
ATSB
Australian Transport Safety Bureau

The Australian Transport Safety Bureau

The ATSB aims to maintain and improve transport safety through excellence in:

- ‘no blame ‘ independent transport accident, incident and safety deficiency investigation,
- safety data, research, and pro-active systemic analysis,
- communication and education, and
- leading development of national and international safety strategies.

AIRCRAFT AVIONICS WIRING & ELECTRICAL SYSTEMS

TWA 800
230
LIVES LOST

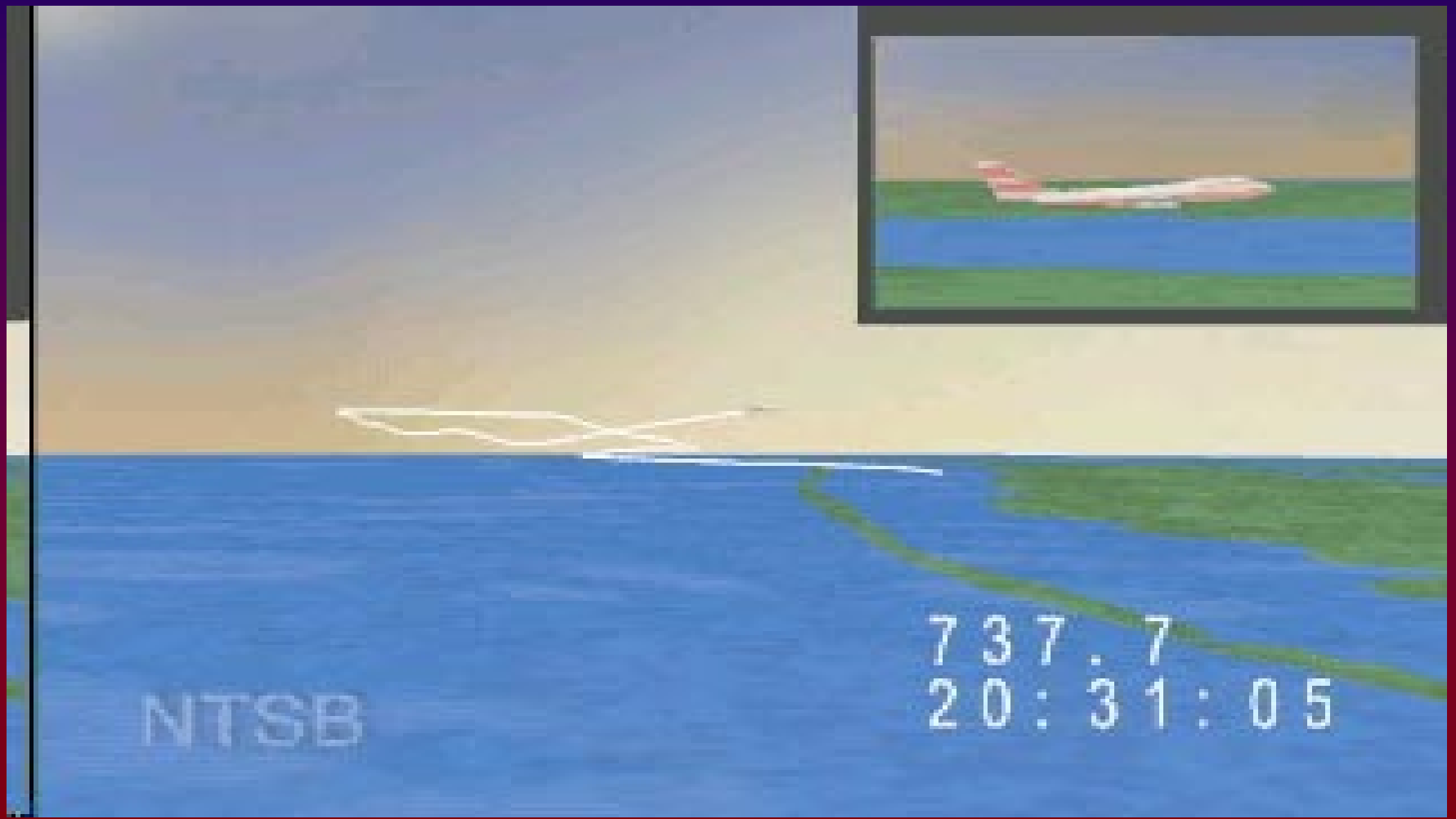
1. HOT DAY WITH DELAYS ON TAKE OFF

2. LOW FUEL QUANTITY IN CENTRE WING TANK

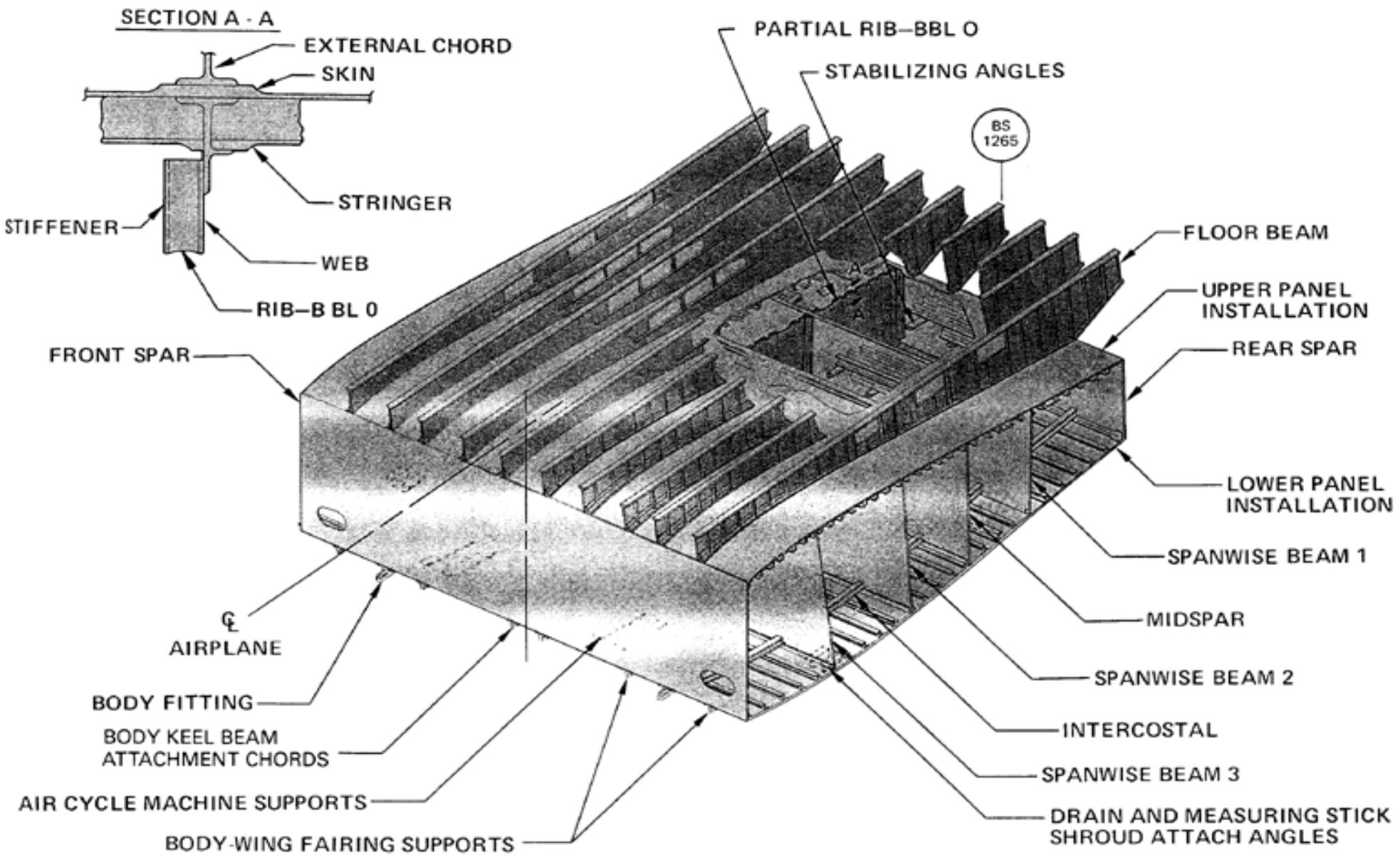
3. HEATING OF THE LOW QUANTITY OF FUEL BY THE AIR CONDITIONER PACKS LOCATED UNDER THE CENTRE WING TANK,CREATING A VOLATILE FUEL AIR MIXTURE.

