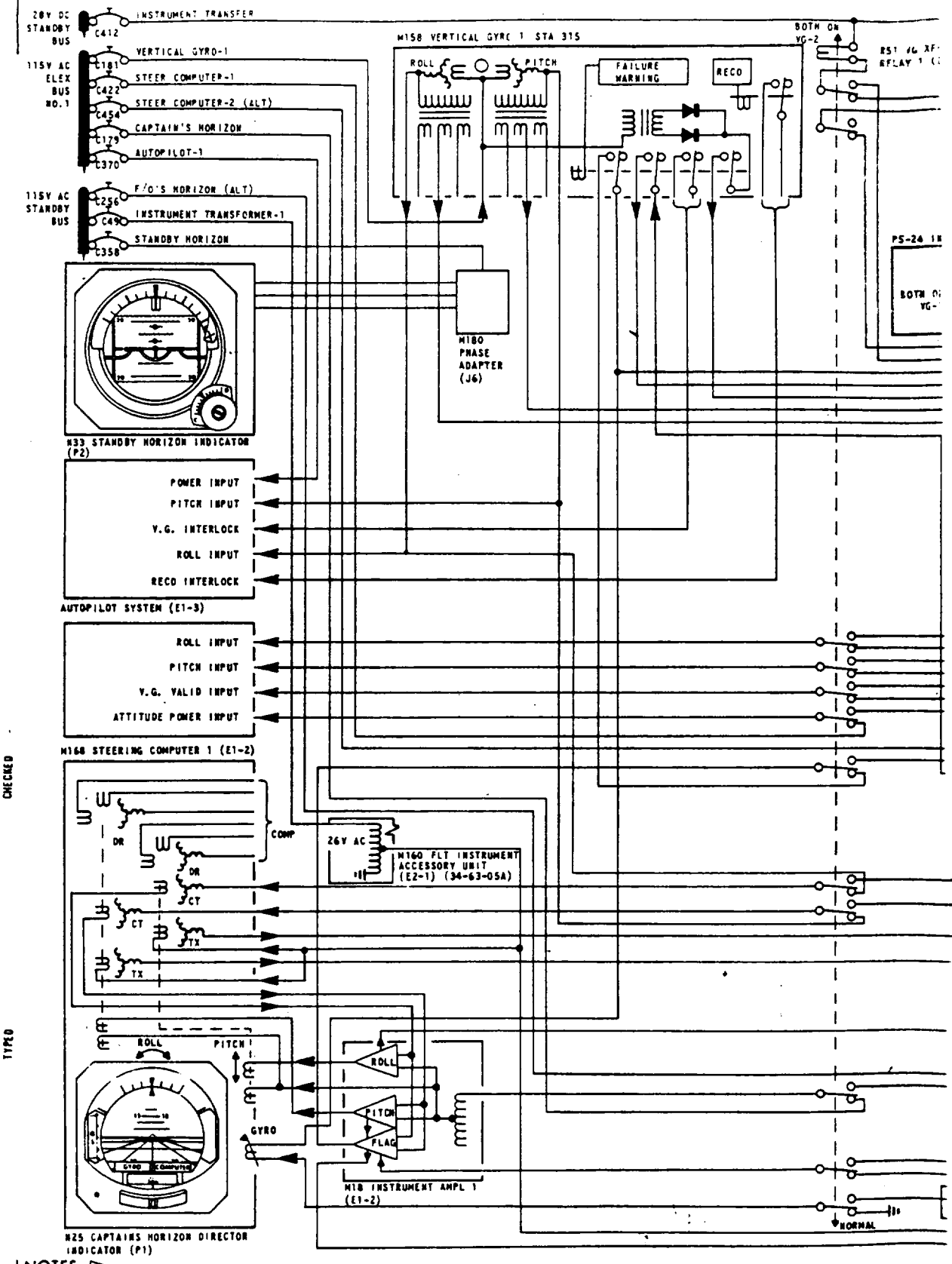
APÉNDICE H

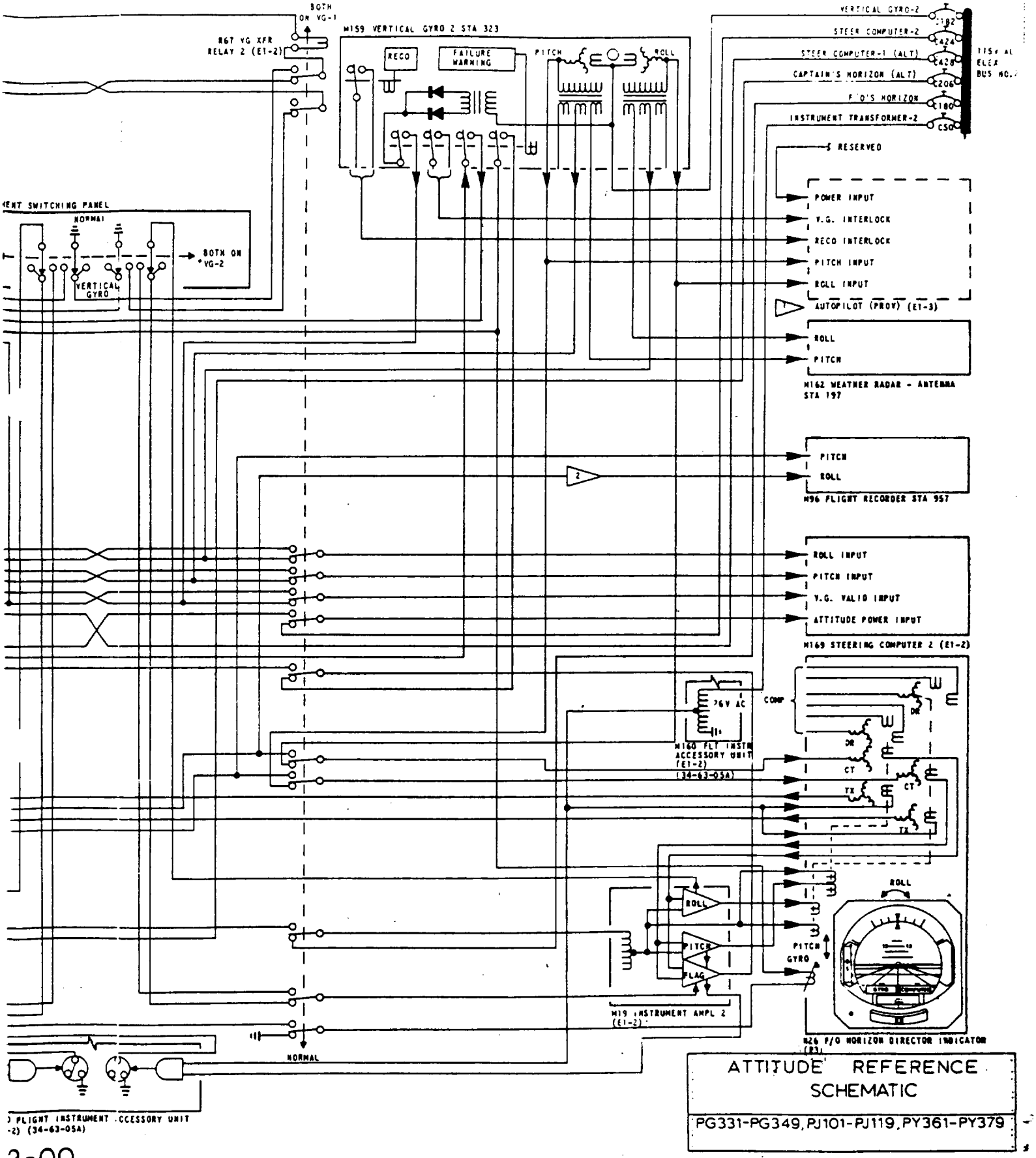
HOJA DE CUBIERTA

Páginas 1 - 2 Diagrama de Cableado de Boeing, Esquemático de Referencia de Actitud, 34-22-00, 10 de Diciembre de 1976



NOTES: 1 DUAL AUTOPILOT ON PG331-PG332 AND PJ101-PJ103

2 PJ107-PJ119



ATTITUDE REFERENCE SCHEMATIC

PG331-PG349, PJ101-PJ119, PY361-PY379

APÉNDICE I

HOJA DE CUBIERTA

Páginas 1 - 2	Reporte Analítico de Ingeniería del Giro Vertical N° 1, Régimen de Tonel del Sincro Rotor B-737 COPA; septiembre 22, 1994.
Páginas 3 -5	Fotografías Representantivas

