

Three witnesses in the Glens Falls area saw the aircraft as it proceeded northbound. Therefore, it is believed that the crew of MO-411 at least could have seen the lights of the town of Glens Falls and probably the lights of the Warren County Airport (the runway lights were on maximum brightness and the runway end lights (south end) and the rotating beacon light were operating). The officially reported weather, however, indicates that the prevailing ceiling and visibility at Glens Falls was 2,100 feet overcast and 7 miles visibility in light rain.

Based upon the above considerations, it is reasonable to assume that no emergency occurred as the flight was in the vicinity of the Glens Falls VORTAC. Had there been, the pilot could have initiated an immediate descent to the airport. Similarly, if the crew were distracted at this point, the distraction would not have been of such a nature that it constituted an emergency or critical situation, since there were no indications of problems associated with ground-based navigational aids or recovered airborne instrumentation, and at least intermittent ground reference was possible.

During the investigation, the question of failure trends with respect to navigational instruments was discussed at length. However, the problems revealed by the maintenance records check were typical of problems encountered by all of the airlines using the "remove and replace" system of maintenance. The inverter was finally replaced, and

^{5/} The explanation of Moderate Turbulence contained in the Weather Bureau Observers Manual 68-12, dated May 24, 1968, is as follows:
"Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as Moderate Turbulence."

this proved to have been the problem. The fact that the DME problem was solved by replacement of the instrument is demonstrated by our finding that the one installed in the aircraft was operational at impact. Furthermore, the two previous flights that day had been without mechanical difficulties except for nonrotation of the bottom rotating beacon (see Section 1.6). Since all but one of the several navigation instruments that were removed, checked out when bench-checked, the Board concluded that these problems did not constitute a trend.

A reversal turn was commenced to the left at the 7 NM DME arc with a continuous turn from 048° to 300°, then an immediate right turn to 150°, at which time the airspeed was reduced to about 135 knots (flap extension speed is 140 knots). As the aircraft crossed the 10 NM DME arc, a descent was initiated. The altitude had remained between 3,000 and 3,200 feet from level off.

The DME receiver was located in the radio rack on the aircraft, and the information received was being relayed to the cockpit instruments. When it was found in the wreckage, it was tuned to Channel 39, the proper channel for Glens Falls. It was indicating 9 NM to the station and a heading of 190°. This is not positive proof that the captain was receiving the same information, but our investigation leads us to believe that he was.

Since there was no CVR information available and considering the foregoing, the Board is unable to determine the exact reason why the captain used this procedure. However, it is concluded that, regardless of his reason, he was utilizing the procedure by choice and his navigation instruments were operating. Further substantiation of this lies in the fact that the flight had not made an "in Range" call. If there had been any intent to descend immediately after passing the VORTAC, the "In Range" call should have been made prior to or immediately after the flight arrived over the VORTAC.

A strong cold front with minor waves was oriented north-south approximately 35 NM west of the accident site at the time the accident occurred. Area and terminal forecasts that were available prior to departure from LaGuardia Airport, New York, did not indicate the front would move as fast as it did; however, the forecasts were accurate in most other respects. Winds aloft forecasts for Albany and Plattsburg for 3,000 feet were reasonably accurate with respect to direction, but the existing velocity was 25 to 30 knots stronger than forecast. With this flow, severe turbulence and strong downdrafts would have been encountered on the lee side of Pilot Knob Mountain.

Surface weather observations at Burlington, Vermont, at 2000 and 2100 indicate that the cloud bases sloped upwards to the north of Glens Falls. Three witnesses near Glens Falls and two in the vicinity

of Lake George saw the aircraft. Witnesses around Lake George also said they could see the tops of the mountains to the east (two of them were about 4 miles from the mountaintops and one was about 1 mile distant). These mountaintops ranged from 2,180 feet to 2,334 feet in the immediate vicinity of the accident site. One witness on the west side of Lake George said there was light rain falling at the time and that the winds were moderate. Another witness said it was raining hard, but she also said, "It (the explosion at impact) was so bright as to silhouette the trees and each individual branch." It could not have been raining very hard at the time for her to have been able to see that well, as she was located over 4 miles from the site.

Witnesses along the eastern shore of Lake George said it was raining hard with strong gusty winds. However, one of these witnesses, who was driving along Pilot Knob Road, was able to see the aircraft. His misconception as to the heading of the flight just prior to impact is quite possible attributable to the intermittent nature of his observation. Attention to driving, combined with intervening trees and existing weather conditions, precluded constant observation. The steady red light which he observed on the aircraft presumably was the lower rotating red beacon which was lighted but probably not rotating. (It had been reported as not rotating earlier that day by Maintenance Operations.)

We believe strong winds may have been the reason that some of the witnesses considered the rainfall heavy. Actually, only 0.27 of an inch of rain fell at Warren County Airport on November 19.

Based upon a complete review of the witness statements, we conclude that MO-411 was beneath the clouds in the vicinity of Glens Falls and during much of the flight north of Glens Falls. In particular, it is noted that the flight was beneath the clouds from the west side of Lake George to within 1 mile of the accident site and was visible from the ground during at least part of the last minute of flight prior to impact.

Whether the descent was initiated to clear clouds in the area or because the 10 NM DME was reached could not be determined. Suffice it to say that descent initiation at 1 minute and 8 seconds prior to impact was intentional by the crew. The momentary level-off at 28 seconds prior to impact could have been a result of the turn reversal from 168° to 186° or it could have been a belated, intentional level-off that should have occurred at 2,700 feet. Regardless of the cause for the 6-second level-off, the indicated airspeed began to drop immediately thereafter and to fluctuate. In the period 12 seconds before impact, the airspeed decreased from 110 knots to 84 knots.

The aircraft crashed in a 12° right-wing-down attitude while descending at a 12° angle.

The Board concludes from the foregoing that the crew of MO-411 initiated a letdown from 3,000 feet about 1 minute and 8 seconds prior to impact. Turns were made thereafter, either in an endeavor to remain clear of clouds, or because of the aircraft's approaching the inbound radial of 019°. During this descent and while the crew was probably concentrating on the turns, the aircraft encountered severe turbulence and wind shear associated with strong winds over mountainous terrain "lee of mountain effect." 6/ (the winds were 60 to 65 knots at 3,000 feet) which resulted in an uncontrolled descent into Pilot Knob Mountain.

6/ Lee of the mountain effect - Following is the definition given by the book, "Aviation Weather for Pilots and Flight Operations Personnel" which is a joint publication of the FAA and the Weather Bureau: "A much disturbed condition occurs when wind blows over large mountain ridges. The wind blowing up the windward slope, in a stable atmosphere, is usually relatively smooth. However, it spills rapidly down the leeward side, setting up strong downdrafts and causing turbulence in a situation which can be compared to water flowing down a rough stream bed. These downdrafts may be dangerous and can place an aircraft in a position from which it might not be able to recover. Pilots should allow for this condition when approaching mountain ridges against the wind. If the wind is strong and the ridges pronounced, several thousand feet above the highest obstruction is recommended in crossing the area. It is important to climb to the crossing altitude well before reaching the mountains to avoid having to climb (or trying to climb) in a persistent downdraft.