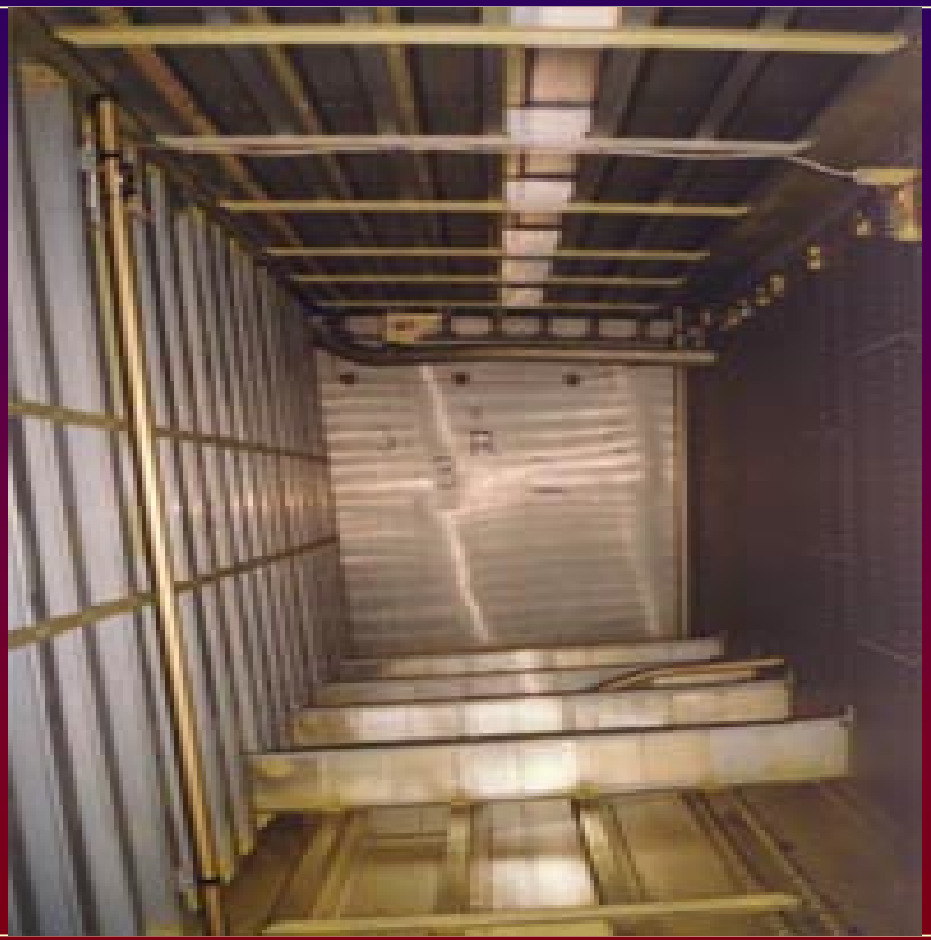
4. IGNITION SOURCE

5. EXPLOSION

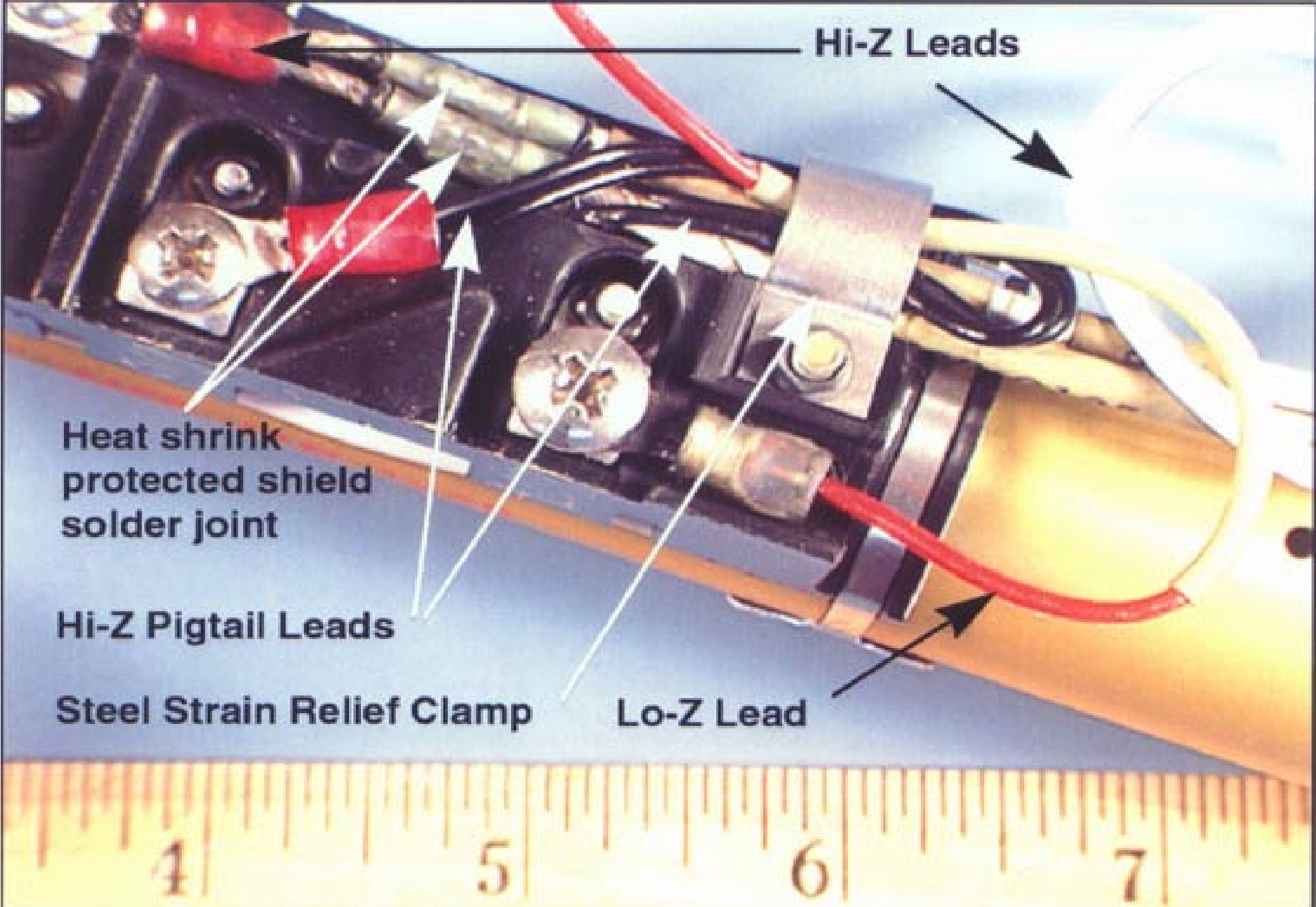

737.7
20:31:05
NTSB

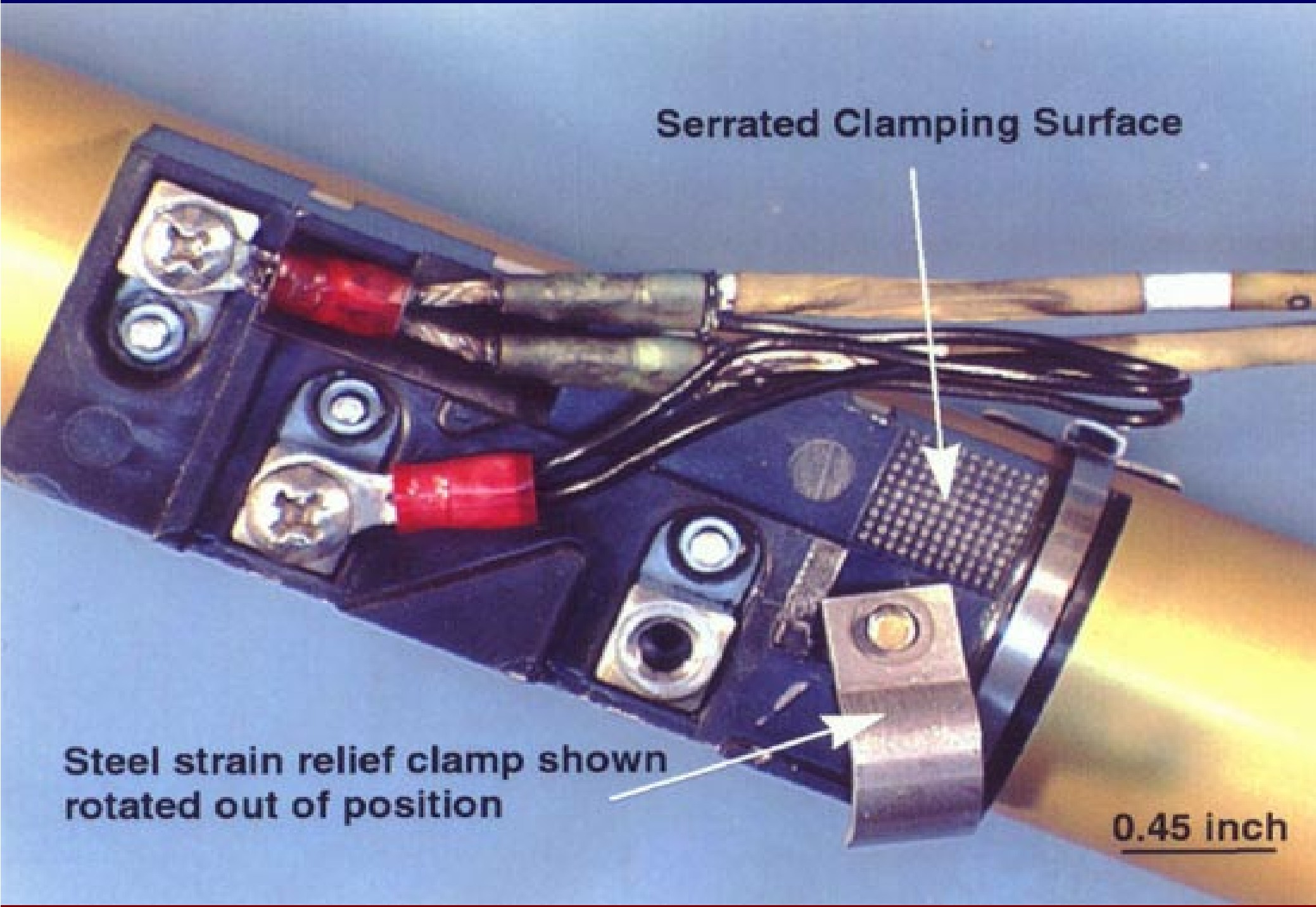
CENTRE WING TANK

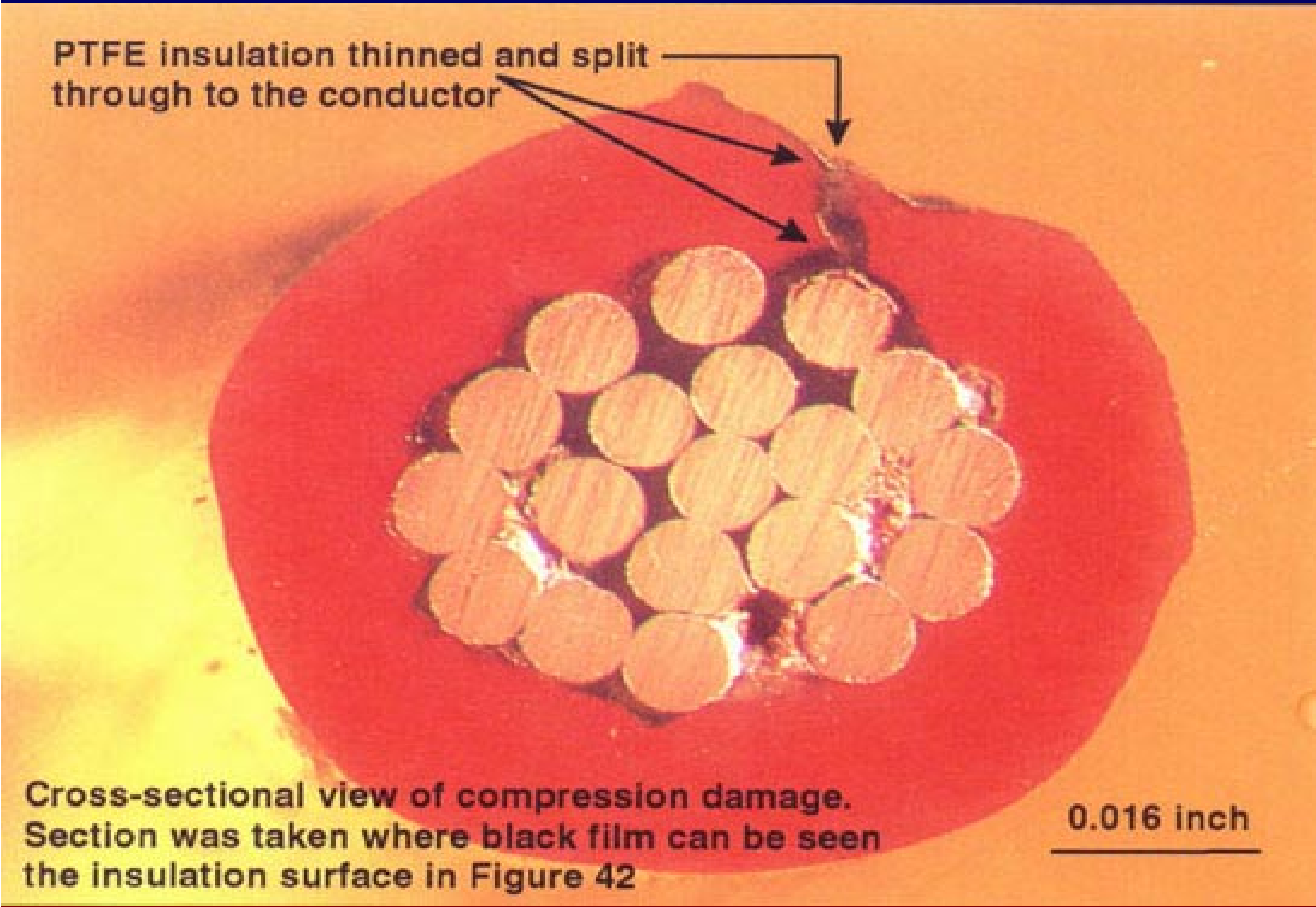

SECTION A - A
EXTERNAL CHORD
SKIN
STRINGER
STIFFENER
WEB
RIB–B BL 0
PARTIAL RIB–BBL O
STABILIZING ANGLES
BS 1265
FLOOR BEAM
UPPER PANEL INSTALLATION
REAR SPAR
FRONT SPAR
LOWER PANEL INSTALLATION
SPANWISE BEAM 1
MIDSPAR
SPANWISE BEAM 2
INTERCOSTAL
SPANWISE BEAM 3
DRAIN AND MEASURING STICK SHROUD ATTACH ANGLES
℄ AIRPLANE
BODY FITTING
BODY KEEL BEAM ATTACHMENT CHORDS
AIR CYCLE MACHINE SUPPORTS
BODY-WING FAIRING SUPPORTS



FUEL QUANTITY PROBE


Hi-Z Leads
Heat shrink
protected shield
solder joint
Hi-Z Pigtail Leads
Steel Strain Relief Clamp
Lo-Z Lead
4
5
6
7


Serrated Clamping Surface
Steel strain relief clamp shown
rotated out of position
0.45 inch



Cross-sectional view of compression damage.
