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16. Abstract

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The National Transportation Safety Board determines that the probable cause of the accident was a failure or malfunction of an undetermined nature in the pilot's attitude indicating system which led to a loss of control and overstress of the aircraft structure.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

AIRCRAFT ACCIDENT REPORT

Adopted: September 14, 1978

SOUTHERN COMPANY SERVICES, INC.
BEECH-HAWKER-125-600A, N40PC
McLEAN, VIRGINIA
APRIL 28, 1977

SYNOPSIS

About 2038 e.d.t. on April 28, 1977, Southern Company Services, Inc., N40PC crashed into a residential area near McLean, Virginia. The corporate aircraft had departed Washington National Airport 4 minutes earlier and was en route to Birmingham, Alabama. After a flightcrew member reported that the aircraft was climbing through 9,300 feet, monitoring radar stations lost continuous reception of the aircraft's primary and secondary radar target information. Shortly thereafter, ground witnesses saw an explosion in the sky followed by the wreckage of the aircraft falling to the ground. The sky was overcast and light rain was falling. The four persons aboard were killed and the aircraft was destroyed. One residence and two automobiles were destroyed by impact and fire and several other homes were damaged by falling debris.

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1. FACTUAL INFORMATION

1.1 History of the Flight

On April 28, 1977, a Southern Company Services, Inc., Beech-Hawker-125-600A, N40PC, was being operated.as a corporate passenger flight from Birmingham, Alabama, to Washington, D.C., and return. The flight departed Birmingham about 0900 e.d.t. 1/ with a crew of two and two company executives. Upon its arrival at Washington National Airport (DCA) about 1025, the company executives departed to attend their scheduled meetings and the crew registered at the Page Airways dispatch desk, arranged for the servicing of their aircraft, and then'went to a nearby motel. The proposed departure time was 2100.

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

About 1834, the crew was briefed by flight service personnel and filed an IFR flight plan to Birmingham with the Washington Flight Service Center (FSS).

About 1945, another Southern Company Services, Inc., flightcrew, who had arrived at Washington National Airport for an overnight stay, met the crew of N40PC at the Page Airways terminal building. The two crews spoke to each other and, according to the incoming crew, the crew of N40PC appeared to be in good spirits.

At 2028:46, after the crew and their two passengers had boarded the aircraft, the crew contacted Washington clearance delivery, and at 2029:02 they were cleared as filed to depart toward the northwest via the Washington 326° radial with vectors to Casanova VOR, to maintain 5,000 ft, and to expect flight level 390 (39,000 ft) 2/ 10 min after departure. They were given a departure frequency of 118.1 MHz, and told to "squawk" 7060. The crew properly acknowledged their clearance; they contacted ground control and were cleared eventually to taxi into position and to hold on runway 36 (360°).

At 2034:14, the flight was cleared to take off and was requested to expedite its climb to 15,000 ft.

At 2036:37, the departure controller instructed the pilot to turn left to 250" and proceed direct to Casanova. About 20 sec later, the controller requested the pilot to confirm that he was climbing to 15,000 ft, and the pilot stated, "Roger." At 2037:05 the controller replied, "Okay your altitude just stayed at five for a while, see you're leaving sixty-two now, is that correct?" The pilot responded, "Standby one, sir please." At 2037:29 the pilot transmitted, "Papa-Charlie say again." The controller advised, "Okay sir Papa-Charlie turn left heading two three zero and say altitude leaving." The pilot stated, "Okay we're going up through about ninety-three.'' The controller again repeated the vector of 230°, and at 2037:46 the pilot acknowledged, "Roger;" this was the last known transmission from the aircraft.

The automated radar terminal system (ARTS 111) provided the departure controller with automatic tracking and flight data information from two antenna sites located at Washington National Airport and Camp Springs, Maryland. Additionally, the National Airspace System (NAS) Stage-A antenna at Suitland, Maryland, tracked and recorded target information in the data analysis reduction tool (DART) system at the Washington Air Route Traffic Control Center (ARTCC). The ARTS III track of the transponder information includes aircraft position, time, altitude, and groundspeed. If a transponder return is missed, the computer will estimate the aircraft's position and identify the target as "coast mode." At 2037:38 the encoded altimeter indicated 9,100 ft. Calculations indicate that the aircraft was traveling at a true airspeed of 274 kns.

2/ All altitudes herein are mean sea level unless otherwise indicated.

After three successive sweeps, another target return was recorded at 4,200 ft at 2037:51. The Camp Springs antenna did not record any targets above 8,500 ft, but did receive a target at 2,100 ft at 2037:54. This was the last radar contact recorded by either radar system. The highest altitude observed was recorded at 9,300 ft by the Suitland antenna at 2037:47.

About 2038, the main aircraft wreckage crashed into a residential area in McLean, Virginia. (See figure 1.)

Seventy-one statements were obtained from witnesses in all quadrants surrounding the crash site, but predominantly to the southwest and southeast. Several persons, located principally in two clusters southwest of the accident site, either saw or heard a jet aircraft in flight before or coincident with an explosion and a fireball. Three others saw aircraft-related shapes in the falling debris. Some witnesses also saw lights operating on the aircraft.

Twenty-three persons, located in an arc south-southwest to south-southeast of the accident site, saw a streak of light, flame, or glow, in the sky before the explosion. Many saw fireballs in the air, and heard an explosion before seeing the fire. Seventeen persons saw the explosion as it occurred.

Witnesses were attracted to the aircraft by the sound of the explosion, the sound of the aircraft, or the brilliance of the streak of light or fireball. They reported an overcast sky with light rain or mist. Witnesses estimated that the cloud ceiling varied from 5,000 to 10,000 ft.

The accident occurred during the hours of darkness at latitude 77° 13' 1" N and longitude 38° 56' 41" W.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	2	2	0
Serious	0	0	0
Minor/none	0	0	0

1.3 Damage to Aircraft

The aircraft was destroyed.

1.4 Other Damage

The aircraft crashed in a populated residential area of Fairfax County, Virginia. One house and two automobiles were destroyed by impact and fire, and several other homes were damaged by falling aircraft debris.

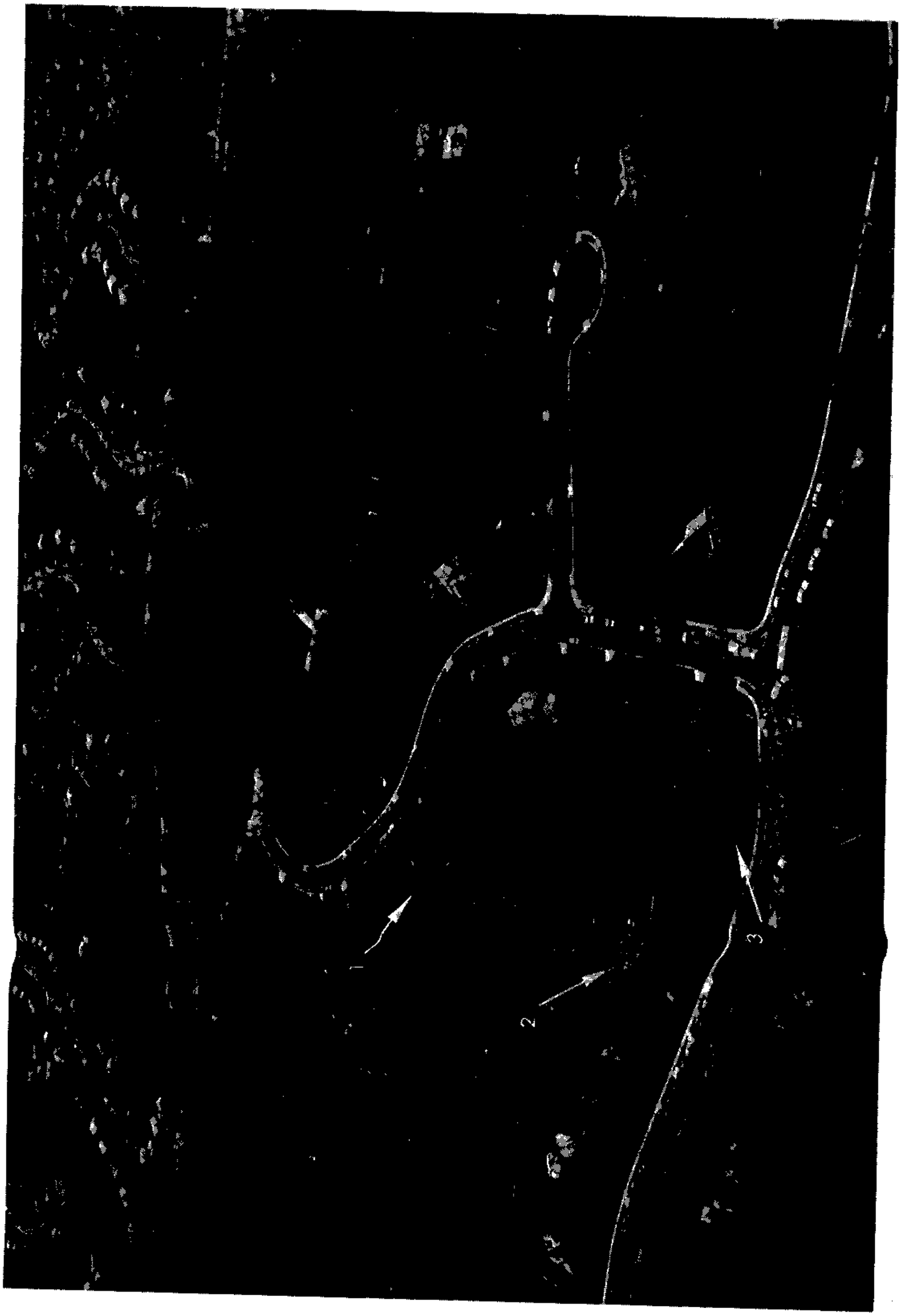


Figure 1. Aerial view of wreckage area.
(1) Left wing,
(2) fuselage, and
(3) right wing and burned house.