"Pilots should be extremely cautious when attempting to cross high mountain ranges under strong wind conditions because winds over ridges and through passes and narrow valleys usually are much stronger and more turbulent than the general wind flow. In addition, the wind usually blows in the direction of the passes and valleys, rather than in the direction of the general wind flow.

"When winds in excess of about 50 knots blow approximately perpendicular to a high mountain range, the resulting turbulence may be extreme. Associated areas of steady updrafts and downdrafts can extend many times higher than the elevation of the mountain peaks, with large waves forming on the leeward side of the mountains and extending upward to beyond the troposphere. In the horizontal dimension, these air waves, referred to as 'standing waves' or 'mountain waves,' sometimes extend as far as 100 miles or more downstream from the mountain range."

2.2 Conclusions

(a) Findings

1. The crew was properly certificated and qualified for the flight and had time for adequate rest prior to reporting for the flight.
2. The aircraft was certificated as being airworthy, and the log book was carrying no discrepancies prior to departure as MO-411.
3. MO-411 was cleared for a VOR approach to Warren County Airport by Albany Departure Control when it was about halfway between Albany and Miller Intersection.
4. MO-411 reported over Miller Intersection about 8 minutes after departing Albany. The aircraft was at 3,000 feet, indicating about 170 knots airspeed.
5. MO-411 passed the VORTAC at 3,000 feet and about 160 knots indicated airspeed.
6. Company policy did not authorize the use of DME equipment as the primary navigational instrument.
7. Three witnesses saw the aircraft in the Glens Falls area.
8. The aircraft made a right turn to 018°, with an immediate return to 002°, in the vicinity of the Glens Falls VORTAC.
9. A minute and 15 seconds after completion of the turn over the VORTAC (about 7 NM DME), a reversal of course was commenced.
10. The aircraft was both seen and heard during the course reversal.
11. There was heavy rain with strong, gusty winds and low hanging clouds along the eastern shore of Lake George in the vicinity of the accident site.
12. The aircraft was seen beneath the clouds during the last minute before impact.
13. The aircraft encountered severe turbulence and wind shear when it was approaching the lee side of Pilot Knob Mountain.
14. The average wind at 3,000 feet between Miller Intersection and the accident site was calculated to have been 61 knots from 181° magnetic.

15. MO-411 impacted the northwest slope of Pilot Knob Mountain about 2020 on November 19, 1969, where it burned fiercely for at least 40 minutes.
16. The captain's VOR was tuned to Glens Falls VOR and the CDI had a course selection between 197° and 208°. This indicator was showing a heading of 190°.
17. The DME was indicating 9 miles to the station on the unit in the radio rack and was tuned to Channel 39, which is the proper setting for Glens Falls.
18. The DME indication on the captain's CDI was 919 miles but the indicators were free to move.
19. The accident site was located 9 NM from the Glens Falls VORTAC on the 016° radial.
20. The blade angle of the right engine propeller was found to be 23°50'. (Idle angle is 16°, cruise is 28°.)
21. The left engine r.p.m. indicator read 12,280 r.p.m. at impact and the pointers were not free to move.

(b) Probable Cause

The Board determines that the probable cause of this accident was that the captain, while conducting an approach, exceeded his clearance limits and, thereafter, flew the aircraft into a severe "lee of the mountain downdraft" at an altitude insufficient for recovery. No evidence was found to explain why this particular approach was attempted.

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

June 25, 1970.

Investigation and Hearing

1. Investigation

The Board received notification of the accident about 2120 e.s.t. on November 19, 1969, from the Federal Aviation Administration. An investigating team was immediately dispatched to the scene of the accident. Working Groups were established for Operations, Air Traffic Control, Witnesses, Human Factors, Maintenance Records, Flight Data Recorder, Systems, Structures, Powerplants, and Weather. Interested parties included: The Federal Aviation Administration, Mohawk Airlines, Inc., Fairchild-Hiller, Air Line Pilots Association, Rolls Royce, Dowty-Rotol, and the International Association of Machinists and Aerospace Workers.

The on-scene investigation was completed on November 26, 1969.

2. Hearing

There was no public hearing.

3. Preliminary Report

An interim report of investigation summarizing the facts disclosed by the investigation was published as a special report on December 26, 1969.

Crew Informationa. Captain Raymond P. Hourihan - aged 31

Airline Transport Pilot Certificate - #1393340
 Medical Certificate - Class I dated 10-25-69. No waivers.
 Type ratings - F27/227, Commercial Privileges - SMEL

Total time	5,167 hours
Time in type	343 hours
Time last 90 days	196 hours
Time last 30 days	53 hours
Last Proficiency Check	5/13/69
Last Line Check	12/2/68
Initial Captain Check	12/2/68
Time preceding 24 hrs: Duty time	2:40 hours
Flight time	1:30 hours
Rest time available	19:50 hours