Section was taken where black film can be seen
the insulation surface in Figure 42

THE NATIONAL TRANSPORTATION SAFETY BOARD DETERMINED THAT THE PROBABLE CAUSE OF THE TWA800 ACCIDENT WAS AN EXPLOSION OF THE CENTRE WING TANK

THE SOURCE OF THE IGNITION ENERGY FOR THE EXPLOSION COULD NOT BE DETERMINED WITH CERTAINTY

BUT, OF THE SOURCES EVALUATED BY THE INVESTIGATION, THE MOST LIKELY WAS A SHORT CIRCUIT OUTSIDE THE CENTRE WING TANK.

ALLOWING EXCESSIVE VOLTAGE TO ENTER THE CENTRE WING TANK THROUGH ELECTRICAL WIRING ASSOCIATED WITH THE FUEL QUANTITY INDICATION SYSTEM (fuel probe)

CONTRIBUTING FACTORS
DESIGN & CERTIFICATION

- THE CONCEPT THAT FUEL TANK EXPLOSIONS COULD BE PREVENTED SOLELY BY PRECLUDING ALL IGNITION SOURCES
- THE BOEING 747 HAS HEAT SOURCES LOCATED BENEATH THE CENTRE WING TANK WITH NO MEANS TO REDUCE THE HEAT TRANSFERRED TO THE CENTRE WING TANK OR TO RENDER THE VAPOR IN THE TANK NONFLAMMABLE