ANALYTICAL ENGINEERING REPORT

To: J.I. Murphy R-6711 96-03

cc: J.D. Rodrigues B-U01B 14-HM

REPORT No.: 9-5576-WP-94-346

DATE: September 22, 1994

PROGRAM: 737

MET LOG No.: 4190

GROUP INDEX: 9-5576 Analytical Engineering - Metallurgical Analysis

SUBJECT: 737 COPA VG1 Roll Rate Synchro Rotor Investigation

REFERENCE:

During teardown investigation of the subject instrument, a 9 to 10 ohm resistive short between the armature coil winding and rotor was isolated to a manufacturing discrepancy where a short loop of wire was pinched between a nylon plug and one of the rotor lobes (Figure 1). The short disappeared when the plug was removed.

The rotor (with coil windings removed) and segment of wire that was pinched were submitted for metallurgical examination. An epoxy stripper, Dynaloy Uresolve Plus 500, had been used to remove conformal coat on the wound armature rotor prior to unwinding the coil.

CONCLUSIONS

The area on the rotor lobe where the wire was pinched was identified. The corresponding area on the wire could not be located because of mechanical deformation that occurred during plug removal and chemical damage to the insulation resulting from exposure to the epoxy stripper. The analysis could not determine, one way or the other, whether the shorting existed at the time of the accident.

RESULTS

The pinched segment of wire was examined by optical and scanning electron microscopy. As seen in Figure 2, the insulation was cracked and flaking from the wire. Optical examination revealed a blackened appearance at the interface between the wire and insulation at the cracks. Experimentation of the effects of the epoxy stripper on the insulation (isomid polyimide-polyester as determined by Fourier transform infrared spectroscopy) confirmed it as the cause of the observed damage. The loop in the wire was reported to have occurred during removal of the nylon plug such that the shape of the wire is not representative of its appearance in Figure 1. The chemical stripper damage to the insulation unfortunately destroyed any evidence regarding its dielectric integrity at the pinch point. No wear, deformed or electrically arced or melted area on the copper conductor that would correspond to the pinch point was identified.

ATTACHMENT 4

Permission was obtained from the NTSB to remove rotor lobes 3 and 4 to facilitate examination of the subject pinched area at the upper edge of lobe 5 (Figure 1). The area was examined with scanning electron microscopy (SEM). Pieces of red insulating paint on the rotor loosened by the epoxy stripper were removed prior to examination. A grooved wear dimple on the outside edge of the outer rotor laminate was observed in the area where the wire was pinched between the nylon plug and rotor (Figures 3 and 4A). The width of the dimple is approximately 0.070" wide. The groove in the middle of the dimple is approximately 0.015" wide.

The coil magnet wire was reported to be 39 AWG which is specified as 0.035" diameter exclusive of insulation. The gage of the wire was confirmed by optical microscopy (0.034" wire diameter with 0.003" of insulation). The width of the groove in the dimple is consistent with the wire diameter.

A couple of small indentations adjacent to the groove in the wear dimple (Figures 4B and 4C) were examined in detail for any indication of melting or copper transfer from the wire to the iron-silicon rotor that could result from resistive heating or electrical arcing. No copper was detected with energy dispersive spectroscopy (EDS) capabilities of the SEM; nor was any evidence of melting confirmed. The analysis could not determine, one way or the other, whether the shorting existed at the time of the accident.

Prepared by: [redacted]
W. S. Spear
[redacted]

Approved by: [redacted] 9-22-94
for W. L. Plagemann
[redacted]