b. First Officer John P. Morrow - aged 31

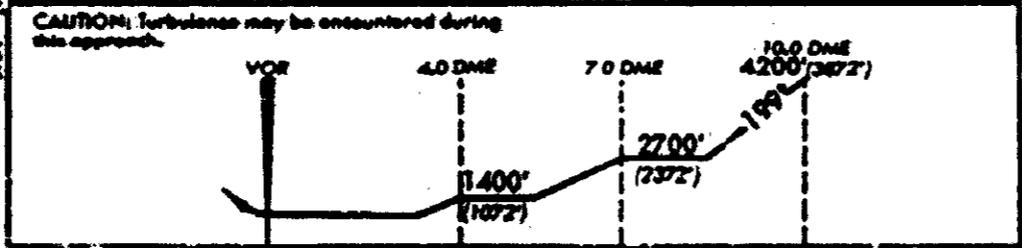
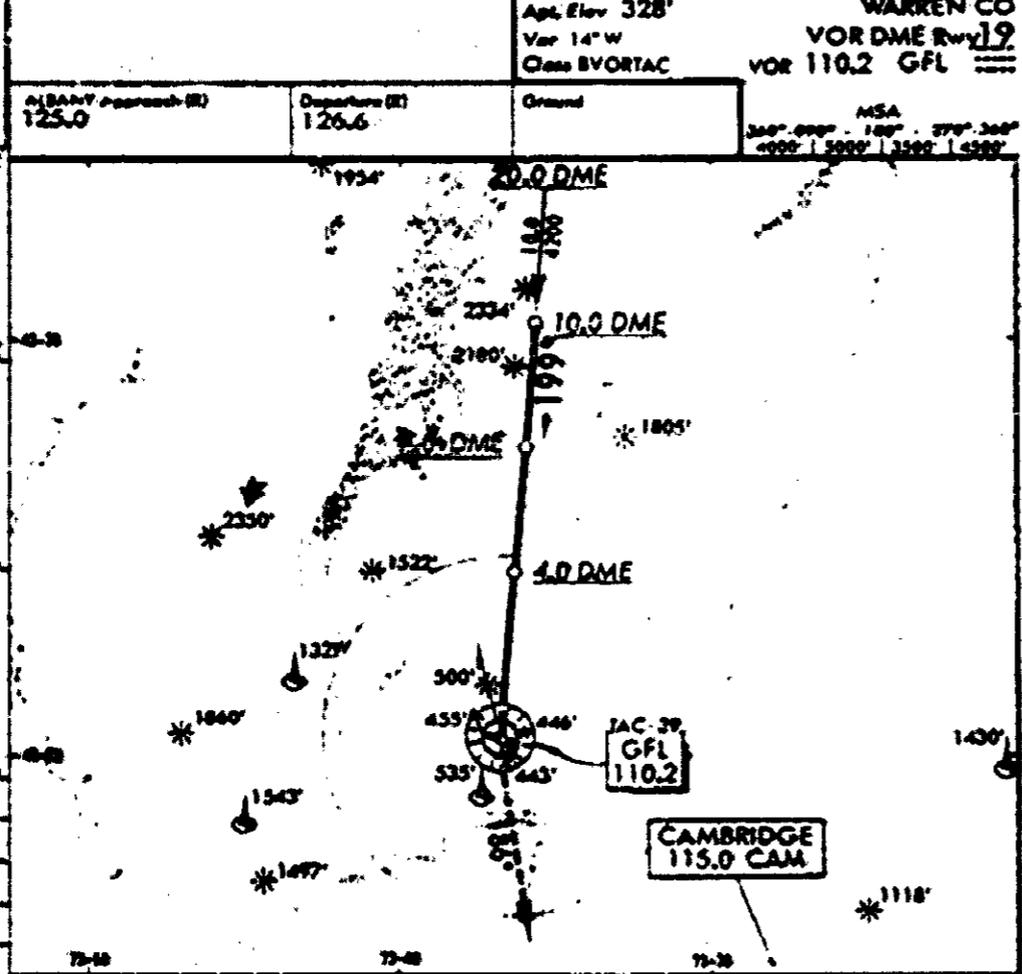
Commercial Pilot Certificate - #1597950
 Medical Certificate - Class I, dated 4-9-69. No waivers.
 Type Ratings - Lockheed 300, SMEL and Instrument Rating

Total time	3,910 hours
Time in type	67 hours
Time last 90 days	67 hours
Last Proficiency Check	10/6/69
Initial Line Check	10/11/69
Time preceding 24 hours: Duty time	2:40 hours
Flight time	1:30 hours
Rest time available	19:50 hours

c. Anne M. Miklochick - Stewardess

Training - current	
Time preceding 24 hours: Available for rest	18 hours
Duty time	6 hours
Flight time this flight	1:30 hours

Terminal Approach Chart SEP 27 48 (13-2) GLENS FALLS, N.Y. WARREN CO VOR DME Rwy 19 VOR 110.2 GFL

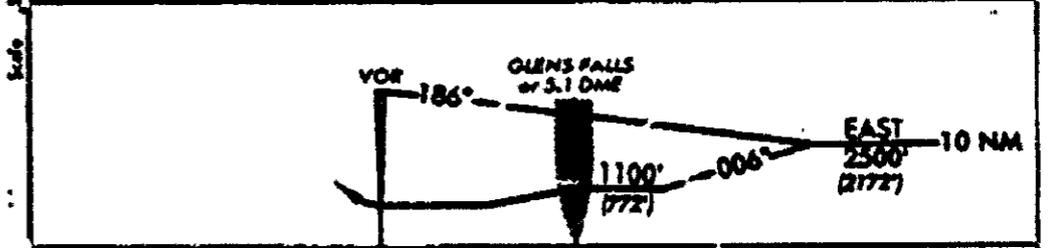
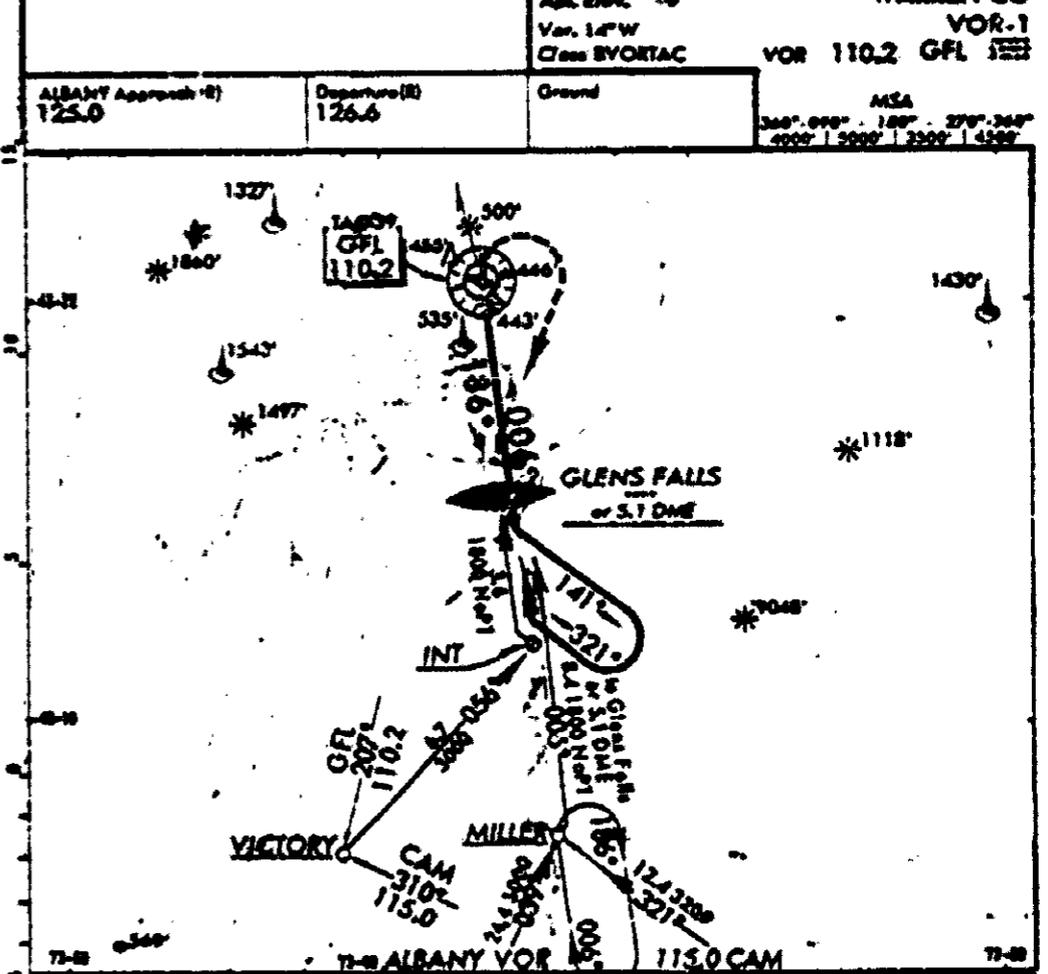


PULL UP to 3000 feet to MILLER INT (GFL VOR R-186 (13.5 DME) & CAM VOR R-321) and hold SOUTH on GFL VOR R-186, RIGHT turns.