NTSB RECOMMENDATIONS

1. NITROGEN INERTING SYSTEM

2. MONITORING OF FUEL TEMPERATURES

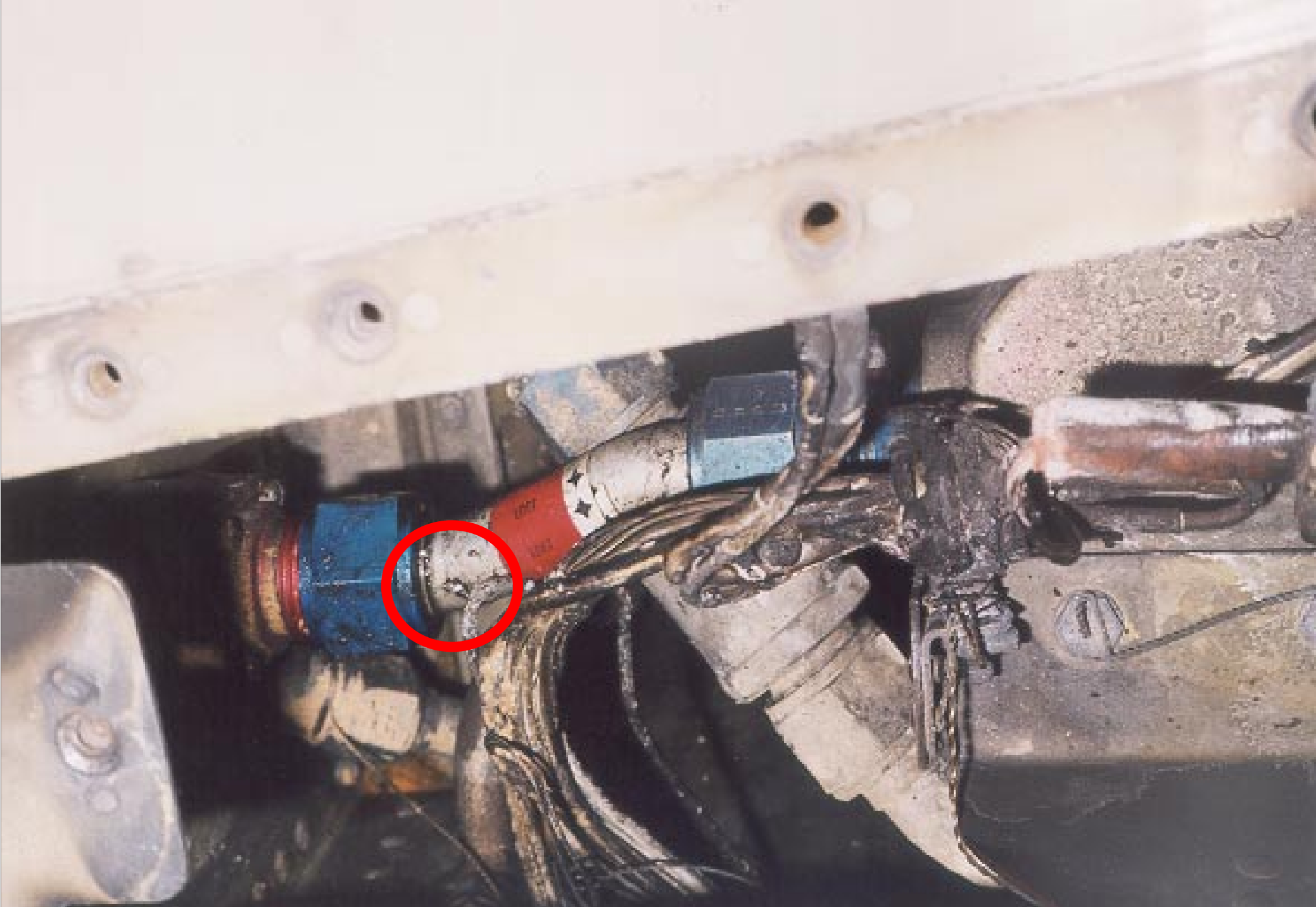
3. FUEL TANK TEMPERATURE PROBES AND COCKPIT DISPLAYS