1.5 Personnel Information

The two crewmembers were properly certificated for the flight. (See Appendix B.)

1.6 Aircraft Information

The aircraft was certificated, equipped, and maintained in accordance with Federal Aviation Administration (FAA) requirements. The gross weight and c.g. were within prescribed limits for the takeoff.

The total wing tank fuel capacity was 1,418 gals of usable fuel. The refueler stated that 449 gals of Jet A kerosene was added to the left wing tank and 451 gals was added to the right wing tank; he stated that the left tank was full. The dorsal and ventral fuselage tanks have capacities of 61 and 135 gals, respectively, and they were empty.

The takeoff gross weight of the aircraft was 22,000 lbs, and the center of gravity was 26.7 percent MAC. The allowable range for that weight is 18.9 percent to 35 percent. The maximum allowable takeoff weight is 25,000 lbs. (See Appendix C.)

The climb performance of the BH-125-600A is as follows:

1. At normal climb power; - 98 percent rpm
   Sustained steady rate of climb - 3,500 ft/min

2. At maximum continuous power; - 100 percent rpm (takeoff power)
   Sustained steady rate of climb - 4,000 ft/min

According to the aircraft manufacturer, the rates of climb are approximate and are based on a climb from sea level to 10,000 ft at 230 kns indicated airspeed (KIAS) and at a gross weight of 22,000 lbs.

1.7 Meteorological Information

The 2000 surface weather map prepared by the National Weather Service showed a stationary front oriented east-west through central Virginia, approximately half way between Washington, D. C., and Richmond. This front passed the Washington area as a cold front with the wind shift reported at Dulles International Airport at 1553 and at Washington National Airport at 1630.

The weather behind the front in northern Virginia was characterized by strong northerly winds with surface gusts to 30 kns, overcast skies, and light rainshowers. Surface visibilities ranged from 4 to 10 mi. Surface temperatures, which had been in the low 80's, had dropped rapidly to the upper 40's after the frontal passage and remained well above freezing throughout the period.

The special surface observation, taken by National Weather Service personnel at Washington National Airport about 2 min after the accident, was as follows:

> Measured 2,100 ft broken, 5,000 ft overcast, visibility--4 mi, light rain, wind--330" at 15 kns, altimeter setting--29.90 ins, pressure rising rapidly.

Two special surface observations by National Weather Service personnel at Dulles International Airport were as follows:

> <u>2020</u> - Measured 1,500 ft broken, 2,600 ft overcast, visibility--7 mi, light rainshowers, wind--360' at 10 kns.
>
> <u>2052</u> - Measured 700 ft broken, 1,500 ft overcast, visibility--5 mi, wind--350° at 9 kns.

The WSR 57 weather radar, operated by personnel of the National Weather Service at the Patuxent River Naval Air Station, showed the area of the accident and the flightpath of the aircraft to be in an area with 5/10 sky coverage of moderate rainshowers at 2030. Most of the cloud tops in the area were at 18,000 ft. There were no significantly higher tops in the vicinity of the accident. A special observation at 2053 showed that the accident area contained thunderstorms and moderate rainshowers with 6/10 sky coverage.

AIRMET BRAVO 5 3/, issued at 1635, and valid for the period through 2235 was as follows:

> <u>Flight precautions.</u> Ohio, adjacent Great Lakes, West Virginia, Maryland, District of Columbia, Delaware, Virginia, North Carolina, South Carolina, and adjacent coastal ... winds 30 kns or greater within 2,000 ft of the surface. Additionally ... occasional moderate turbulence below 8,000 ft. Continue advisory beyond 2235.

The convective forecast, issued by the National Severe Storm Forecast Center at Kansas City, Missouri, at 1100, and valid between 1100 on April 28 and 0800 on April 29, called for the possibility of general thunderstorms in an area which included the intended flightpath of N40PC. There were no severe thunderstorms forecast for the area.

3/ An AIRMET is issued for weather phenomena of particular significance to light aircraft safety.

The terminal forecasts for the vicinity of the flightpath issued by the National Weather Service Forecast Office, Washington, D.C., were, in part, as follows:

1500 - Cold frontal passage, ceiling 5,000 ft broken, wind--290" at 12 kns. Chance of ceiling 3,000 ft overcast, visibility--5 mi reduced by light rainshowers.

After 1800 - Wind--350° at 14 kns.

After 2100 - Ceiling 3,000 ft broken, 10,000 ft overcast, wind 350" at 12 kns. Clouds broken, variable scattered.

The 2000 radiosonde sounding, made by personnel of the National Weather Service at Dulles International Airport, showed strong layering between the surface and 14,000 ft. The column was saturated between 4,700 and 13,000 ft with shear zones at 3,000 and 10,500 ft. The freezing level was at 8,800 ft.

The winds aloft recorded during the 2000 sounding at Dulles International Airport are as follows:

Height (ft)	Direction (°T)	Speed (kns)
Surface	330	14
1,193	357	30
2,107	002	35
2,994	352	21
3,892	284	15
4,840	256	29
5,770	224	38
6,718	240	40
7,658	242	39
8,597	250	41
9,536	255	44

1.8 Aids to Navigation

N40PC was being radar vectored by DCA departure control. The radar equipment, ASR-7, was located on the airport adjacent to the approach end of runway 36. The Washington National noise abatement procedures include flight departure reference to the 326" radial of the DCA VOR-DME navigational station. Both facilities were checked after the accident and were found to operate normally.

1.9 Communications

No communication problems were reported.

1.10 Aerodrome Information

Not applicable.

1.11 Flight Recorders

Not applicable.

1.12 Wreckage and Impact Information

The aircraft broke up in flight and was scattered over an area 4,200 ft long and 1,600 ft wide. The wreckage was strewn through the heavily populated residential area on a heading of 022°. Starting at the perimeter of the 4,200-ft-long wreckage path, the first major piece of structure was the middle section of the rudder. The dorsal fuel tank was found about 900 ft farther along the wreckage path with portions of the left aileron, left wing leading edge, and left elevator within the next 1,100 ft. The outboard section of the left wing was about 600 ft farther along the wreckage path. A large section of the rear fuselage with two-thirds of the vertical stabilizer attached was found 300 ft farther along the wreckage path. A large section of the rear fuselage with two-thirds of the vertical stabilizer attached was found 300 ft farther along the wreckage path. Finally, the right wing and wing center section struck a house, which was subsequently burned, and the main section of the fuselage landed inverted in the backyard of another house, bounced, penetrated the back wall of the house and became lodged. Both engines, which had separated in flight, and the aircraft batteries, which had also separated, were located near the main section of the fuselage. (See Appendix D.)

All flight control surfaces were found. There was no evidence of either lightning or bird strike damage, nor was there any evidence that an explosive device had detonated. There was no fire damage on any of the fuselage or empennage structure.

About 70 percent of the wing structure was identified, and there was sufficient residual structure to account for about 20 percent of the remainder of the structure. Virtually all of the wing structure had been burned by ground fire except skin fragments and ribs 4 and 7 of the left wing.

The left wing front spar had been bent downward with an increasing downward twist at the tip. The rear spar was also bent downward except for a sharp upbend at the tip. The upper and lower skin of the left wing exhibited compressive buckles. A large T-shaped fracture was found at the tip in the upper skin over the left wing fuel tank area. The fracture surfaces were sooted. The right wing had been damaged severely by impact and fire, and wing deformation before impact could not be determined.

The upper vertical stabilizer was separated from the horizontal stabilizer attaching structure. The horizontal stabilizer was separated from the lower vertical stabilizer between ribs 4 and 5. The left horizontal stabilizer had separated along the chord line at rib 6. The upper and lower skin of the horizontal stabilizer had been buckled by compressive loading.

Both engines had been damaged severely by impact. There was no indication of fire or foreign object damage around or inside the nose cowls, air intakes, or compressors, and none of these showed evidence of significant rotation at impact. No evidence of internal operating distress was found during examination of either engine.

Examination of the aircraft's hydraulic and air conditioning system components showed no evidence of operating distress. The aft fuselage had separated from the forward fuselage section at a point just aft of the aft pressure bulkhead.

Examination of the design features of the electrical system showed that interruption of electrical power should result if the aft fuselage section of the aircraft separates. In addition, separation of the control circuit wiring should result in the opening of all generator and battery relays.

The attitudes displayed on the captain's and first officer's attitude indicators differed markedly. The captain's flight director indicated an upright attitude with 4° nosedown and 7" right wing down. The first officer's self-contained attitude indicator showed an inverted attitude with 30° noseup, 10" left wing down.

The vertical gyro, which provides attitude information to the pilot's flight director, was damaged by impact. The case was squashed down and aft forming a mold over the inner gyro structure. The gyro gimbals indicated a 45" left wing down attitude and a 35" nosedown attitude. The lockout solenoid was extended; however, it was damaged and free to move to either the extended or retracted positions.

If all electrical power is lost on the aircraft, the pilot's ADI should display five failure flags, and his course deviation indicator (CDI) should display three failure-flags. There were no failure flags showing on either instrument when they were examined. 'However, the preimpact position of the flags could not be determined. The solenoid pin retracts during operation with 115-volt a.c. electrical power and extends when power is removed so that the gyro will not roll inverted. If power is interrupted while the gyro is inverted, the pin will permit the gyro to return to the upright position.