STRAIGHT-IN LANDING RWY 19		CIRCLE-TO-LAND	
msl 828'(300')		msl	
A	1	A	828'(500')-1
B	1	B	828'(500')-1 1/2
C	1	C	928'(600')-2
D	1	D & J	928'(600')-2
DEI	msl 828'(300')	Non-Std	1028'(700')-2

Grid: 40 40 100 120 140 160 NOTE: Sliding scale NA.

Terminal Approach Chart DEC 20 48 (13-1) GLENS FALLS, N.Y. WARREN CO VOR-1 VOR 110.2 GFL



PULL UP: turn RIGHT to 3000 feet to MILLER INT and hold SOUTH.

STRAIGHT-IN LANDING RWY 1		CIRCLE-TO-LAND	
msl 828'(300')		msl	
With FM or S.I DME	Without FM or S.I DME	With FM or S.I DME	Without FM or S.I DME
A	1	A	828'(500')-1
B	1	B	1128'(800')-1
C	1	C	828'(500')-1 1/2
D	1	D	1128'(800')-1 1/2
DEI	msl 828'(300')	Non-Std	1028'(700')-2

Grid: 40 40 100 120 140 160 NOTE: Sliding scale NA.

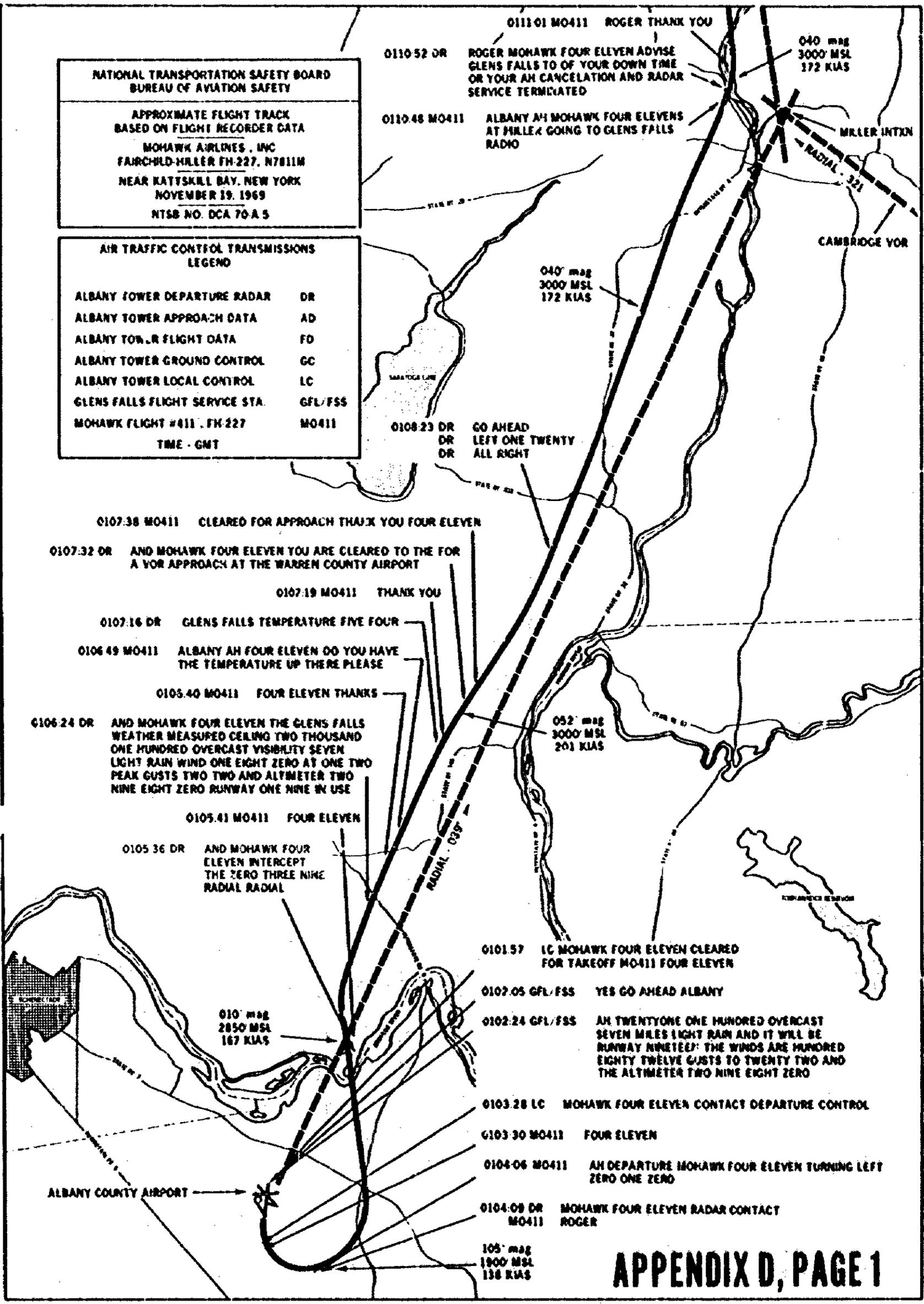
Appendix C

NATIONAL TRANSPORTATION SAFETY BOARD
BUREAU OF AVIATION SAFETY

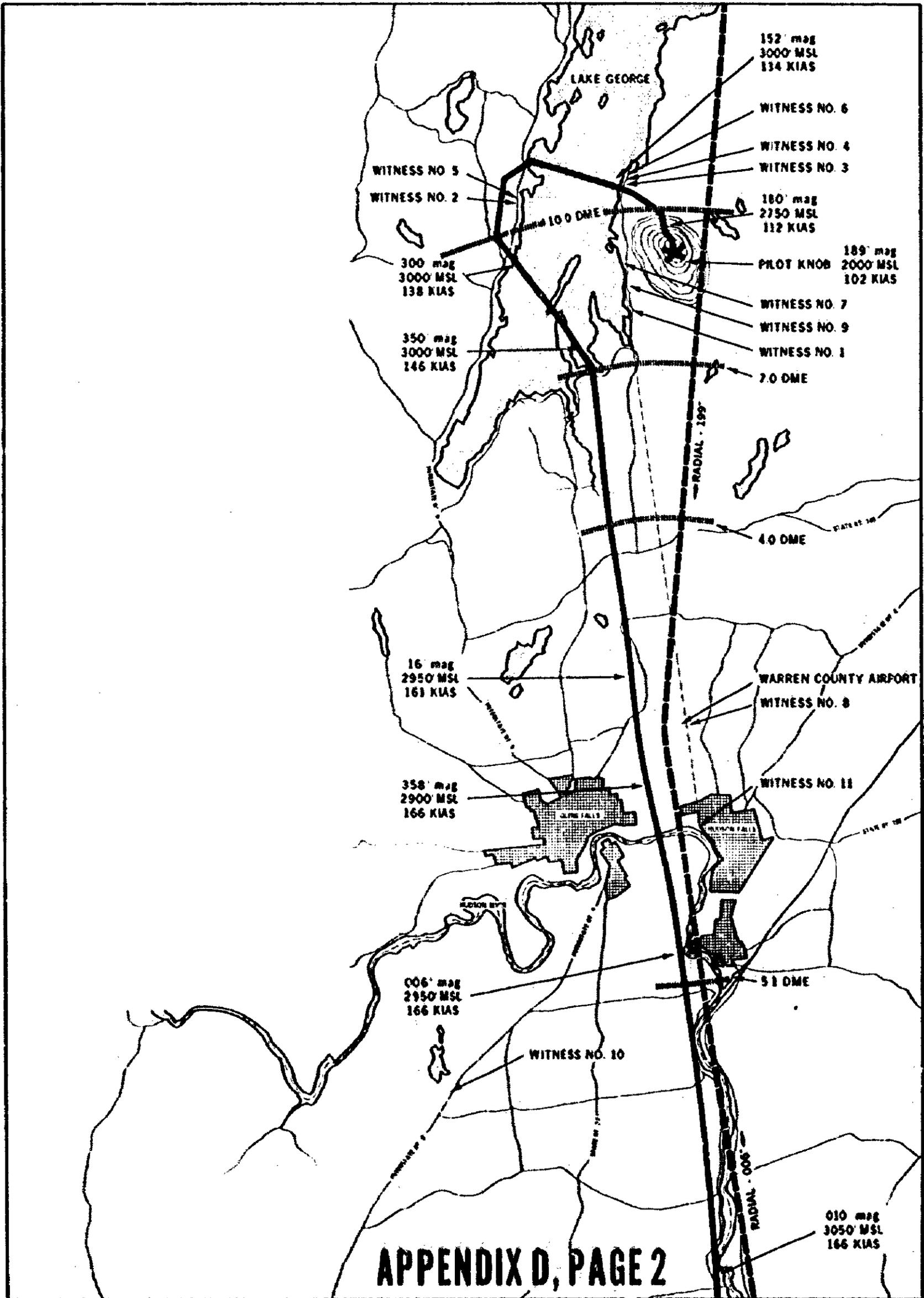
APPROXIMATE FLIGHT TRACK
BASED ON FLIGHT RECORDER DATA
MOHAWK AIRLINES, INC
FAIRCHILD-MILLER FH-227, N7811M
NEAR KATTSKILL BAY, NEW YORK
NOVEMBER 19, 1969
NTSB NO. DCA 70-A 5

AIR TRAFFIC CONTROL TRANSMISSIONS
LEGEND

ALBANY TOWER DEPARTURE RADAR	DR
ALBANY TOWER APPROACH DATA	AD
ALBANY TOWER FLIGHT DATA	FD
ALBANY TOWER GROUND CONTROL	GC
ALBANY TOWER LOCAL CONTROL	LC
GLENS FALLS FLIGHT SERVICE STA.	GFL/FSS
MOHAWK FLIGHT #411, FH-227	MO411
TIME - GMT	