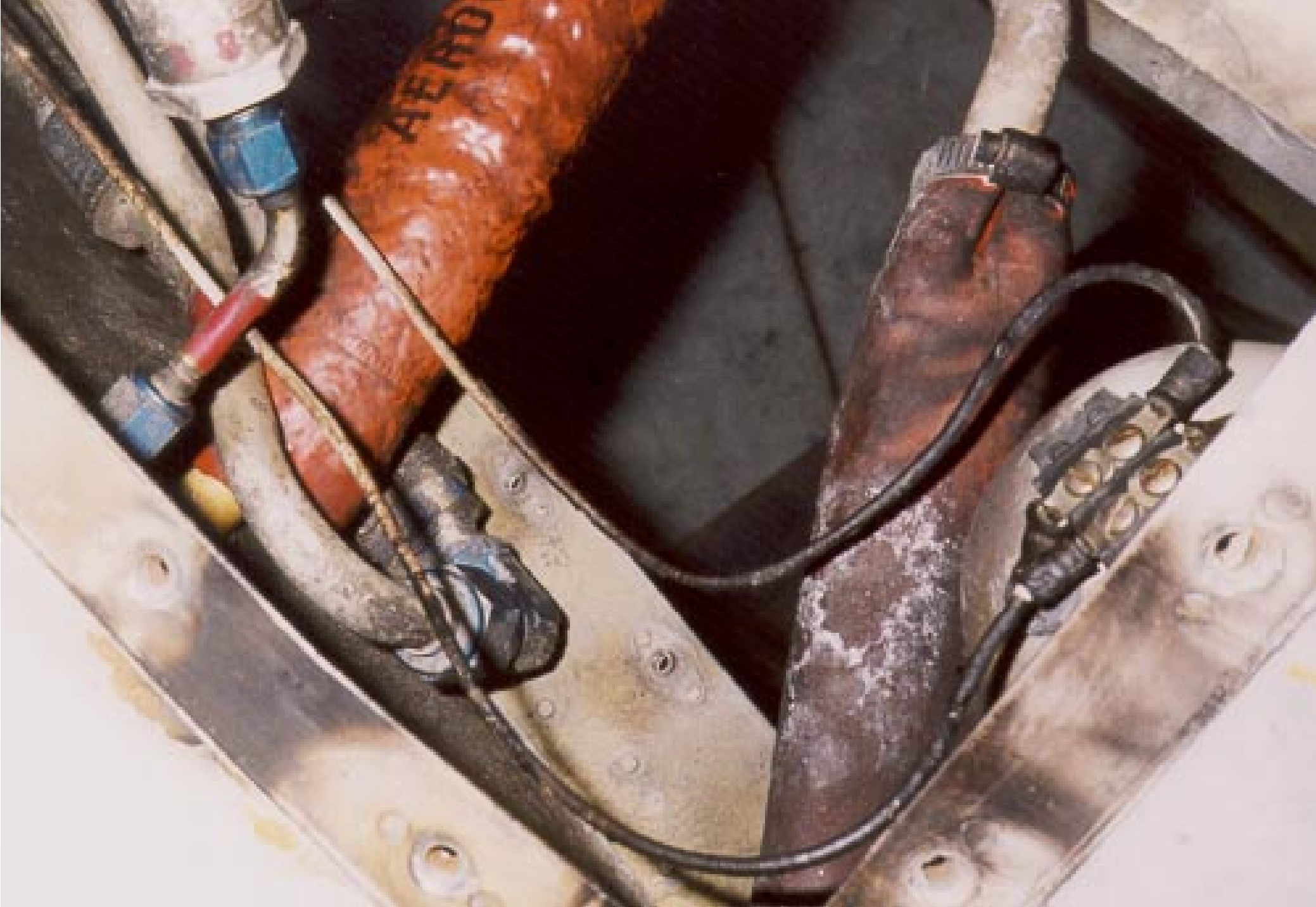
BEECHCRAFT 1900D WING FIRE

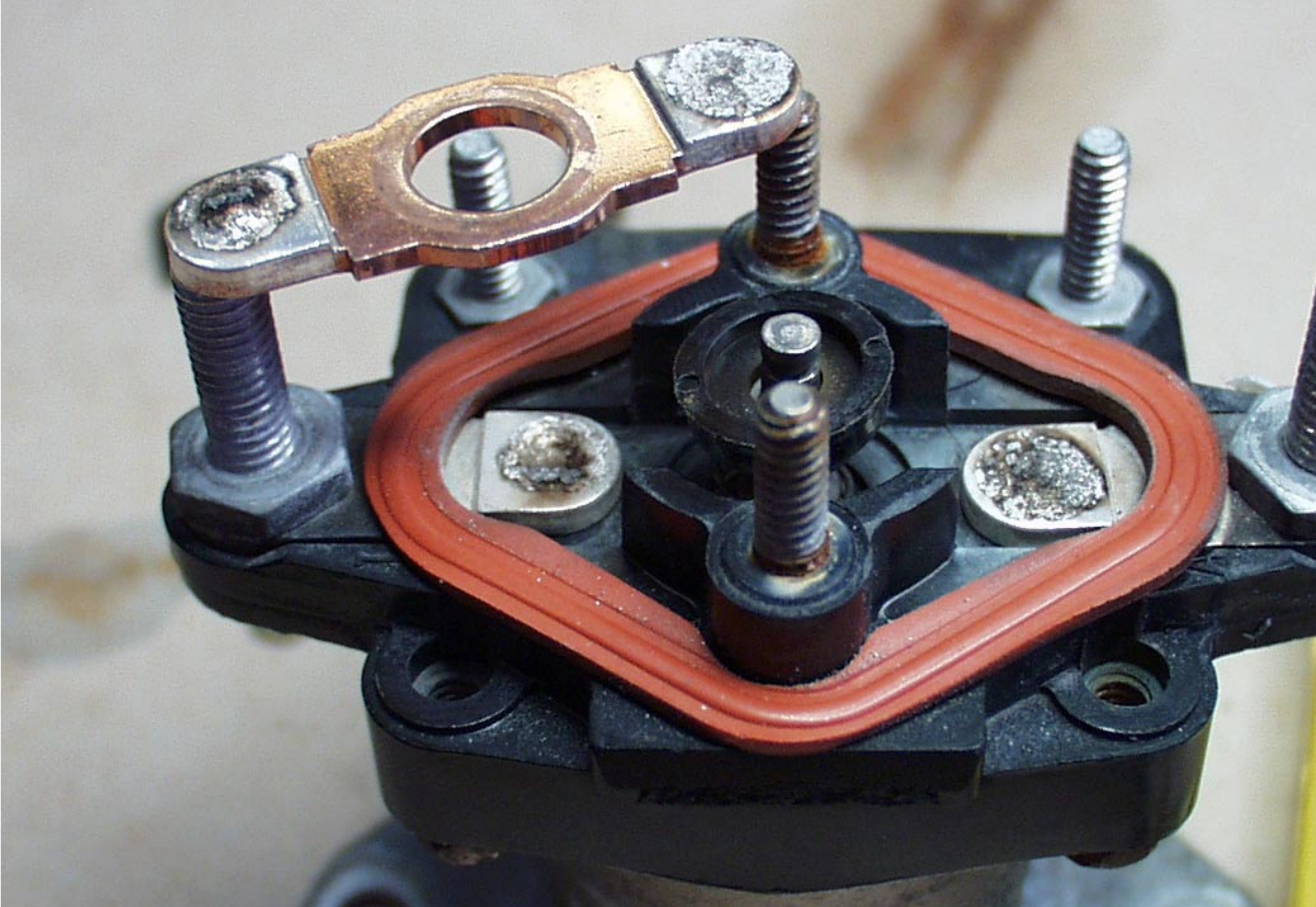
THE INVESTIGATION FOUND EVIDENCE OF A FUEL FED FIRE IN THE AFT AREA OF THE RIGHT MAIN LANDING GEAR WHEEL WELL AND IN