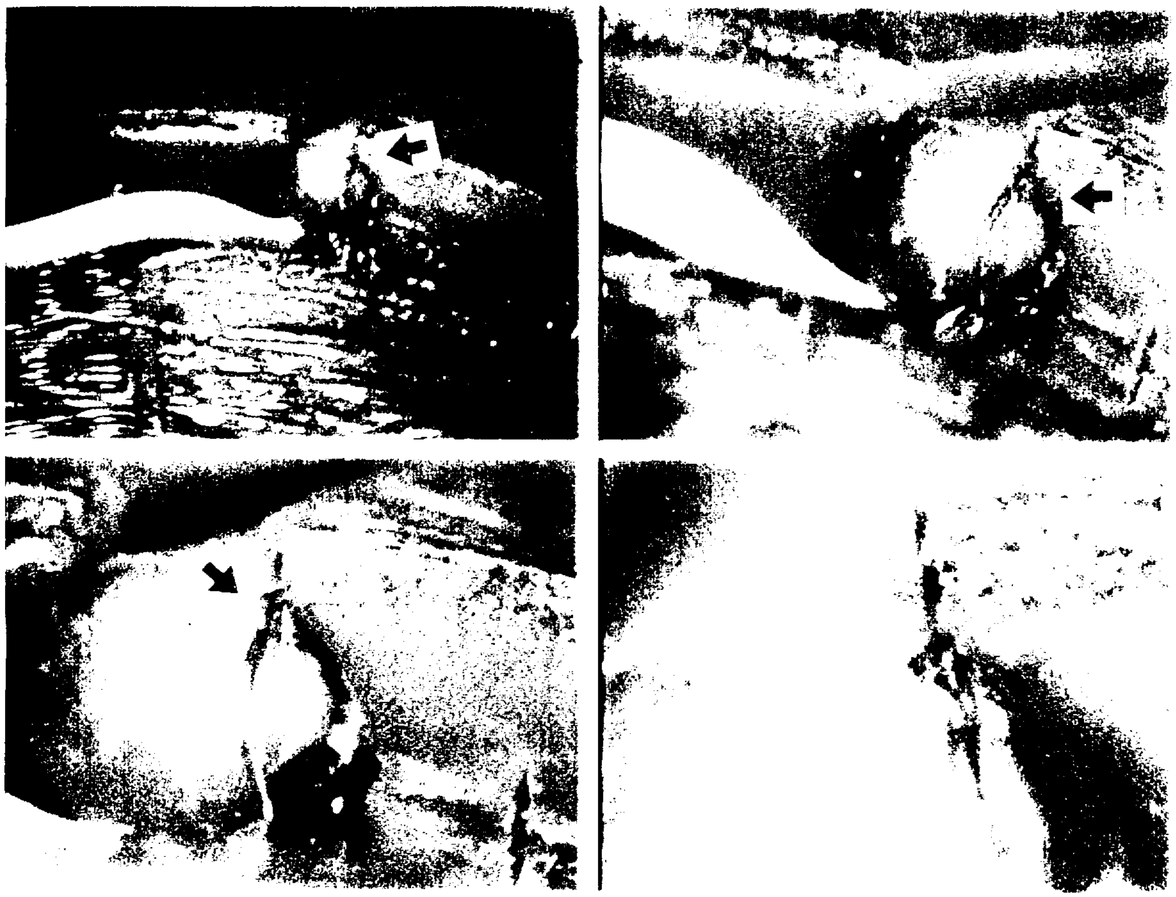


Figure 1: Location of 5 to 10 ohm resistive [illegible] between nylon plug and rotor lobe number 5. Rotor assembly [illegible] to epoxy stripper to remove conformal coat prior to [illegible]

Figure 2: SEM micrograph of pinched wire segment. Insulation (dark) is cracked and flaking from exposure to stripper.