Examination of the E-1 slip ring block in the vertical gyro revealed that the No. 3 brush, which provides 115-volt a.c. power to the gyro motor, the No. 4 brush, which provides 26-volt a.c. power to the pitch synchronizer, and the No. 5 brush, which provides ground for the pitch synchronizer, were burned off on the same side of the slip ring block. The brush holders were also damaged. Brushes on the E-2, E-3, and E-4 slip ring blocks were not burned. However, the No. 5 left hand brush of the E-3 slip ring block appeared to have arcing marks, and the No. 3 left hand brush showed evidence of overheating.

Examination of all light bulbs removed from the wreckage revealed that only three had nodules on the end of the filaments. The three bulbs were from the aft emergency exit light (self-contained battery unit) and the two bulbs from the lower rotating beacon.

1.13 Medical and Pathological Information

Post-mortem and toxicological examinations and a review of the medical records of the crew did not reveal any preexisting disease or condition which would have precluded them from performing their duties.

1.14 Fire

Emergency fire equipment from Fairfax County fire stations responded immediately upon being notified of the accident. Fire, rescue, and police units from McLean, Dunn Loring, and Great Falls, Virginia, were dispatched to the scene by the Fairfax Operations Center, which serves as a dispatch and coordination center for all emergencies in Fairfax County.

1.15 Survival Aspects

This accident was not survivable.

1.16 Tests and Research

1.16.1 NASA Trajectory Analysis

At the Safety Board's request, NASA's Langley Research Center conducted a trajectory analysis in order to determine the altitude of breakup. Four major assumptions and estimates were used in the analysis:

(1) Breakup was caused predominately by aerodynamic flutter;
(2) the in-flight breakup was instantaneous;
(3) all fragments selected for analysis had the same initial velocity; and
(4) the aerodynamic characteristics--drag coefficients and reference areas--were estimated.

The trailing edge of the left flap skin, the left aileron balance weight, the vertical fin leading edge tank, and the left and right elevator balance weights were selected for the analysis.

A computer program was developed to determine the probable trajectory of selected pairs of the wreckage fragments. Initial conditions were assumed for fragment airspeed at breakup and flightpath orientation. The program determined an airplane altitude at breakup in which the computed distance between the fragments at ground level was equal to the measured ground distance. The computed line connecting the two fragments at ground level was to coincide with the direction of the line connecting the fragments on the wreckage distribution plot adjusted.

The'initial estimate of flight direction at breakup was based on a radar plot and the wreckage distribution chart. These data indicate a steep left spiral to breakup, with the final portion of flight in a northeasterly direction of about 35° magnetic. For most calculations, the computer analysis of data assumed a flutter speed of 530 KIAS (1.4 times the maximum cruise speed) at breakup. 'The average flightpath angle of -25" during the final portion of the flight was also used for most calculations. However, some calculations were made at zero and speeds of 355 and 470 KIAS, and at flightpath angles of 0°, -45°, -60°, and -90" in order to assess the sensitivity of the results to the various airspeeds or flightpath angles or both. Some calculations were also made using twice the assumed drag coefficient.

The breakup point was found to be most sensitive to the initial flightpath angle of the left flap skin and the left aileron balance weight. At the assumed 530 KIAS, breakup varied from 2,300 ft for 90° to 500 ft for 0"; the predicted breakup altitude for a 530-KIAS, 90° dive differed only by 100 feet of altitude from a 0 airspeed free-fall case. Similarly, at a flightpath angle of -25°, a change in airspeed from 530 KIAS to 355 KIAS only changed the breakup altitude from 1,280 to 1,400 ft. It is not likely that the aircraft could have reached the breakup position for either the shallow or steep flightpath angles from the last radar positions. However, the aircraft could have reached the flightpath angle of -25°. Considering a possible +5° error in the flightpath angle and some uncertainty in speed and—in the estimates of the aerodynamic parameters of the fragments, the trajectory analysis indicated that the aircraft probably broke up at 1,300 ft, +300 ft. Further, the direction of flight was estimated to be within—10' of the original 35° estimate.

1.16.2 Hawker-Siddeley Aviation, Ltd. Flutter Calculations

Flutter involves aerodynamic forces, inertia forces, and the elastic properties of a surface. The distribution of mass and stiffness in a structure determines certain natural frequencies and modes of vibration. Flutter is generally a problem of high speed flight and, if an aircraft is properly constructed, it will not occur within the normal flight operating envelope of an aircraft. Flutter for the Beech-Hawker 125-600A was calculated by Hawker-Siddeley Aviation, Ltd.; no flutter problems occurred within the flight envelope of the aircraft. All speeds at which flutter occurred were above 450 kns equivalent airspeed, which is 1.25 x V_D.

1.16.3 Metallurgical Examination of Plunger of the Roll Stop Solenoid

The damaged plunger of the roll stop solenoid of the Collins 332D-11A gyro was examined to determine if it was fully extended (electrical power off) or retracted (power on) when it was damaged; however, this could not be determined. The fracture features and associated deformation of the plunger indicated that the separation of the plunger resulted from overload bending forces with the pin partially extended. Gross deformation to the gyroscope cover near the plunger showed that the overload force had been transmitted through the cover. It was noted that impact forces could cause the pin to travel to its extended position just before it impinged the cover.

1.16.4 Examination of Flight Director/Gyro Malfunctions on the BH-125 Aircraft

Because of the postaccident condition of the components of the Collins ADI and the results of the findings when the instrument was examined at Rockwell International Corporation, the Safety Board conducted a special investigation of flight director/gyro malfunctions on the BH-125 aircraft. A portion of the investigation pertained to the examination of the wire brush holders and brushes from the Collins ADI aboard N40PC.

Damaged brush holders E-1, E-2, and E-3 were examined in the Safety Board's laboratory. Visual examination determined that brushes 3, 4, and 5 of the E-1 holder had evidence of molten ends. They were located on the lower half of the outer end of the brush block. These three wires had been shortened about one-third their original length. The ends of six of the remaining wires had started to melt. Only the top No. 1 wire had not melted or burned. There was no arcing on any remaining brush at its contact point with the slip ring. There was no evidence of arcing or melting on the brushes on the E-2 brush holder; however, brush No. 5 of E-3 brush holder appeared to have arcing marks and the No. 3 left hand brush showed evidence of overheating. The inside surface of the metal cover in the immediate area of E-1 brush holder was damaged where it contacted the E-1 brush holder and slip ring assembly. The gouge marks on the inner surface of the cover were examined carefully for evidence of electrical arcing, but none was observed. However, there were marks which corresponded to the spatial relationship of four of the brushes which had been burned.

Testing could not duplicate the burns on the brushes found in the wreckage. The brushes are designed to withstand a current flow of 3 amperes and are protected by a 1-ampere fuse in the power supply circuit.

The study also concluded that the gyro will take 10 min to run down from a maximum of 22,000 rpm. It will stay upright down to a speed of 400 rpm under test conditions which do not include the effects of acceleration forces during maintenance flight.

As the result of these findings and because of the possibility that, if such brush damage occurred in normal flight, the ADI would malfunction and would probably give incorrect attitude indications, a survey was made of repair facilities to determine if similar malfunctions had occurred. Reports received indicated that brushes were burned or arced only at the slip ring contact surface. There were no reports of brushes burned away or melted on the tip ends. Additionally, a request was made through the National Business Aviation Association (NBAA) that its members report any failure of the gyro or attitude indicators which they may have experienced. No reports were received by NBAA.

However, several pilots had previously told Safety Board investigators that ADI's had displayed erroneous attitude information without displaying a warning flag but they had not documented their observation. Therefore, the Safety Board could not pursue this area of investigation.

1.17 Additional Information

1.17.1 Previous Electrical and ADI Problems

Southern Company Services, Inc., pilots reported a previous electrical failure in N40PC which resulted in a total loss of AC power. As a result of the failure, the No. 1 voltage regulator (Rotax U6120, serial No. 1212) was replaced. This regulator came under Safety Board custody before any maintenance was performed. The Safety Board took it and two regulators from N40PC to Trio Aviation, Dallas, Texas, for testing.

Voltage regulator serial No. 1212 was found to have a faulty No. 1 card (oscillator). The No. 1 voltage regulator from N40PC also was found to have a faulty oscillator card. The cards were examined to determine the cause of the faults. The card from serial No. 1212 was faulty on the first test, but performed normally thereafter. All attempts to duplicate the first test were in vain. The oscillator card from N40PC's No. 1 voltage regulator had a failed toroid coil in the oscillator circuit. Microscopic examination of the failed wire showed separation under a tension overload, but no evidence of heat. The failed section of wire was bonded in the epoxy covering around the toroid coil. This portion of the epoxy covering was not rigid.

A fault tree analysis of the electrical system in N40PC was performed to verify the accuracy and sequence of the reported electrical failure. However, it was determined that the failure, as reported by the previous flightcrew, could not be duplicated with the electrical system installed in N40PC. Either the flightcrew's recollection of the previous failure was in error, or normal procedures were not followed.

Hawker-Siddeley Aviation, Ltd., had issued Flight Crew Information Circular No. 17 for 125-Series aircraft concerning the attitude director indicator. This was available to the crew of N40PC. It states, "There has been a recent incident where an Attitude Director Indicator froze at zero roll attitude without a failure flag showing. The particular aircraft was fitted with dual instruments and a comparator which did give a warning of the failure. The standard installation of a single attitude director indicator relies upon the instrument and gyro monitoring circuits to detect failures and provide a flag warning. Pilots are reminded that there are faults which would not produce a flag, therefore, reliance is placed upon flight crew cross monitoring the other artificial horizon and additional indication from altimeter, turn and slip and vertical speed indicator."

Since the electrical system failure that occurred on March 29, 1977, the company syllabus emphasized flightcrew emergency training for that possibility.

2. ANALYSIS

The aircraft was properly certificated and had been maintained in accordance with FAA regulations and company procedures. The crew was qualified, and there was no indication of any preexisting disease that would have affected the performance of their duties.