THE WING IMMEDIATELY OUT BOARD OF THE RIGHT ENGINE NACELLE


13 9'99

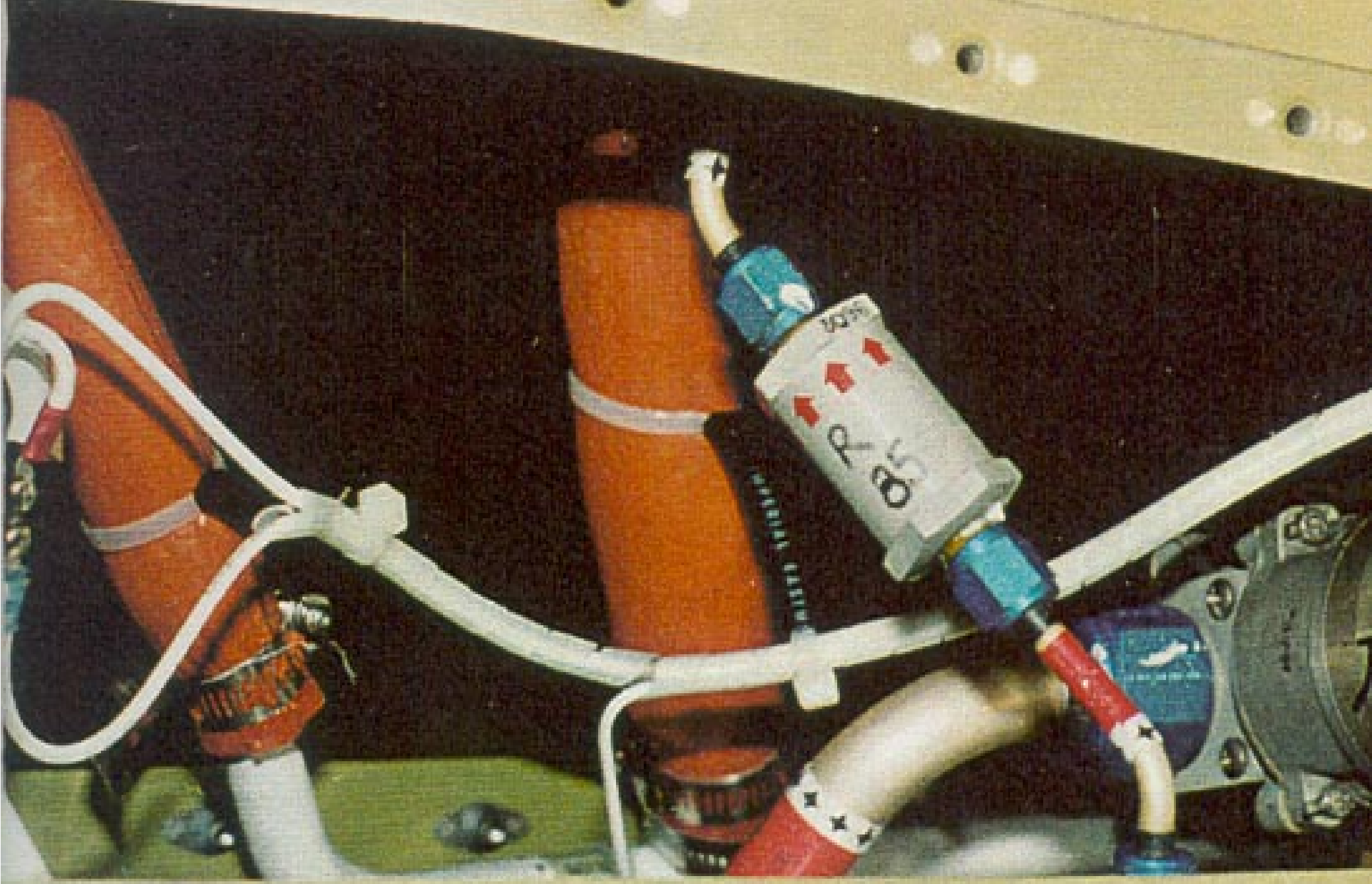
FUEL TO THE FIRE HAD BEEN SUPPLIED FROM TWO DAMAGED ALUMINIUM ALLOY FUEL TANK LINES IN THE RIGHT WING EQUIPMENT BAY