Attachment 10:
9 5576 WL-94 346

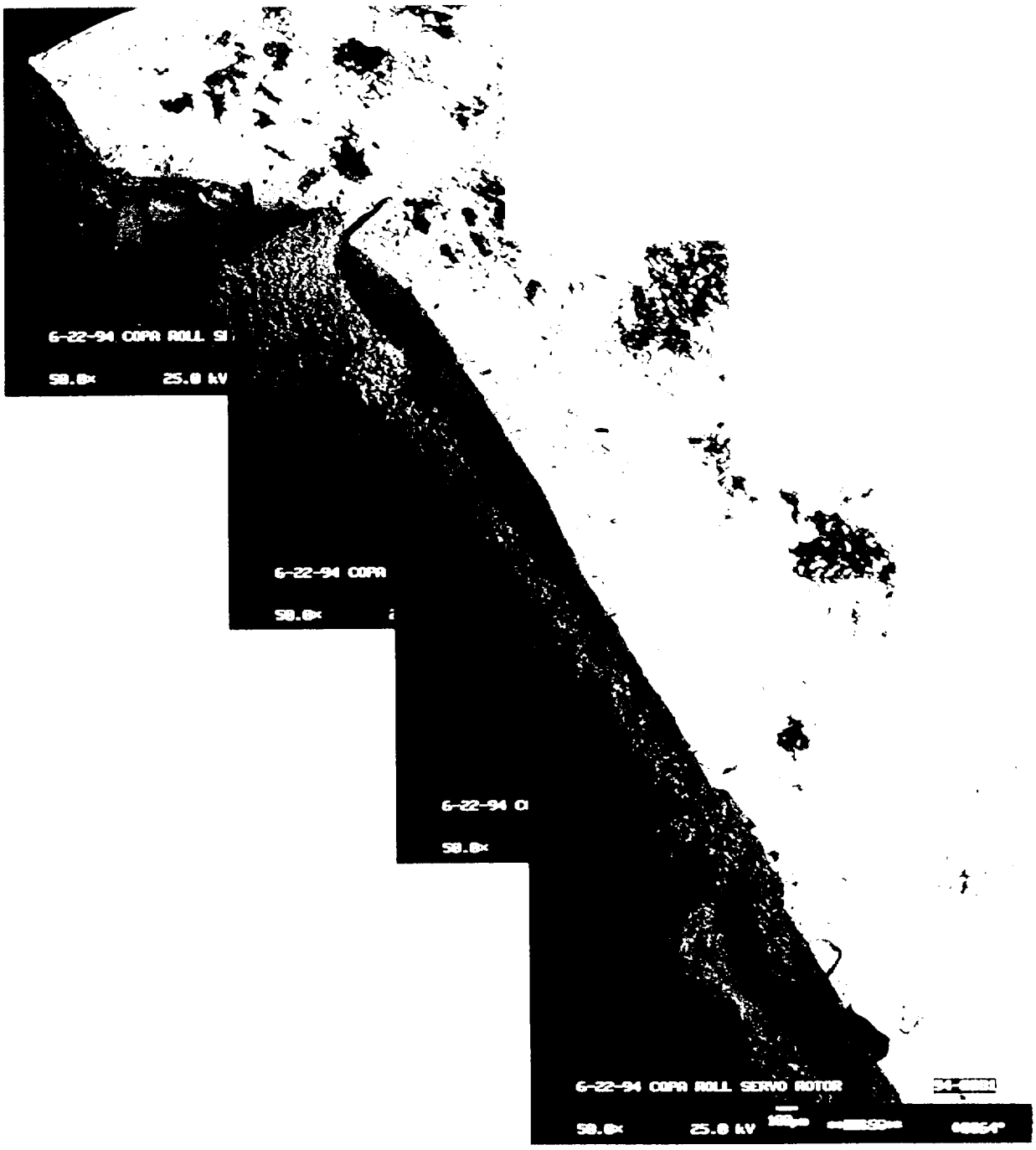


Figure 3: SEM micrograph of rotor armature lobe surface 5. Arrow points to dimple associated with coil wire pinch point.