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APPENDIX D, PAGE 2

SEQUENTIAL

FRAMES

OF

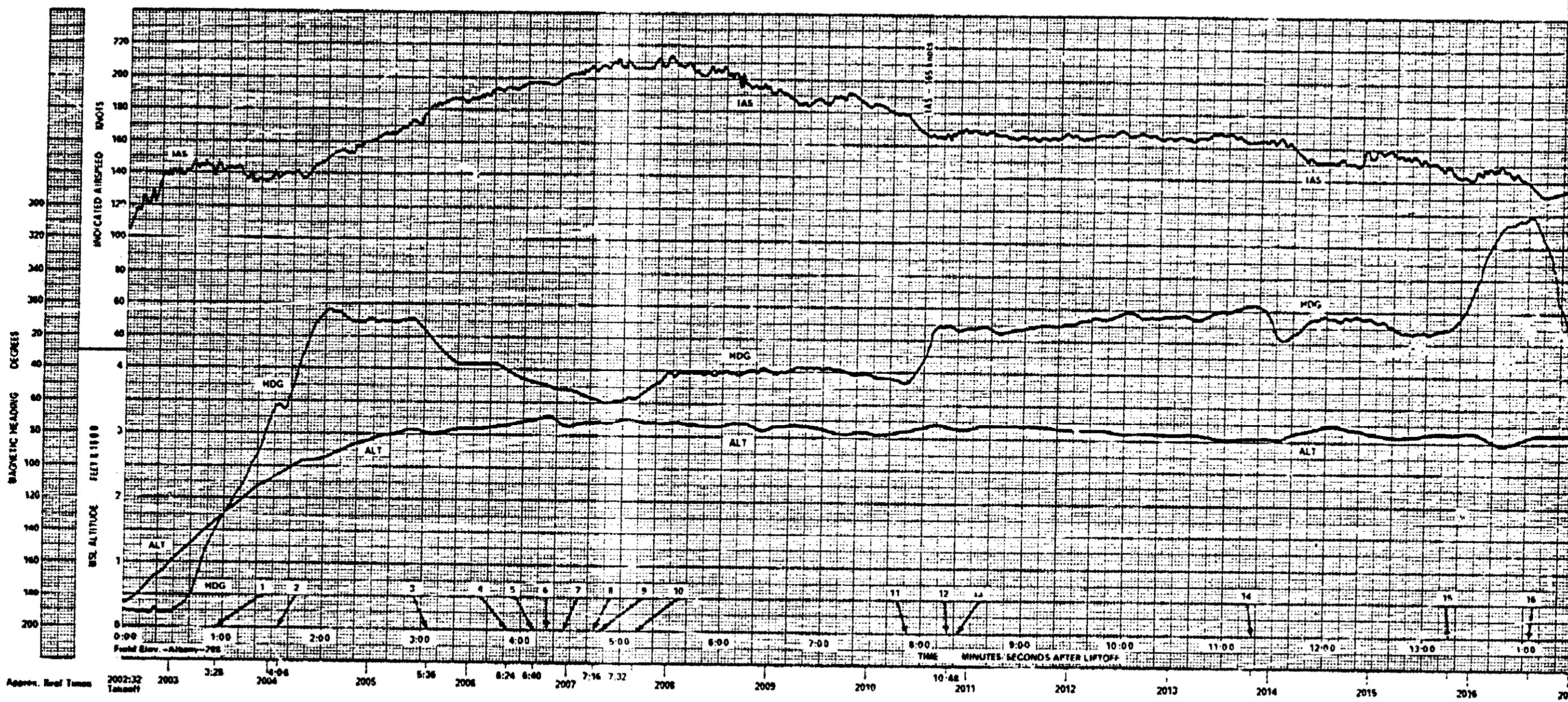
OVERSIZED

DOCUMENT

REQUIRES 2 FRAMES

PAGE # 34

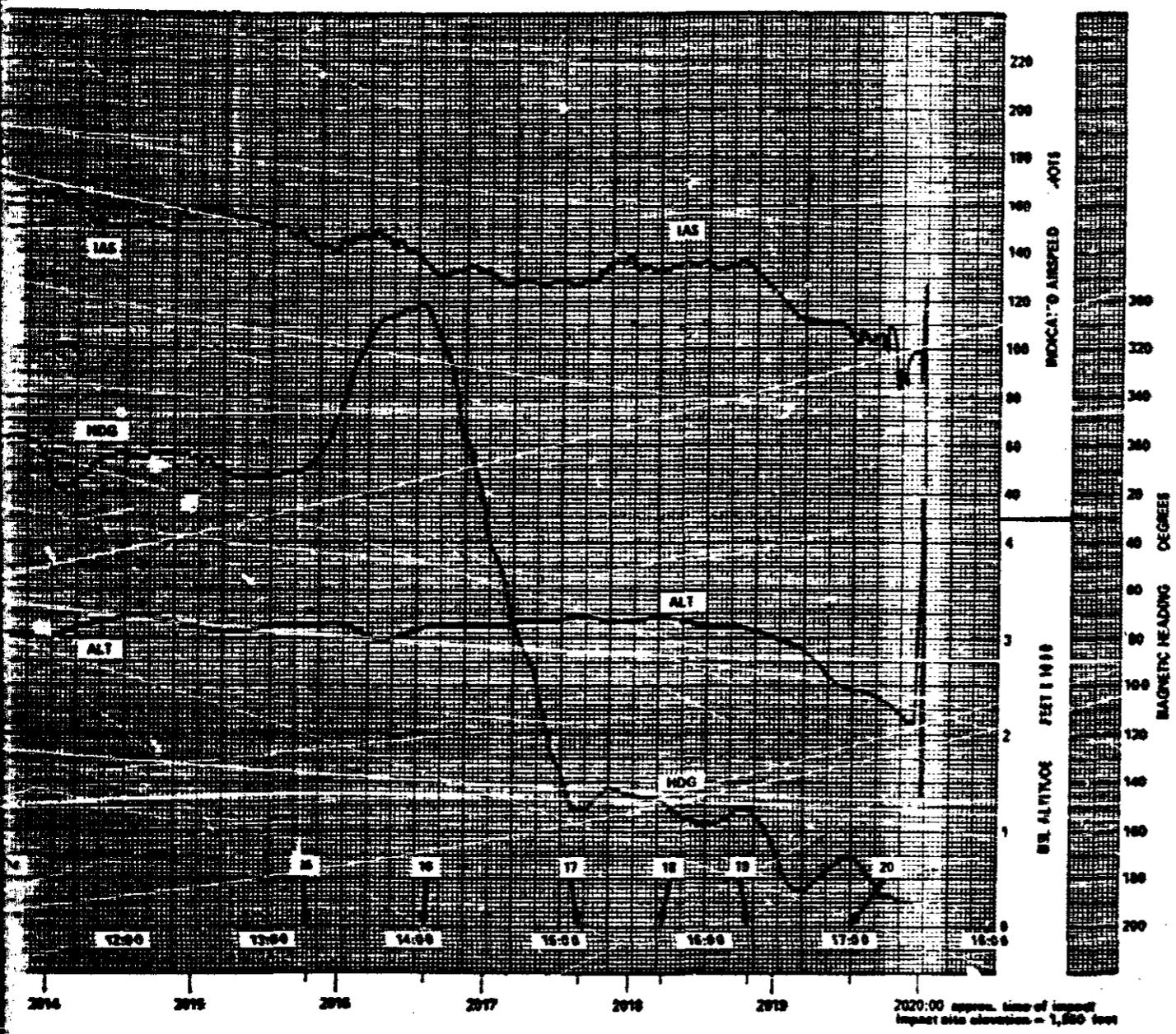
A Thru B



LEGEND

- 1 DR - Mohawk 411 Contact Departure Control
- 2 DR - Air Departure Mohawk 411 turning left zero one zero
- 3 DR - Air Mohawk Four Eleven Air intercept the zero three nine radial
- 4 DR - Air Mohawk 411, the Glens Falls weather measured ceiling 2100 ft, overcast, visibility 7, light rain, wind 180 at 17, peak gusts 22, and altimeter 29.80. Rv 14 in use
- 5 411- Four Eleven, Thanks
- 6 411- Albany Air Four Eleven, do you have the temperature up there?
- 7 DR - Ah, stand by one
- 8 DR - Air Glens Falls temperature two four
- 9 411- Thank you
- 10 DR - Air Mohawk Four Eleven, you're cleared to me - for a VOR approach at the Warren County Airport. 411 - cleared approach. Thank you Four Eleven
- 11 Turn to 090° initiated Miller interaction
- 12 411- Albany Air Mohawk Four Eleven's at Miller going to Glen Falls Radio
- 13 DR - Roger Y. MO-411, advise Glens Falls to, of your down time for your cancellation and radar service terminated - 411 - Roger, thank you.
- 14 Right, left turn commences in vicinity of Glens Falls VORTAC
- 15 Reverse AI turn initiated to the left
- 16 Left turn stops and immediate right turn commences over Lake George
- 17 Right turn stopped at 150°
- 18 Gradual descent begins
- 19 Airspeed begins to bleed off as right descending turn commences
- 20 Momentary level-off about same time greater turbulence commences

APPENDIX



APPENDIX E

DCA 70-4-6
 RPT. NO. 70-25
 NOVEMBER 25, 1969
 REVISED: MARCH 27, 1977

NATIONAL TRANSPORTATION SAFETY BOARD BUREAU OF AVIATION SAFETY WASHINGTON, D.C.
ROMARK AIRLINE, FAIRCHILD-MILLER F41-277 KORTHA, NEAR GLENS FALLS, NEW YORK NOVEMBER 18, 1969
CATASTROPHIC ACCIDENT
FLIGHT RECORDER DATA GRAPH UCDD MODEL, F-542, 5/76 1616