The earliest indication of abnormal operation was about 3 min after takeoff when the aircraft was in a left climbing turn to 250°. Correlation of the ATC transcript and the ARTS III radar plot indicates that during this turn the climb was interrupted. The aircraft descended from 5,400 ft to 5,000 ft and maintained that altitude for about 10 secs before resuming the climb. This anomaly in the encoded altitude indication prompted the controller to request confirmation that the aircraft was climbing to 15,000 ft. The crew then responded with an unusual, "Standby one, sir please." The significance of this transmission is emphasized by the fact that the aircraft was operating in a dense traffic area with instructions to expedite the climb to 15,000 ft, and the copilot's only responsibility at that time was to handle radio communications with the departure controller.

The Safety Board believes that some unusual event must have captured the crew's attention because at this point they began to deviate away from their turn to the assigned heading of 250°. The turn reversed back to the northwest as the rate of climb began to increase rapidly. The Safety Board cannot explain the reason for the climb, which exceeded the 4,000 ft per minute steady-state climb at maximum continuous power as specified by the manufacturer. The crew was probably absorbed by this unreported event and did not communicate for 20 secs and then either could not remember or never understood what had been requested of them earlier. They requested, "Papa Charlie say again?" The controller issued a new vector of 230° and requested the altitude. The copilot responded, "Okay we're going up through about ninety-three." The controller again issued the 230° vector, and the copilot acknowledged, "Roger." This acknowledgement was made during an 18-sec interval when the radar was not receiving the transponder, but the computer was continuing to project the probable track of the aircraft. The next transponder target indicated a change in track to the left and an altitude loss of about 5,000 ft. A final encoded target was received at an altitude of 2,100 ft, about 16 secs after the 9,100-ft reception. This represents an overall linear velocity of about 413 kns, based on the vertical component and an average dive angle of -39".

The trajectory analysis indicated that the final maneuver was a steep diving left spiral, during which the aircraft turned about 270" and broke up on a northeasterly heading at an altitude of 1,300 ft, ± 300 ft; the aircraft was still in a -25° descent. Witness accounts corroborate the final phase of just such a maneuver, particularly the altitude of breakup. As a result, the Safety Board examined a number of factors that could have caused such a loss of control.

The Safety Board considered the possibility of turbulence. Although a review of the meteorological information and witness statements indicate that the aircraft did not encounter any reported thunderstorm cells, the possibility exists that a cell could have been penetrated. In addition, N40PC could have encountered moderate turbulence caused by convective activity and midlevel wind shear. However, even if turbulence was encountered it would not have been severe enough to cause such an upset, and the pilot was experienced enough to know how to handle such an encounter. Therefore, the Safety Board dismissed the possibility that turbulence could have caused the upset.

Sabotage was discounted after examination of the wreckage. Powerplant, structural, or control problems were also discounted after evaluation of the evidence. The powerplants were capable of normal operation before they separated from the aircraft. There was no evidence of turbine overheating or other preimpact engine distress. Examination of the control system of the aircraft showed no preexisting discrepancies that could have resulted in a control failure. In addition, there was no evidence of a progressive-type failure or preexisting damage in any of the structural members of the aircraft. All of the major damage was typical of aerodynamic overloading.

When the aircraft broke up, it was well above the speed at which flutter might be expected, and there is considerable evidence that flutter did occur in the wings and horizontal stabilizers. For example, the top and bottom of the left wing skin showed a series of compression buckles over the entire wing surface. In addition, all ribs of the interior of the left wing had collapsed vertically, which is typical of flutter deformation.

The Safety Board considered the possibility that a failure of the electrical system had caused the upset. The aircraft had experienced previous electrical problems. If the electrical system had failed, flight manual procedures for such an anomaly, if properly followed, would not have allowed the power interruption to last long enough to destroy flight guidance information. The flight operations manual contained procedures to handle generator failures, generator overheat, out-of-balance generator output, bus bar failure, inverter failure, abnormal voltage, br voltage fluctuation. Further, the aircraft was equipped with an emergency electrical source to power instrument panel lights. Pilot training records showed that both crewmembers had demonstrated satisfactory proficiency in electrical system operation after they had received additional training.

Additional evidence that a total and prolonged electrical system failure did not occur includes: (1) Witnesses saw lights operating on the aircraft; (2) the physical characteristic of light bulb filament failure at impact; and (3) the receipt of transponder signals during the descent from 9,300 ft. However, the Safety Board cannot dismiss the possibility that an electrical failure did occur and caused the flightcrew to become distracted to the extent that control was lost before the electrical fault could be corrected.

The Safety Board also examined the possibility that the upset was caused by a loss of attitude reference information. The conflict between the pilot's and copilot's attitude indicators indicated a need for further investigation, since the difference between the two instruments could be attributed to a failure or malfunction in one of the instruments before the aircraft broke up. The only abnormalities found during the examination of either attitude system were the burned brushes in the vertical gyro which provided attitude information to the pilot's ADI and the discrepancy between his ADI and its controlling vertical gryo. This lends support to a theory that an attitude system failure occurred. As previously mentioned, review of the flight shows clearly that the pilot was experiencing difficulty in complying with the controller's instructions.

The conflict in the information found on the pilot's and copilot's attitude indicators indicates that they ceased normal operation at different times. Despite the fact that the breakup and power interruption should have occurred simultaneously to both instruments, the pilot's flight director displayed a 4" nosedown, 7° right wing down, upright attitude, and the copilot's attitude indicator displayed a 30" noseup, 10° left wing down inverted attitude. Since the copilot's indicator is a self-contained unit and can function correctly for a few min after removal of electrical power, the Safety Board believes that it correctly indicates the aircraft's inverted impact attitude. On the other hand, the pilot's attitude instrument would freeze immediately upon removal of electrical power, Therefore, the Safety Board believes that it indicates the attitude of the aircraft at some point before or during the pilot's loss of attitude control.

Further support of the theory that a failure/malfunction occurred in the pilot's attitude indicating system is the variance between the pilot's ADI and its controlling vertical gryo which was found in a 45° left wing down, 35° nosedown attitude.

The Safety Board is unable to explain the precise failure mode, which resulted in the loss of attitude reference on the pilot's ADI

One theory is that the brushes, which were found to be burned, in the pilot's vertical gryo were shorted by a piece of wire or other foreign object coming in contact with them and causing a short sometime prior to the loss of control. However, the physical location of the brushes (lower half of the brush holder) makes such contact difficult when the aircraft is in normal flight. No foreign objects were found inside the case.

Another theory is that the brushes were shorted by contact with the metal cover of the gyro's case when it was deformed. Examination of the inside surface of the cover in the immediate area of the brush holder showed some evidence that the cover had contacted the brushes. Here again the evidence appears to be conflicting. If the brushes were burned as the result of case deformation, which most likely occurred at impact, there would have to have been electrical power available to the gyro. This is refuted since all the electrical supply sources and contactors separated with the aft fuselage section during the breakup sequence. In addition, examination of the damaged plunger of the roll stop solenoid of the gryo failed to reveal whether or not power was being supplied to the gryo when the case was deformed. Thus, the Safety Board cannot explain the existence of the apparent brush marks on the inside of the cover nor the condition of the brushes as found.

The Safety Board believes that the weight of evidence shows that the pilot's attitude indicating system did fail or malfunction in flight for some undetermined reason. Such a failure should have caused warning flags to appear on the ADI which would have been immediately recognized by the crew. In such case, reference to the copilot's gyro and the pilot's secondary attitude instruments should have provided adequate attitude reference to prevent any loss of control. If the failure occurred without any warning flags, such as cited in the Hawker Siddeley Flight Crew Information Circular No. 17, then the insidious nature of the failure could have masked detection of the problem until the aircraft had entered an unusual attitude from which they could not recover.

In summary, although the Safety Board could not determine the exact reason for the attitude indicating system failure, it concludes that there was a failure/malfunction in flight.

This is yet another accident investigation involving a corporate jet for which a cockpit voice recorder and a flight data recorder would have been invaluable tools in cause determination. Since there was none, preventive measures which could be taken to prevent similar accidents also go undetermined.

3. CONCLUSIONS

3.1 Findings

1. The aircraft was certificated and maintained in accordance to approved procedures.

2. All crewmembers were certificated and qualified for the flight.

3. There was no evidence of preimpact incapacitation of the crew.

4. The flight was operating in accordance with an IFR flight plan and was under radar control.

5. The aircraft was in instrument meteorological conditions at the time of the upset.

6. The aircraft entered a steep diving left spiral and at 1,300 ft, $\pm$ 300 ft, the aircraft reached a speed of about 530 kns and a dive angle of -25°.

7. The loss of control was not the result of sabotage.

8. The powerplants, airframe, and controls were functional before the in-flight breakup.

9. The crew did not report any difficulties or malfunctions; however, it was evident by the crew's radio contacts that a problem existed.

10. The pilot's attitude indicating system failed or malfunctioned in flight.

3.2 Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was a failure or malfunction of an undetermined nature in the pilot's attitude indicating system which led to a loss of control and overstress of the aircraft structure.