Attachment to:
9 5576 WP-94 346

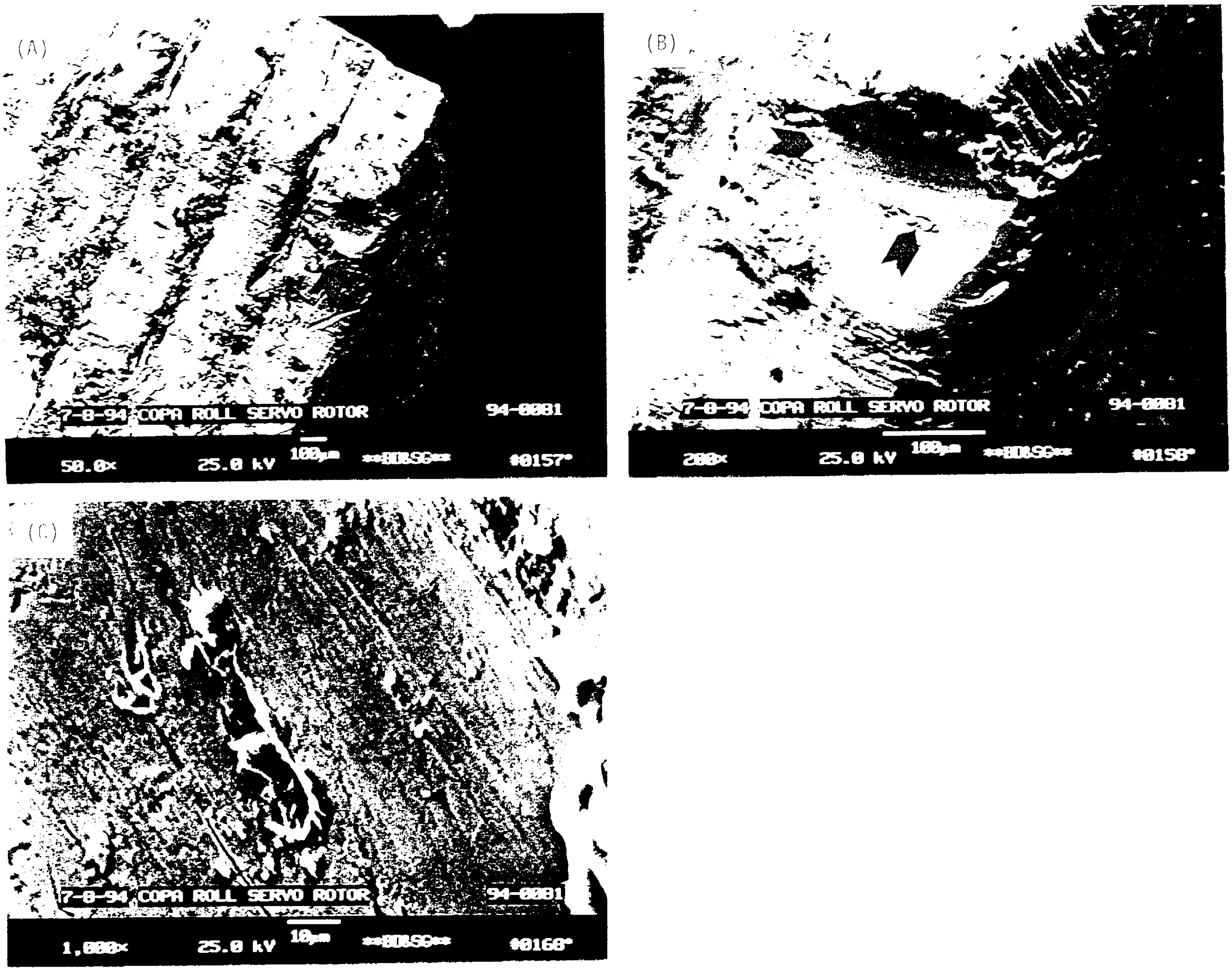


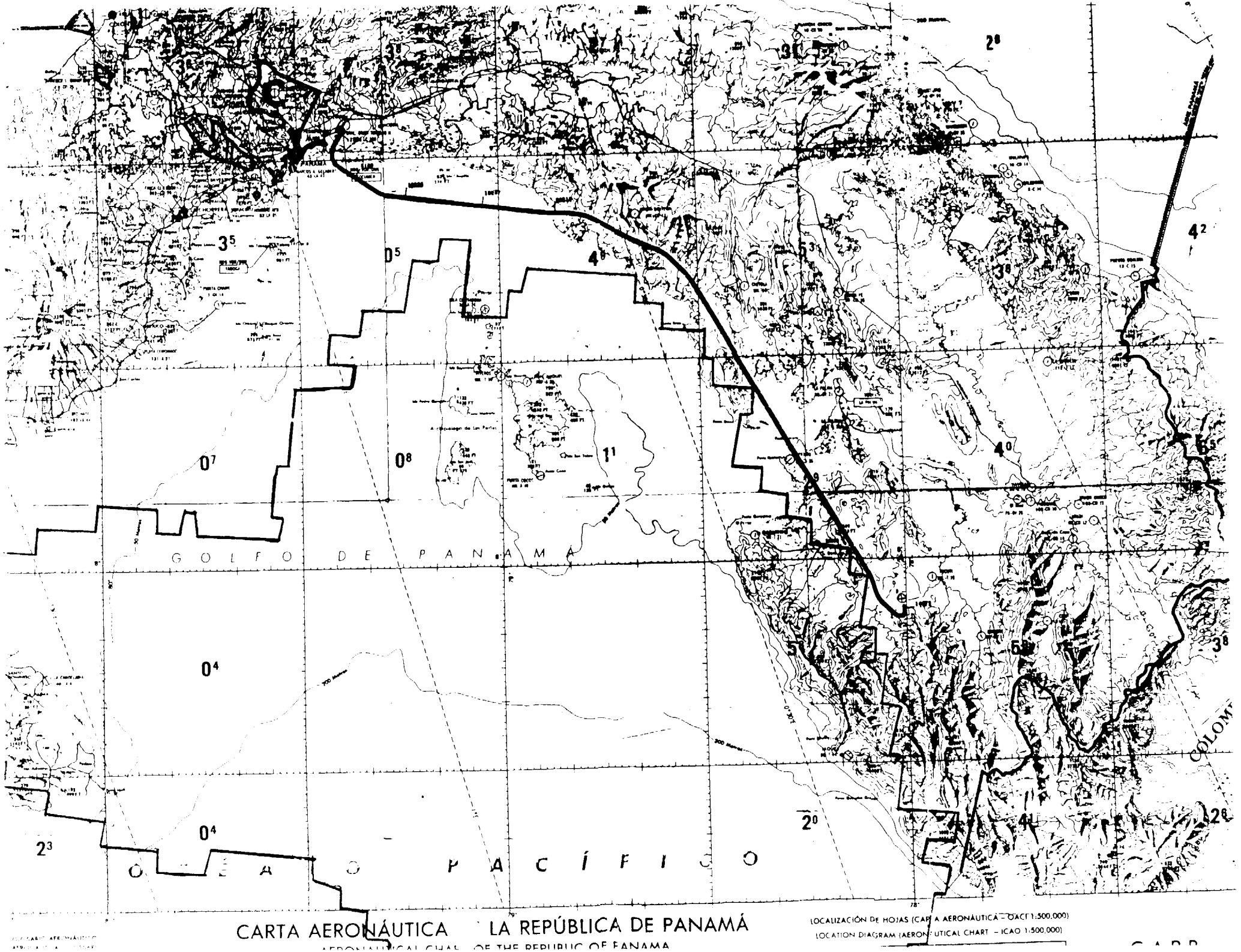
Figure 4: SEM micrographs of wear dimple and details. Arrows in (B) indicate center wear groove and suspect short indications. Close-up of indications shown in (C).