Handwritten initials

SEQUENTIAL

FRAMES

OF

OVERSIZED

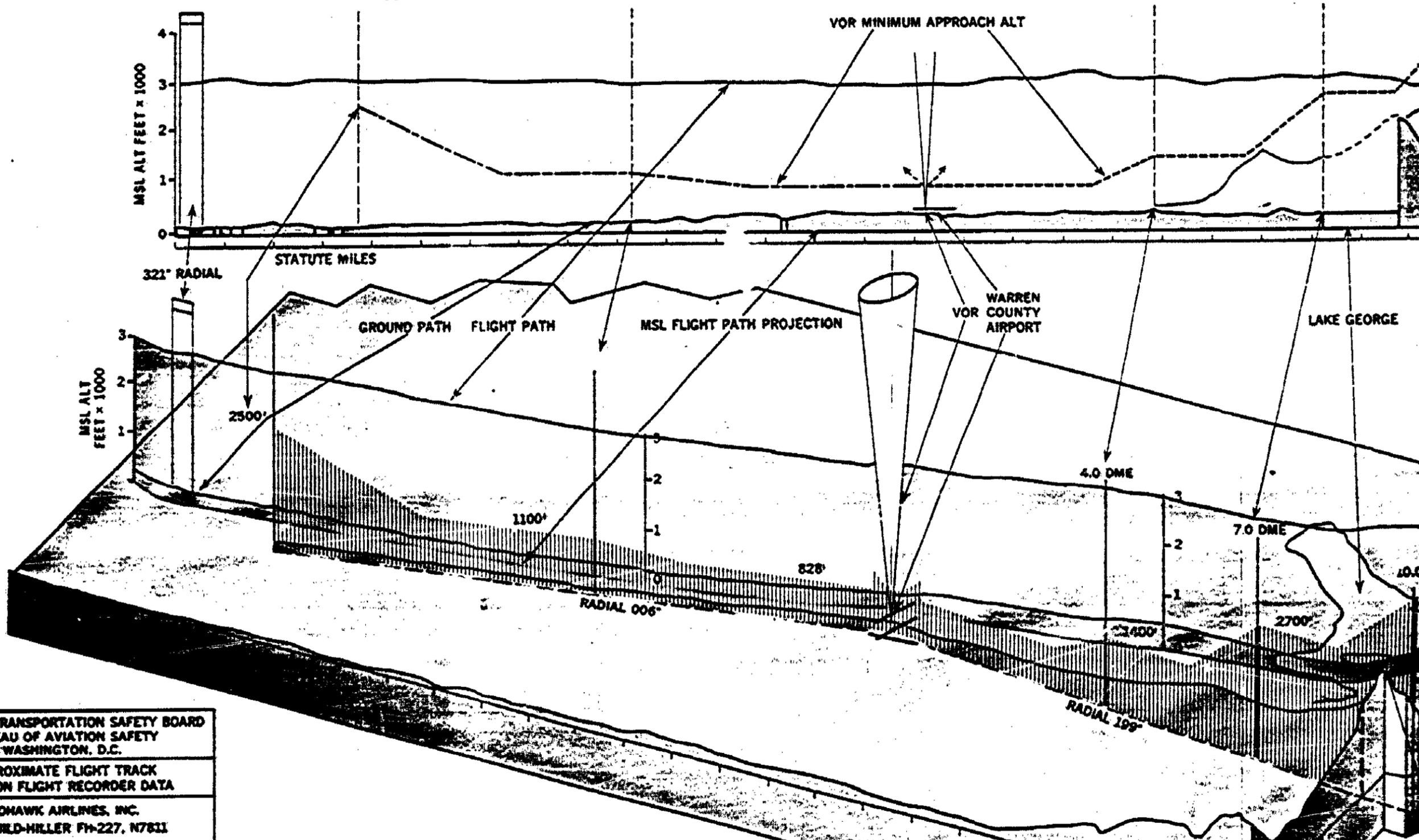
DOCUMENT

REQUIRES 2 FRAMES

PAGE # 3B

A Thru B

ELEVATION VIEW OF FLIGHT PATH



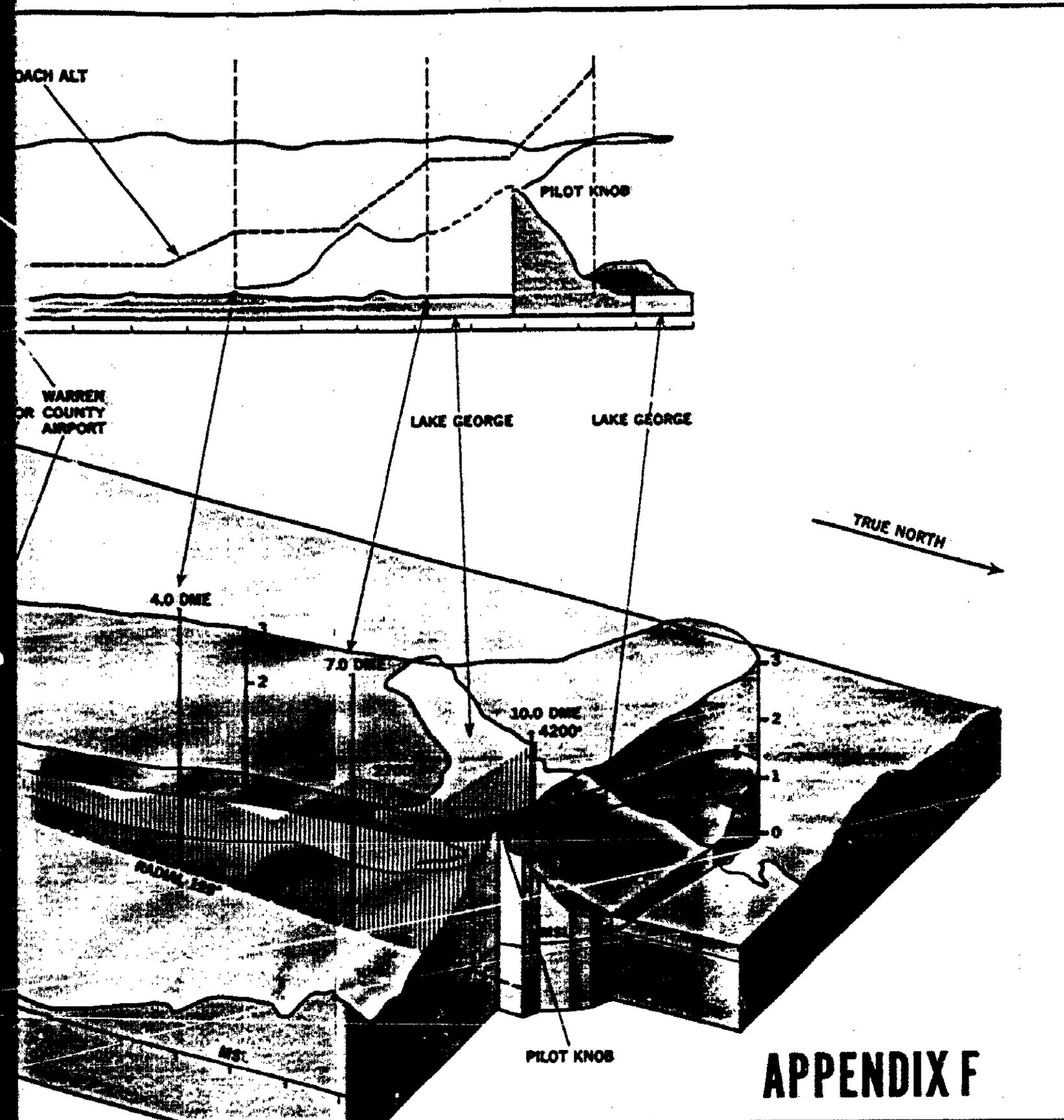
ISOMETRIC VIEW OF FLIGHT PATH

NATIONAL TRANSPORTATION SAFETY BOARD
 BUREAU OF AVIATION SAFETY
 WASHINGTON, D.C.