4. RECOMMENDATIONS

As a result of this accident, the National Transportation Safety Board has recommended that the Federal Aviation Administration:

"Develop, in cooperation with industry, flight recorder standards (FDR/CVR) for complex aircraft which are predicated upon intended aircraft usage. (Class 11, Priority Action) (A-78-27)

"Draft specifications and fund research and development for a low cost FDR, CVR, and composite recorder which can be used on complex general aviation aircraft. Establish guidelines for these recorders, such as maximum cost, compatible with the cost of the airplane on which they will be installed and with the use for which the airplane is intended. (Class II, Priority Action) (A-78-28)

In the interim, amend 14 CFR to require that no operation (except for maintenance ferry flights) may be conducted with turbine-powered aircraft certificated to carry six passengers or more, which require two pilots by their certificate, without an operable CVR capable of retaining at least 10 minutes of intracockpit conversation when power is interrupted. Such requirements can be met with available equipment to facilitate rapid implementation of this requirement. (Class II, Priority Action) (A-78-29)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PHILIP A. HOGUE
Member

/s/ ELWOOD T. DRIVER
Member

Septennber 14, 1978

5. APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

1. Investigation

The Safety Board was notified of the accident about 2040 on April 28, 1977. Investigators from the Safety Board's Dulles Field Office and Washington, D.C., headquarters went directly to the scene. Working groups were established for operations, air traffic control, structures, systems, powerplants, maintenance records, witnesses, and weather.

Parties to the investigation were the United Kingdom, Hawker-Siddeley Aviation, Inc., Rolls Royce, Inc., Beech Aircraft Corporation, Southern Company Services, Inc., National Business Aircraft Association, and the Federal Aviation Administration.

2. Public Hearing

A public hearing was not held.

APPENDIX B

PERSONNEL INFORMATION

Captain Thomas R. Taylor, III, 34, was employed on March 10, 1970, and at the time of the accident held Airline Transport Pilot Certificate No. 1757638, with ratings for airplane multi-engine land and the HS-125. He had commercial privileges for airplane single-engine land. He had accumulated 7,807 flight hours, 1,900 of which were in this type aircraft. In the last 90 days, he had flown 151.1 hours, 91.1 of which were in type. His FAA first-class medical certificate was issued on July 7, 1976, with no limitations. At the time of the accident, his first-class medical certificate had lapsed and he held a second-class certificate. He had about 4.0 hours of duty time in the previous 24 hours.

Captain Taylor received his HS-125 training at the facilities of Flight Safety, Inc., Wilmington, Delaware. His training records indicate that he needed additional training in the handling of electrical emergencies to achieve the desired proficiency for passing that phase of his training.

Copilot Ronald L. Golden, 30, was employed on January 15, 1975, and held a valid Airline Transport Pilot Certificate No. 259720651, with ratings for airplane multi-engine land and commercial privileges for single-engine land. He had accumulated 4,049 flight-hours, 114 hours of which were in HS-125 aircraft. In the last 90 days, he had flown 76.2 hours, 4.7 of which 4.7 were in type. His FAA first-class medical certificate was issued on March 11, 1977 with no limitations. He had about 4.0 hours of duty time in the last 24 hours.

Mr. Golden received his HS-125 training from the Flight Safety Foundation. His training records indicate that he also needed additional training in the handling of electrical emergencies to achieve the desired passing proficiency.

Both pilots were given the additional training after which they demonstrated satisfactory proficiency in handling electrical system emergencies.

APPENDIX C

AIRCRAFT INFORMATION

Beech-Hawker 125, model 600A, (N40PC) was built by Hawker-Siddeley Aviation, Ltd., Broughton Chester, England. The aircraft was completed in February 1973 and given serial No. 256010 and an American registration N23BH.

The aircraft was ferried from England on February 26 and 27, 1973, to the Beech Aircraft Corporation in Wichita, Kansas, for modifications. The records indicated that the American registration was changed during the time of the modifications to N40PC.

N40PC was purchased by Southern Company Services, Inc., from the Beech Aircraft Corporation on September 5, 1973, and had been operated continuously by the company. The aircraft's total time on September 5, 1973 was 29:13 hours.

The aircraft had undergone a 600 hour inspection and a 12-month inspection on February 3, 1977, with a total time of 1,806:09 hours. The last entry in the logbook was dated April 26, 1977, and indicated the aircraft's total time was 1904:16 hours.

The records reviewed reflected the documentation of maintenance, inspections, and modifications accomplished on the aircraft and its engines. The flight log sheets and aircraft status reports were checked for continuity and found to be complete. Maintenance checks and inspections were shown to have been completed within their specified time limits. The records also indicated that all applicable Airworthiness Directives had been complied with.

The aircraft was equipped with two Rolls Royce "VIPER" Mark 601-22 engines:

	Left Engine (S/N VL601041)	Right Engine (S/N EL601044)
Total Time	1,584 hours	1,631 hours
Total Cycles	1,438	1,459
Since Overhaul	155 hours	463 hours

The last engine inspection on the left engine was accomplished on February 3, 1977. The engine total time since overhaul was 56:40 hours. During the inspection no components were replaced.

The last engine inspection on the right engine was accomplished on February 3, 1977. The engine total time since overhaul was 364:39 hours. During this inspection the inboard ignitor plug was replaced.

The following is a list of selected Aircraft Status Reports with corrective action comments from September 9, 1976, through April 25, 1977:

"a. September 28, 1976 - Number one inverter failed. Corrective action - Work order dated September 30, 1976. Tightened loose connector.

b. October 9, 1976 - Number one inverter failed. Corrective action - Work order dated October 13, 1976. Reset and inverter came on line, ran one-half hour, checked normal.

c. October 27, 1976 - Number one inverter
Corrective action - Work dated December 30, 1976. Trouble-shoot number one inverter system. Troubleshot and found both voltage protection units defective. Voltage sense unit S/B HSD/711 F127 was installed in the number one reverse position which proved to be a bad unit. The original number one sense unit was installed in the number two position which was also bad. The aircraft is now operating with a good unit in the number two position and a defective unit in the number one position S/N HSD/70/2324/H was removed from number two position.

Corrective action - Work order dated January 4, 1977. Replaced number one inverter protection unit (customer furnished) top unit. Removed S/N HSD/71/F127. Installed S/N HSD/71/F115. Inverter checked OK.

d. March 4, 1977 - Flt. Dir Sync sticky
T/B Ind shows constant turn
No. 2 DME Intermittent

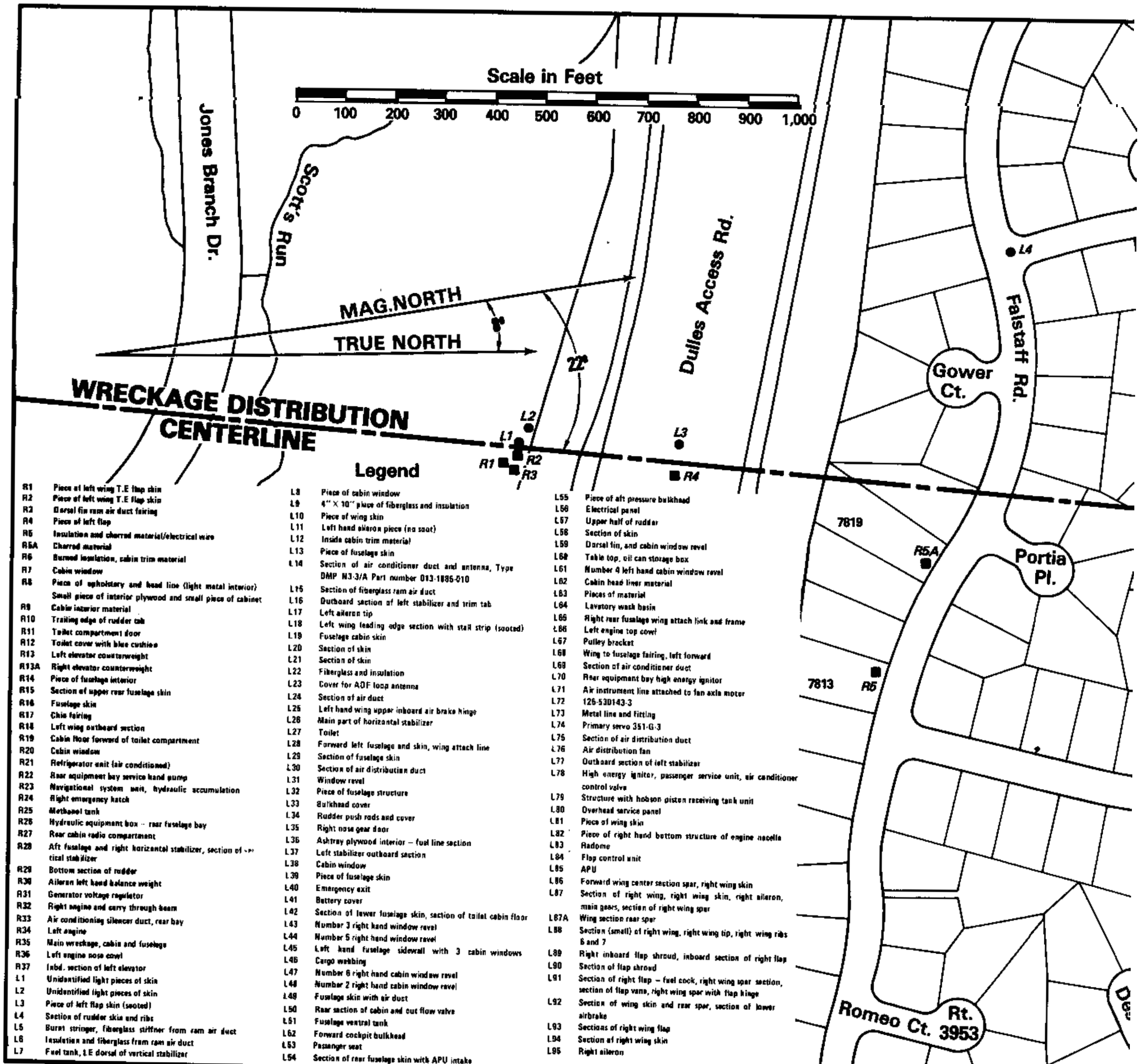
The aircraft records did not reveal any corrective actions being taken for these items. On March 14, 1977, the No. 2 DME was again written up as being intermittent, with no corrective action reflected in the records. However, after March 14 these items were not repeated.