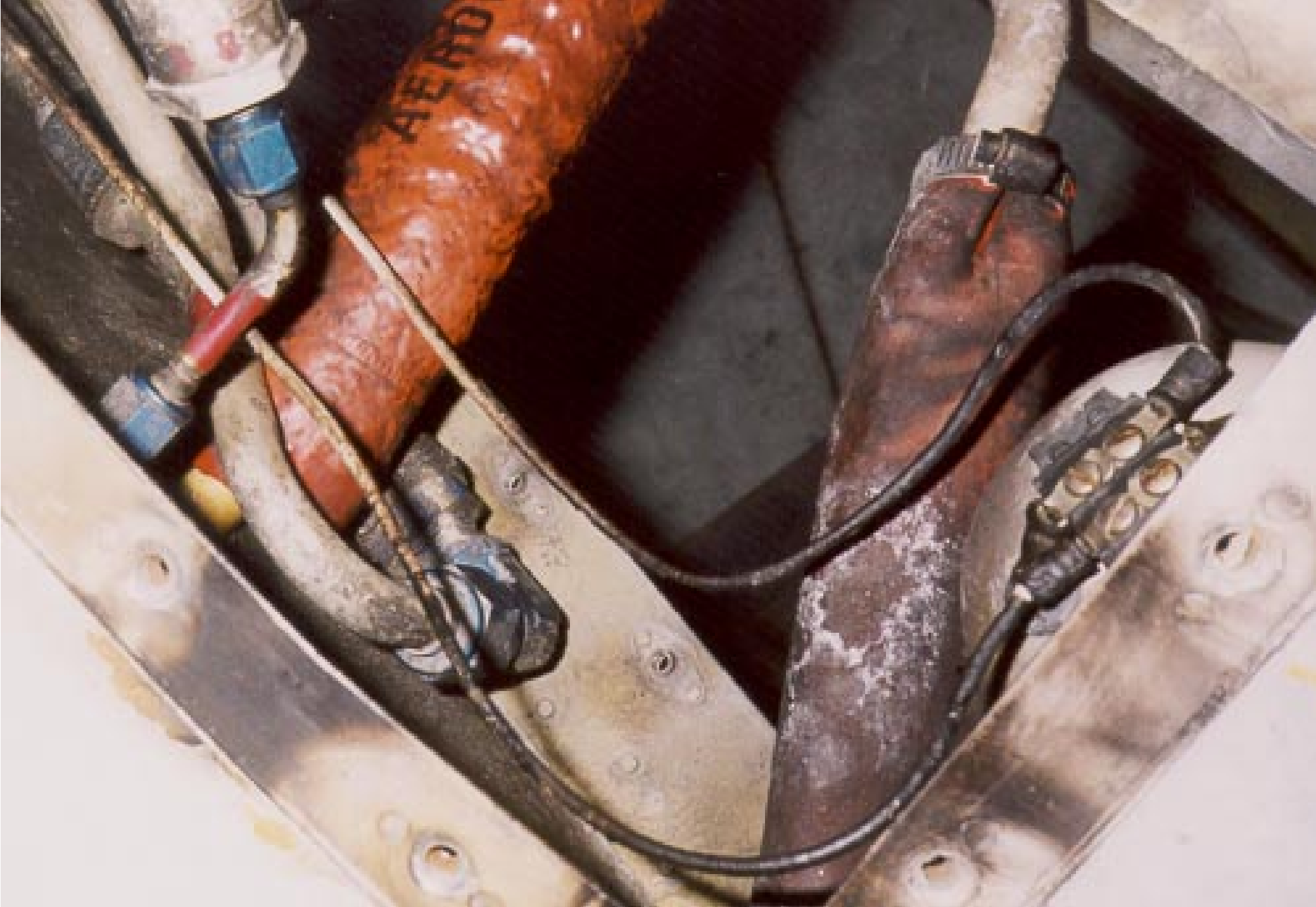






THE AIRCRAFT INVOLVED IN THIS ACCIDENT HAD BEEN REPAIRED PRIOR TO THE ACCIDENT AND THE CORRECT WIRING STAND - OFFS WERE NOT INSTALLED





INTERIM RECOMENDATION

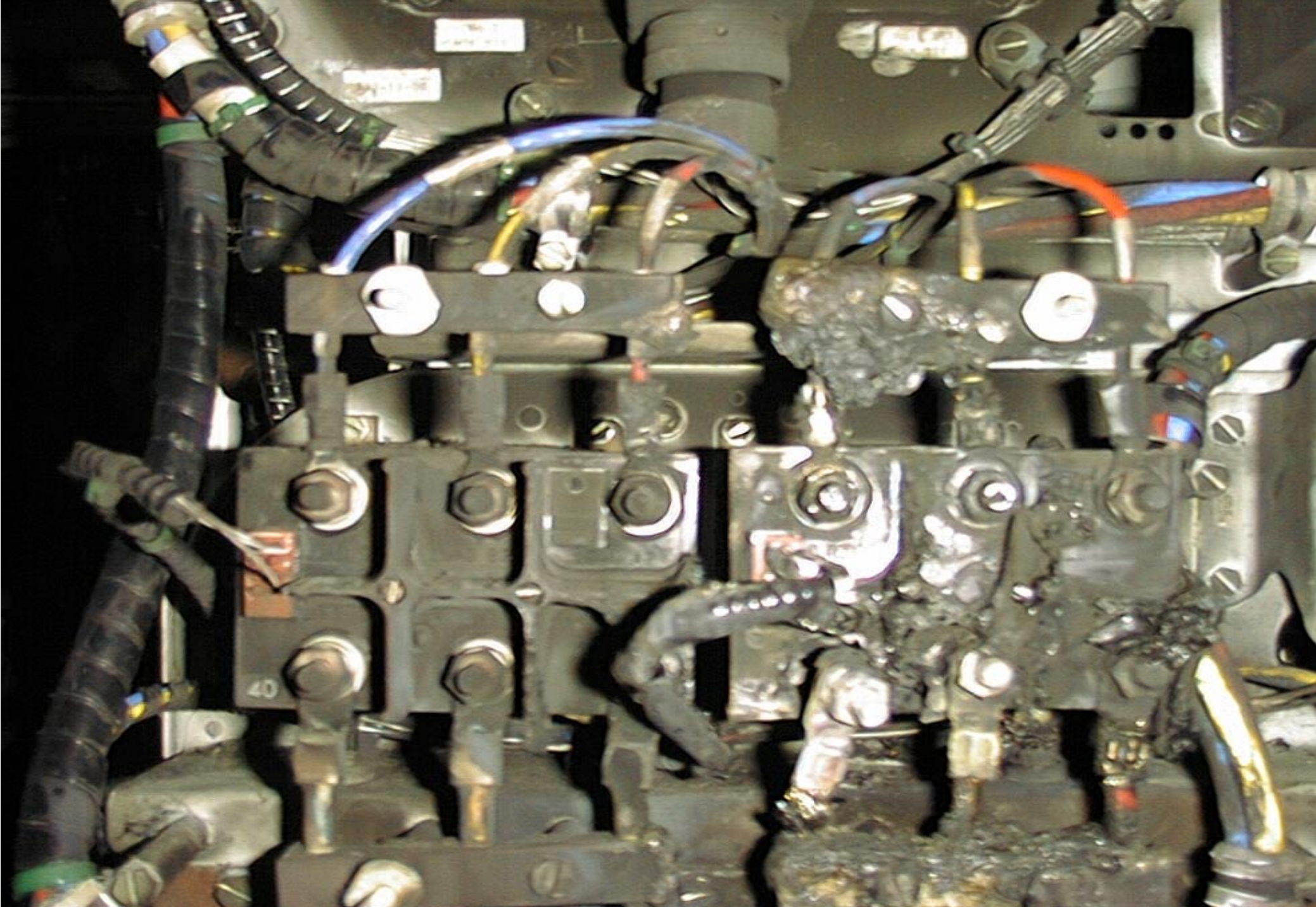
ALL OPERATORS INITIATE IMMEDIATE WIRING AND FUEL LINE INSPECTION IN WING ZONES 531 & 631