APÉNDICE J

HOJA DE CUBIERTA

Meteorología Referente al Accidente CMP 201

Páginas 1	Trayectoría del Vuelo CMP 201 con relación al mal tiempo existente en el Golfo de Panamá.
Páginas 2 -	Fotografía del mal tiempo en el Golfo de Panamá
Páginas 3	Nota del especialista del NTSB en Meteorología, describiendo el mal tiempo en el Golfo de Panamá, en el momento del accidente.



CARTA AERONÁUTICA LA REPÚBLICA DE PANAMÁ

AERONAUTICAL CHART OF THE REPUBLIC OF PANAMA

LOCALIZACIÓN DE HOJAS (CARTA AERONÁUTICA – OACI 1:500.000)

LOCATION DIAGRAM (AERONAUTICAL CHART – ICAO 1:500.000)


02:01 07JN92
I18 HI-RES D-SAT

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington D.C. 20594

Review of GOES Data on McIDAS

Z = Coordinated Universal Time

Geostationary Operational Environmental Satellite (GOES) infrared data (Band = 8) for 0101, 0131, and 0201Z were reviewed on the Safety Board's McIDAS Workstation. The data showed a large area of cold radiative temperatures (high cloud tops) south of the Panama City area. This area was expanding to the northwest and contained active thunderstorms. The Flight Track of Copa 201 was along the eastern edge of this area.

Radiative temperatures at the accident site were -75 degrees C at 0101Z, -75 degrees C at 0131Z, and -71 degrees C at 0201Z. Using upper air data from Albrook AFS it was determined that these temperatures would correspond to cloud tops of approximately 48,000, 48,000, and 47,000 feet respectively. The 0131Z data showed closed cold radiative temperature contours (possible maximum cloud tops) about 40 kilometers west of the accident site. Radiative temperatures in this area were near -80 degrees C. This corresponds to cloud tops of about 51,000 feet. At 0201Z a closed cold radiative temperature contour was located about 60 kilometers to the west of the accident site. Radiative temperatures were again near -80 degrees C, corresponding to a height of about 51,000 feet.

Significant radiative temperature decreases (increase in the cloud tops) were seen about 60 kilometers northeast of the accident location during the time period 0131 to 0201Z. No significant changes in radiative temperature were seen in the area of the accident.

[redacted]
Gregory D. Salottolo
National Resource Specialist
Meteorology

7-8-92