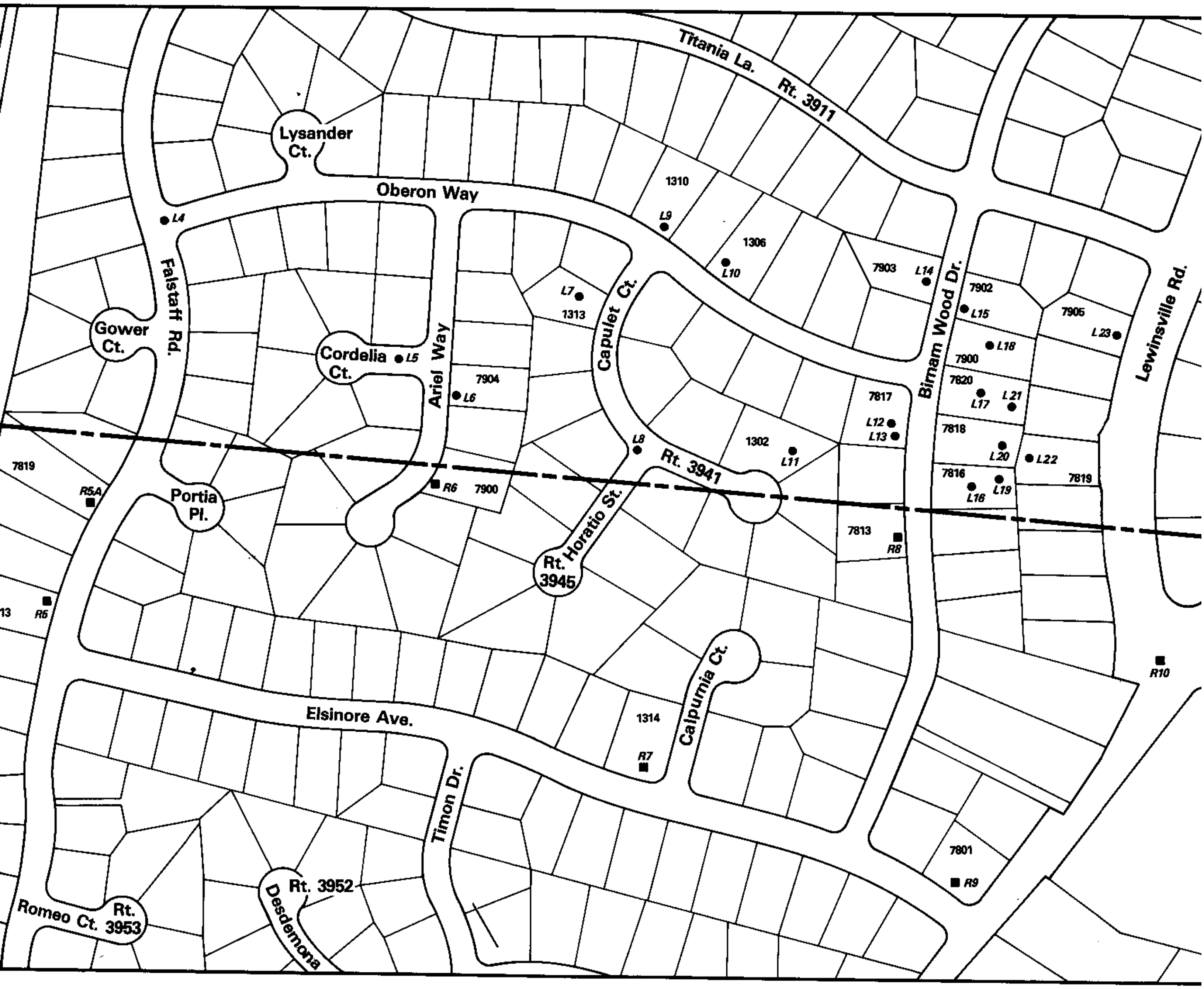
e. March 29, 1977 - L.H. generator failed on climb-out from EWR. Generator would not reinstate.

Corrective action - Work order Dated March 30, 1977. Checked generator, found OK. Swapped voltage regulators. Operation normal. Installed new voltage regulator S/N 1249.

f. March 29, 1977 - APU inoperative, will not accelerate over 78 per cent.

Corrective action - Work order dated March 30, 1977. Found fuel control acceleration control malfunctioning ordered new fuel control. Installed new fuel control. Engine still bangs on acceleration and much fuel dumping overboard. Removed engine and tailpipe shrouds found start nozzle purge restrictor leaking badly. Could not repair. Installed new restrictor. Found check ball and spring missing from combustor drain valve. Replaced valve. Found KT 9 time delay relay wired wrong causing max fuel valve to open too early. Removed control box reworked relay and reset time delay to 5 seconds. Reinstalled all removed parts. Ground run normal."