APPROXIMATE FLIGHT TRACK
 BASED ON FLIGHT RECORDER DATA

MOHAWK AIRLINES, INC.
 FAIRCHILD-HILLER FH-227, N7811
 NEAR KATTSKILL BAY, NEW YORK
 NOVEMBER 19, 1969

DCA 70-A-5, NTSB #



APPENDIX F

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The following information was extracted from the aircraft log book commencing with the page dated September 19, 1969, and ending with the one dated November 18, 1969.

- 9/10/69 Radar OK -F/O CDI-directional flap occasionally disappears from view (as if indicating station passage). Course indicator indicates correctly (this only happens within 10-15 miles of station). Replaced #2 VOR rec. ground checks OK. Request in flt functional check.
- 9/11/69 Radar OK - #2 VOR - no course info on F/O flight director. Everything else normal with exception of VOR flap.
Note: This condition intermittent - OK now. Repeated #2 VOR sys. Functional ck normal on test. Request further inflight check and observation.
- 9/12/69 The #2 VOR indicator intermittent on some frequencies. Momentary flap and buzz on audio Refer to prev. write-ups. Replaced #2 VOR control and #2 VOR revr - inspected antenna connectors - functionally checked on several frequencies with SG 13 tester.
- 9/21/69 Radar - DME OK
Capts. CDI sometimes sticks when coming off side. Replaced CDI indicator, checks normal. Inflight check required.
- 9/25/69 ADF loop switch will not rotate ADF needle either right or left. Loop being routed to A/C - operate per MEL Chapt. 34, Item 17, Page 30.
- 9/26/69 Radar appears normal. Replaced ADF rec. per Page 71828 and functionally checked normal.
- 9/27/69 Radar & DME OK. #2 comm head still stuck on .00 digit. Replaced #2 comm. rec. head. Checks normal.
- 10/2/69 ADF will not home until almost on top of station. Found ADF loose in rack, tightened.
- 10/3/69 Radar and DME OK. #1 NAV comm control head is in non-standard location as to rest of fleet. Please move same. Standardized nav.-comm control head. Left cruise pitch lock hung on level off, light remained on after 10 min. Light went out and lock operated normal after that. Replaced cruise pitch lock indicator switch, performed pitch lock removals static check from expanded check list on left eng. Functionally checked good.

- 10/7/69 Spare inverter 120 volts. OK at LGA. Request further inflight check. ADF homing weak. Replaced ADF rec.-check.
- 10/9/69 Radar and DME OK. Two hdsts, etc. There is a 4 degree discrepancy between capt's and first officer's course directors at times. Cleaned and reseated both compass couplers. Request further observation. At cruise altitude of 12,000 at 180 kts indicated, left cruise pitch unlock light started blinking intermittently, put cruise pitch lock to emerg. Found wrong type gasket and installed new one, left cruise pitch switch. Checked normal on run and shut down.
- 10/12/69 #2 CB60 compass reads 20 degrees high. #2 CB60 compass has returned to normal. Radar DME OK.
- 10/17/69 Voice recorder erase function inop. Adjusted micro switch striker arm. #2 comm receiver distorted. Replaced-off 5943 on 1759.
- 10/18/69 Radar DME tpdix normal. #1 V/G erratic in pitch and roll - replaced #1 VG and functionally checked. OFF-136 ON 122.
- 10/19/69 #1 compass system preprocessing - replaced #1 DG and system functionally checked. OFF 583 ON 607559.
- 10/24/69 Radar DME 2 head sets OK
Check capt's VOR for error - 8 degree diff between capt's and f.o. VOR. Reseated VOR - checks normal.
- 11/3/69 Radar and DME normal. Copilot's VOR erratic. Needle bounces, VOR/LOC flag bounces in and out. Radar spoking (occasionally). Replaced receiver unit. Please comment next flight. VOR rec. OFF 325, ON 3524.
Note - VOR rec. 325 found OK. Bench check OK.
- 11/5/69 Capt's head set intermittent. Replaced head set. Capt's marker beacon lites not working properly. Marker beacon receiver replaced and functional checked satisfactory with test set. OFF 675, ON 771. #1 comm T/R due O.H. Replaced OFF 743, ON 1756. DME due O/H. Replaced DME T/R - functional check satisfactory. OFF 160, On 151.

- 11/9/69 Radar-DME OK. #2 VG very slow to erect - replaced #2 VG. System funct. ckd. satisfactory. OFF 537, ON 520.
- 11/14/69 1. Copilot's VOR erratic, flag occasionally shows and course deviation needle wavers - see previous. Changed VOR rec. JFK. OFF 3534, ON 5503. Note - bench check 3534 OK.
2. Capt's compass card starts motoring during turns, eventually lost sensing altogether.
3. Capt's pitch command bars sluggish to extend, unable to fully retract-afterswitching inverter all instruments worked normal. 2/3 - found main inverter low voltage output 40V. Replaced inverter. Functional checked satisfactory. OFF 15088, ON 16101.
- 11/15/69 FDR tape has less than 20 hours remaining - action - reversed FDR tape. Functional checked satisfactory. #2 VHF nav. receiver failed - replaced #2 nav. rec. Functionally checked OK. S/N 5503 OFF, S/N 5641 ON.
Two pitot drains missing in nosewheel well. Action taken - put in OPR (Open Pilot Report) (Aircraft Status and Deferred Item Sheet Mohawk Form #1605F004)
Note - Mechanic submitted clarification statement - "pitot static drains missing should read: push to drain on two static drains in nosewell missing."
- 11/17/69 Radar transponder and DME normal
Item 1 - When operating on the spare inverter, both VOR flags appear intermittently. Appears to be frequency problem, voltage is normal. No flags appear when operating main inverter.
Action - see Item 3 below.
Item 3 - In reference to item 1, upon further investigation the problem seems to stem from the No. 1 nav. head or from the VOR receiver.
- 11/17/69 Receive an intermittent flag on both VORs with a loud tone at the same time. With #2 nav. off, there seems to be no problem. ILS freq. OK. Replaced spare inverter and taxi checked for correct phasing. Checked normal. VOR S/N 5641 OFF, 10422 ON. Inverter OFF S/N 474, On S/N 015.
- 11/18/69 DME inop. Action - replaced DME. Checked OK on test. OFF, S/N 151, ON 113. Radar and DME look OK.