Scale in Feet
0 100 200 300 400 500 600 700 800 900 1,000
Jones Branch Dr.
Scott's Run
Dulles Access Rd.
MAG.NORTH
TRUE NORTH
22°
WRECKAGE DISTRIBUTION CENTERLINE
Falstaff Rd.
Gower Ct.
Portia Pl.
Romeo Ct.
Rt. 3953
7819
7813
L1
L2
L3
L4
R1
R2
R3
R4
R5
R5A
Legend
R1 Piece of left wing T.E flap skin
R2 Piece of left wing T.E flap skin
R3 Dorsal fin ram air duct fairing
R4 Piece of left flap
R5 Insulation and charred material/electrical wire
R5A Charred material
R6 Burned insulation, cabin trim material
R7 Cabin window
R8 Piece of upholstery and head line (light metal interior) Small piece of interior plywood and small piece of cabinet
R9 Cabin interior material
R10 Trailing edge of rudder tab
R11 Toilet compartment door
R12 Toilet cover with blue cushion
R13 Left elevator counterweight
R13A Right elevator counterweight
R14 Piece of fuselage interior
R15 Section of upper rear fuselage skin
R16 Fuselage skin
R17 Chin fairing
R18 Left wing outboard section
R19 Cabin floor forward of toilet compartment
R20 Cabin window
R21 Refrigerator unit (air conditioned)
R22 Rear equipment bay service hand pump
R23 Navigational system unit, hydraulic accumulation
R24 Right emergency hatch
R25 Methanol tank
R26 Hydraulic equipment box – rear fuselage bay
R27 Rear cabin radio compartment
R28 Aft fuselage and right horizontal stabilizer, section of vertical stabilizer
R29 Bottom section of rudder
R30 Aileron left hand balance weight
R31 Generator voltage regulator
R32 Right engine and carry through beam
R33 Air conditioning silencer duct, rear bay
R34 Left engine
R35 Main wreckage, cabin and fuselage
R36 Left engine nose cowl
R37 Inbd. section of left elevator
L1 Unidentified light pieces of skin
L2 Unidentified light pieces of skin
L3 Piece of left flap skin (sooted)
L4 Section of rudder skin and ribs
L5 Burnt stringer, fiberglass stiffner from ram air duct
L6 Insulation and fiberglass from ram air duct
L7 Fuel tank, LE dorsal of vertical stabilizer
L8 Piece of cabin window
L9 4" X 10" piece of fiberglass and insulation
L10 Piece of wing skin
L11 Left hand aileron piece (no soot)
L12 Inside cabin trim material
L13 Piece of fuselage skin
L14 Section of air conditioner duct and antenna, Type DMP N3-3/A Part number 013-1886-010
L15 Section of fiberglass ram air duct
L16 Outboard section of left stabilizer and trim tab
L17 Left aileron tip
L18 Left wing leading edge section with stall strip (sooted)
L19 Fuselage cabin skin
L20 Section of skin
L21 Section of skin
L22 Fiberglass and insulation
L23 Cover for ADF loop antenna
L24 Section of air duct
L25 Left hand wing upper inboard air brake hinge
L26 Main part of horizontal stabilizer
L27 Toilet
L28 Forward left fuselage and skin, wing attach line
L29 Section of fuselage skin
L30 Section of air distribution duct
L31 Window revel
L32 Piece of fuselage structure
L33 Bulkhead cover
L34 Rudder push rods and cover
L35 Right nose gear door
L36 Ashtray plywood interior – fuel line section
L37 Left stabilizer outboard section
L38 Cabin window
L39 Piece of fuselage skin
L40 Emergency exit
L41 Battery cover
L42 Section of lower fuselage skin, section of toilet cabin floor
L43 Number 3 right hand window revel
L44 Number 5 right hand window revel
L45 Left hand fuselage sidewall with 3 cabin windows
L46 Cargo webbing
L47 Number 6 right hand cabin window revel
L48 Number 2 right hand cabin window revel
L49 Fuselage skin with air duct
L50 Rear section of cabin and out flow valve
L51 Fuselage ventral tank
L52 Forward cockpit bulkhead
L53 Passenger seat
L54 Section of rear fuselage skin with APU intake
L55 Piece of aft pressure bulkhead
L56 Electrical panel
L57 Upper half of rudder
L58 Section of skin
L59 Dorsal fin, and cabin window revel
L60 Table top, oil can storage box
L61 Number 4 left hand cabin window revel
L62 Cabin head liner material
L63 Pieces of material
L64 Lavatory wash basin
L65 Right rear fuselage wing attach link and frame
L66 Left engine top cowl
L67 Pulley bracket
L68 Wing to fuselage fairing, left forward
L69 Section of air conditioner duct
L70 Rear equipment bay high energy ignitor
L71 Air instrument line attached to fan axle motor
L72 126-530143-3
L73 Metal line and fitting
L74 Primary servo 351-G-3
L75 Section of air distribution duct
L76 Air distribution fan
L77 Outboard section of left stabilizer
L78 High energy ignitor, passenger service unit, air conditioner control valve
L79 Structure with hobson piston receiving tank unit
L80 Overhead service panel
L81 Piece of wing skin
L82 Piece of right hand bottom structure of engine nacelle
L83 Radome
L84 Flap control unit
L85 APU
L86 Forward wing center section spar, right wing skin
L87 Section of right wing, right wing skin, right aileron, main gears, section of right wing spar
L87A Wing section rear spar
L88 Section (small) of right wing, right wing tip, right wing ribs 6 and 7
L89 Right inboard flap shroud, inboard section of right flap
L90 Section of flap shroud
L91 Section of right flap – fuel cock, right wing spar section, section of flap vane, right wing spar with flap hinge
L92 Section of wing skin and rear spar, section of lower airbrake
L93 Sections of right wing flap
L94 Section of right wing skin
L95 Right aileron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Oberon Way
Falstaff Rd.
Gower Ct.
Cordelia Ct.
Ariel Way
Capulet Ct.
Birnam Wood Dr.
Lewinsville Rd.
Portia Pl.
Horatio St.
Rt. 3945
Rt. 3941
Calpurnia Ct.
Elsinore Ave.
Timon Dr.
Rt. 3952
Desdemona
Romeo Ct.
Rt. 3953
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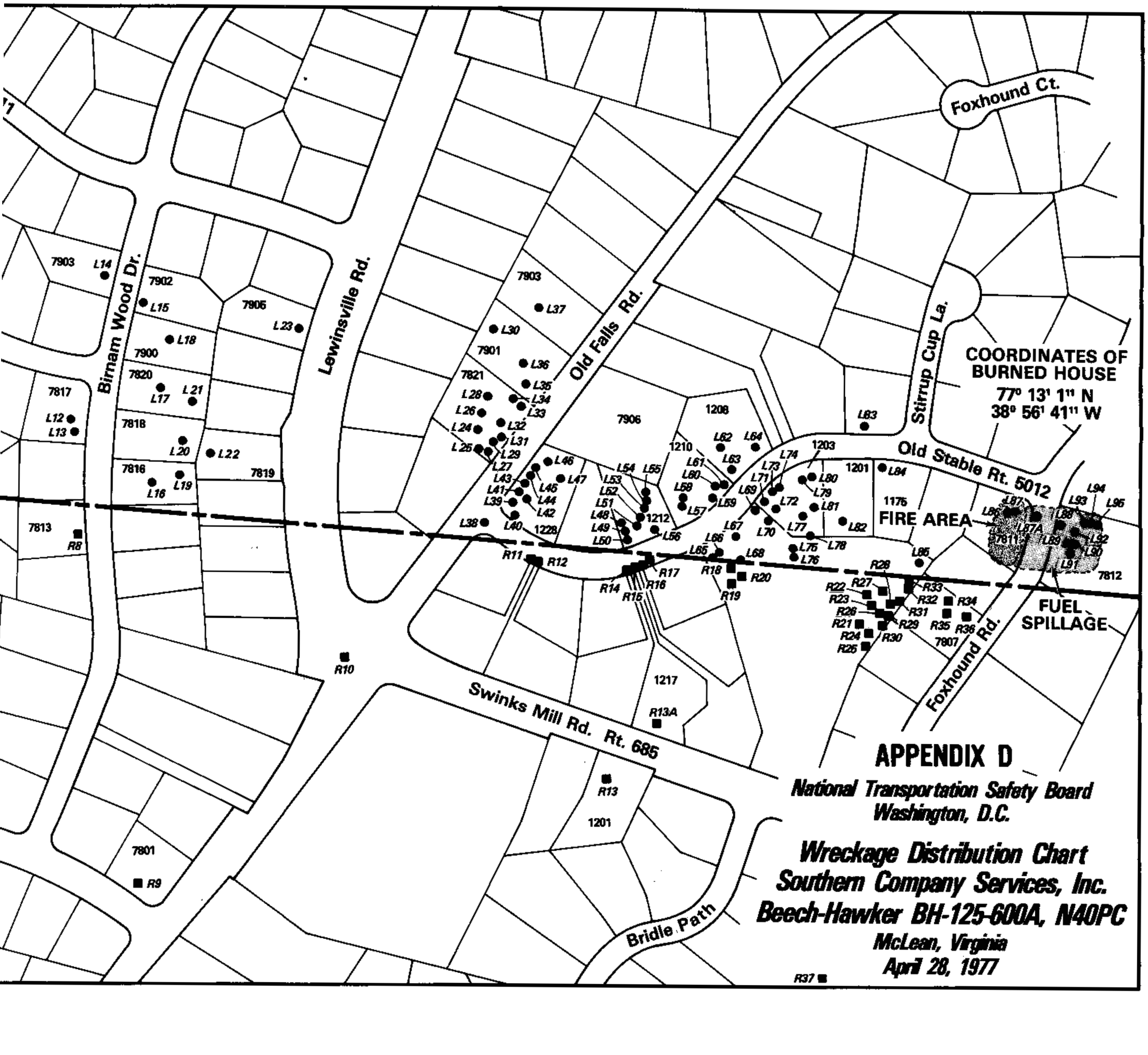
R7
R8
R9
R10

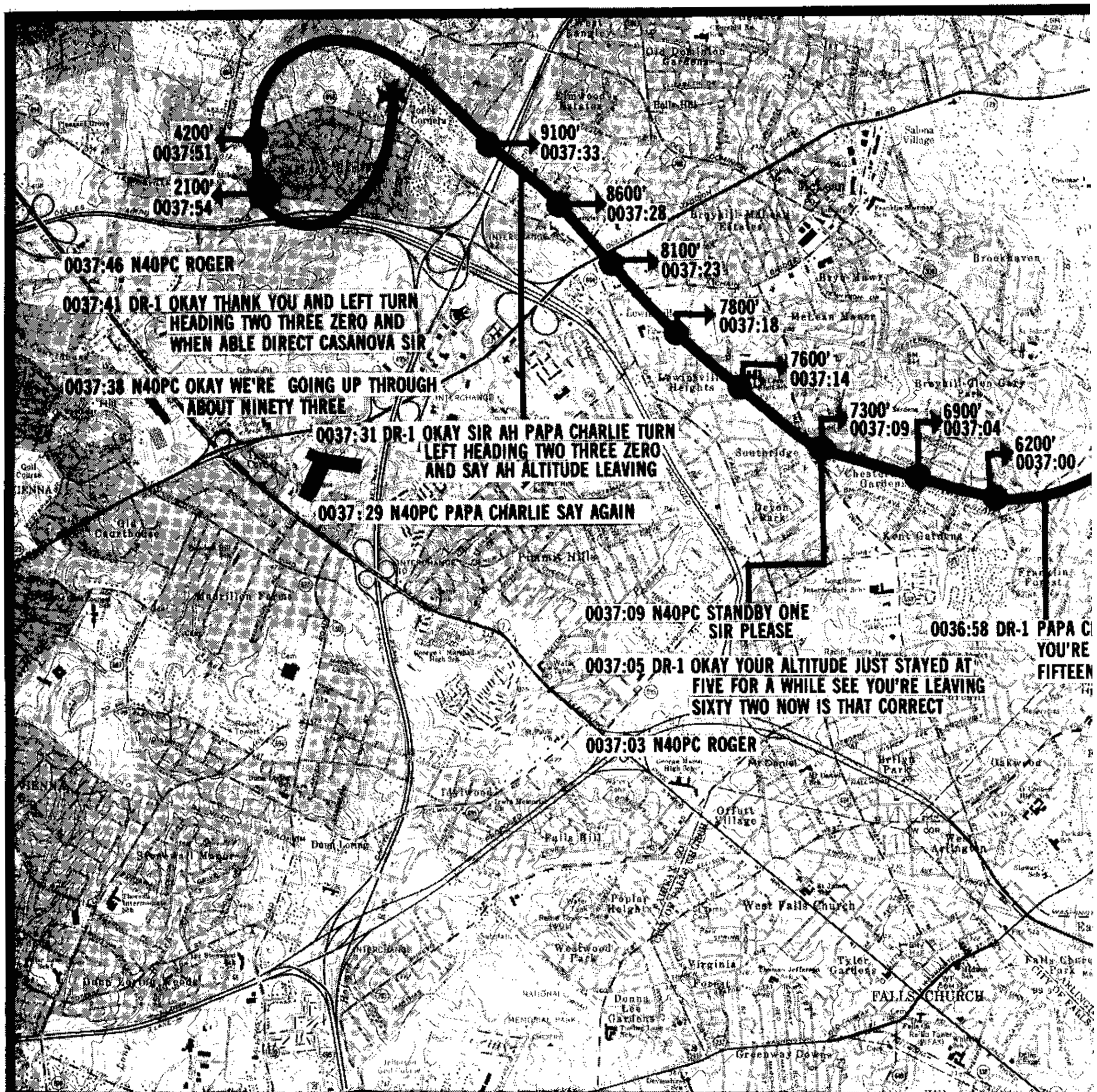


APPENDIX D

National Transportation Safety Board
Washington, D.C.

Wreckage Distribution Chart
Southern Company Services, Inc.
Beech-Hawker BH-125-600A, N40PC

McLean, Virginia
April 28, 1977



SCALE 1:24000

1 MILE

7000 FEET

1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1971 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

● RADAR RETURNS FROM ANTENNA LOCATED AT NATIONAL AIRPORT

■ RADAR RETURNS FROM ANTENNA LOCATED AT SUITLAND MD.

NOTE 1.
ALL RADAR TRACKING AND ALTITUDE DATA WERE OBTAINED FROM WASHINGTON NATIONAL'S ARTS III SYSTEM.

NOTE 2.
THE PORTION OF THE GROUND TRACK FROM TIME 0037:33 TO 0037:51 COULD ONLY BE ESTIMATED. THEREFORE, AN EXACT CORRELATION OF THE ATC TRANSCRIPT AND PROBABLE GROUND TRACK IS NOT POSSIBLE FOR THIS PORTION OF THE FLIGHT.

ATC TRANSCRIPT LEGEND

N40PC - HAWKER SIDLEY 125 N40PC

31 - WASHINGTON TOWER (LOCAL CONTROL)

DR - 1 - WASHINGTON DEPARTURE (RADAR ONE)

NATIONAL T

PROBA

SOUTHE

BE

APPENDIX E

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C.

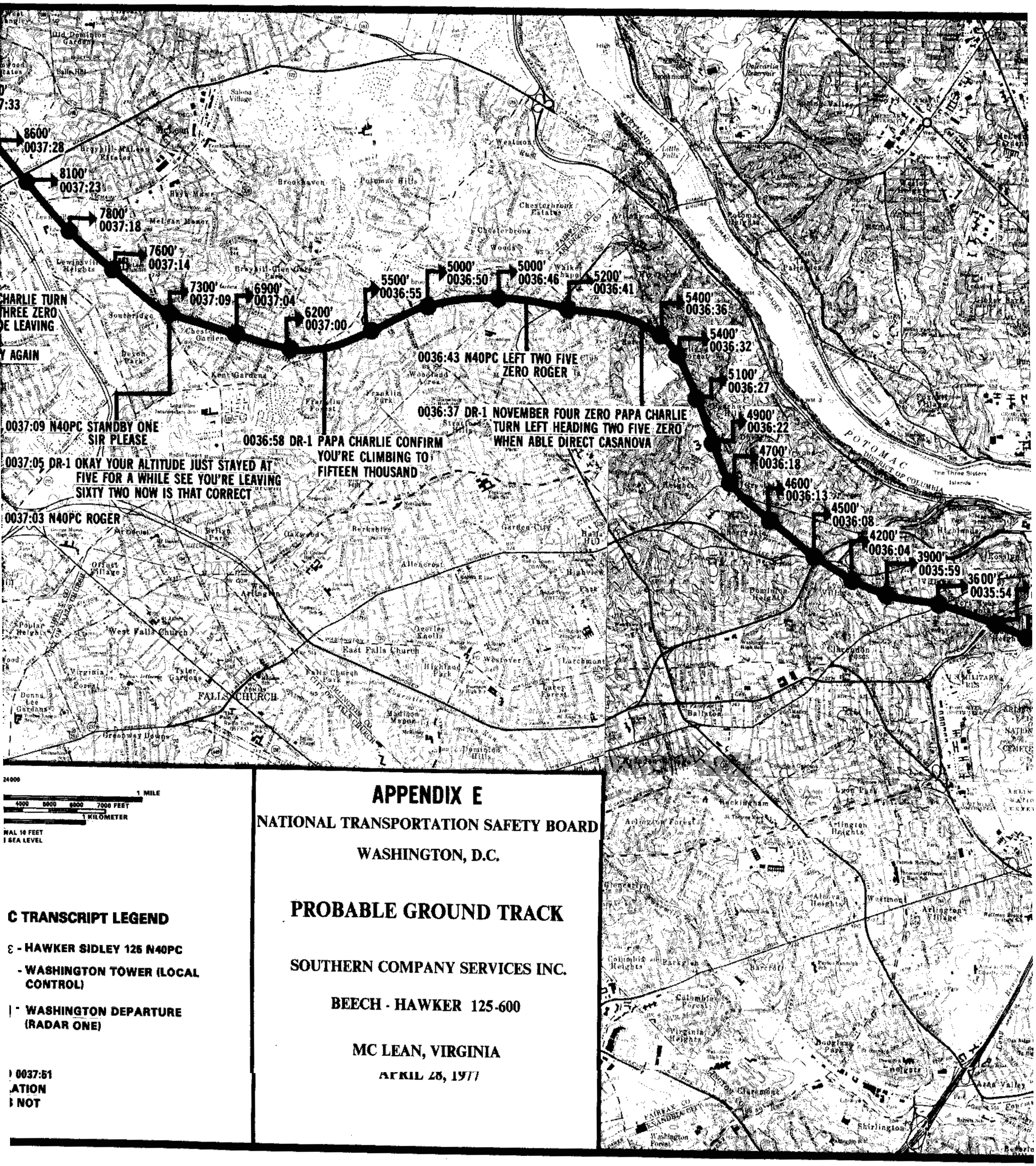
PROBABLE GROUND TRACK

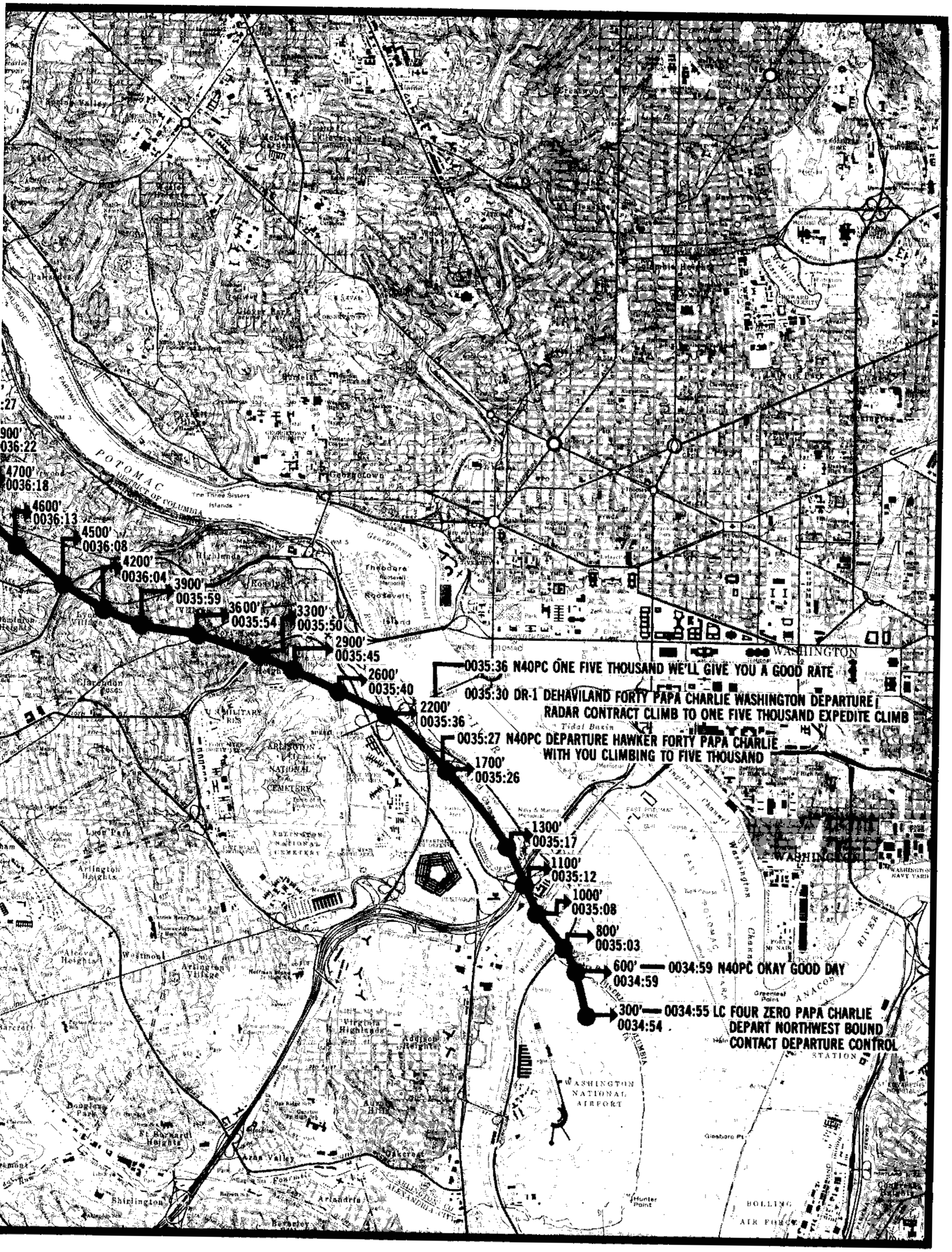
SOUTHERN COMPANY SERVICES INC.

BEECH - HAWKER 125-600

MC LEAN, VIRGINIA

APRIL 28, 1977





900'
036:22
4700'
0036:18
4600'
0036:13
4500'
0036:08
4200'
0036:04
3900'
0035:59
3600'
0035:54
3300'
0035:50
2900'
0035:45
2600'
0035:40
2200'
0035:36
1700'
0035:26
1300'
0035:17
1100'
0035:12
1000'
0035:08
800'
0035:03
600'
0034:59
300'
0034:54
0035:36 N40PC ONE FIVE THOUSAND WE'LL GIVE YOU A GOOD RATE
0035:30 DR-1 DEHAVILAND FORTY PAPA CHARLIE WASHINGTON DEPARTURE RADAR CONTRACT CLIMB TO ONE FIVE THOUSAND EXPEDITE CLIMB
0035:27 N40PC DEPARTURE HAWKER FORTY PAPA CHARLIE WITH YOU CLIMBING TO FIVE THOUSAND
0034:59 N40PC OKAY GOOD DAY
0034:55 LC FOUR ZERO PAPA CHARLIE DEPART NORTHWEST BOUND CONTACT DEPARTURE CONTROL
POTOMAC
WASHINGTON
WASHINGTON NATIONAL AIRPORT
ARLINGTON NATIONAL CEMETERY
Georgetown
Rosslyn
Tidal Basin