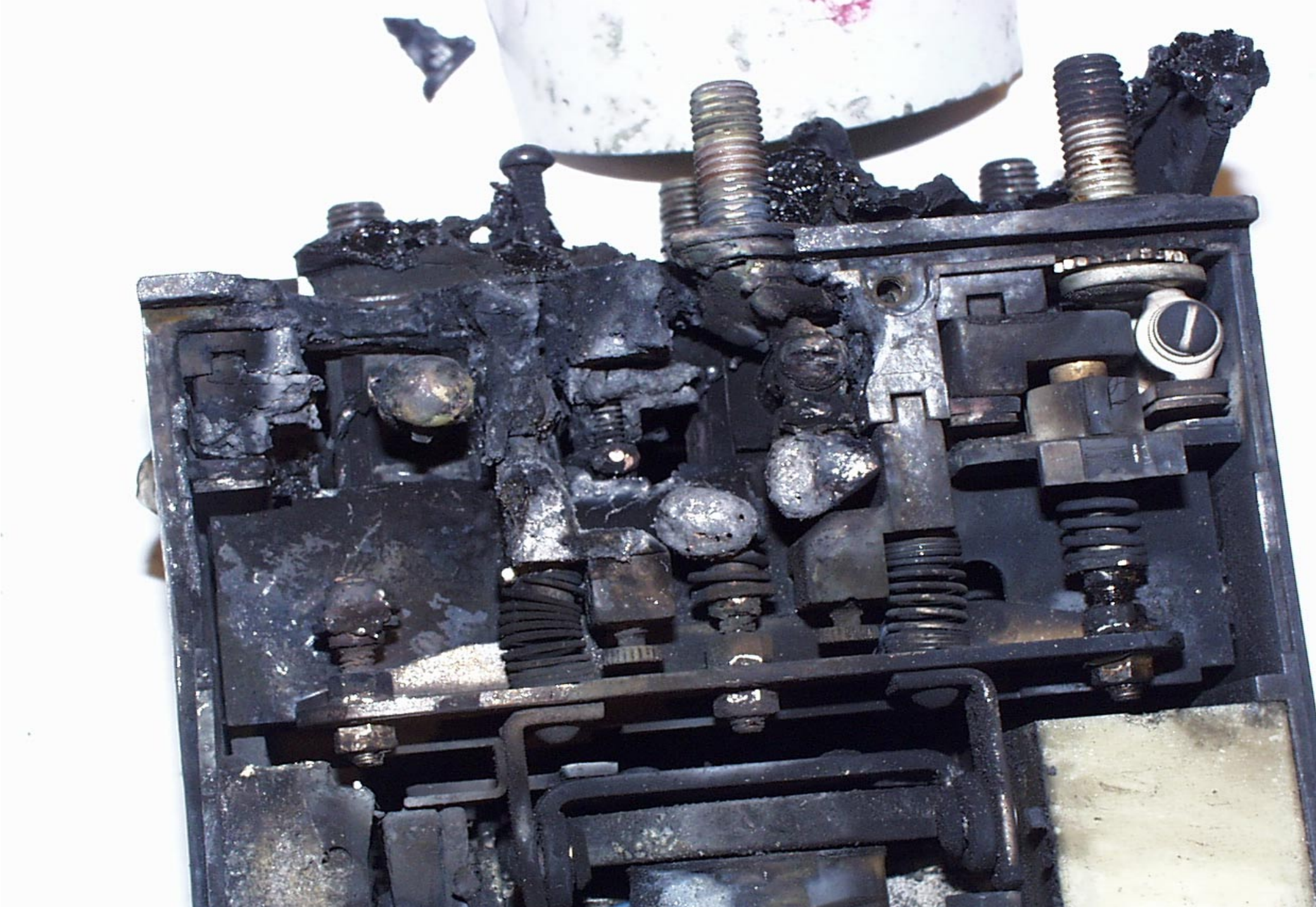
CLOSED AND ACCEPTED

BAe146 REMOTE CONTROL CIRCUIT BREAKER (RCCB) FIRE

HIGH CURRENT DRAW DEVICES SUCH AS A HYDRAULIC PUMP REQUIRE SWITCHING DEVICES (RCCB) OR RELAYS

THESE DEVICES REQUIRE REGULAR MAINTENANCE INSPECTIONS PARTICULARLY IN AGEING AIRCRAFT AS THESE DEVICES ARE DEGRADED BY THE HEAT PRODUCED BY THEIR OWN OPERATION





THE RCCB LOCATED IN THE EQUIPMENT BAY WITHIN THE CABIN IS NOT MONITORED BY FIRE OR SMOKE DETECTORS THE TECHNICAL CREW WERE ALERTED BY SMOKE IN THE COCKPIT, SYSTEM FAILURES AND THE FIRE

THE AIRFRAME MANUFACTURER'S FAILURE TREND DATA FOR THE RCCB WAS EXAMINED AND IT WAS FOUND TO BE A VERY RELIABLE COMPONENT CONSEQUENTLTY A RECURRENCE OF THIS TYPE UNLIKELY

SAFETY ACTION

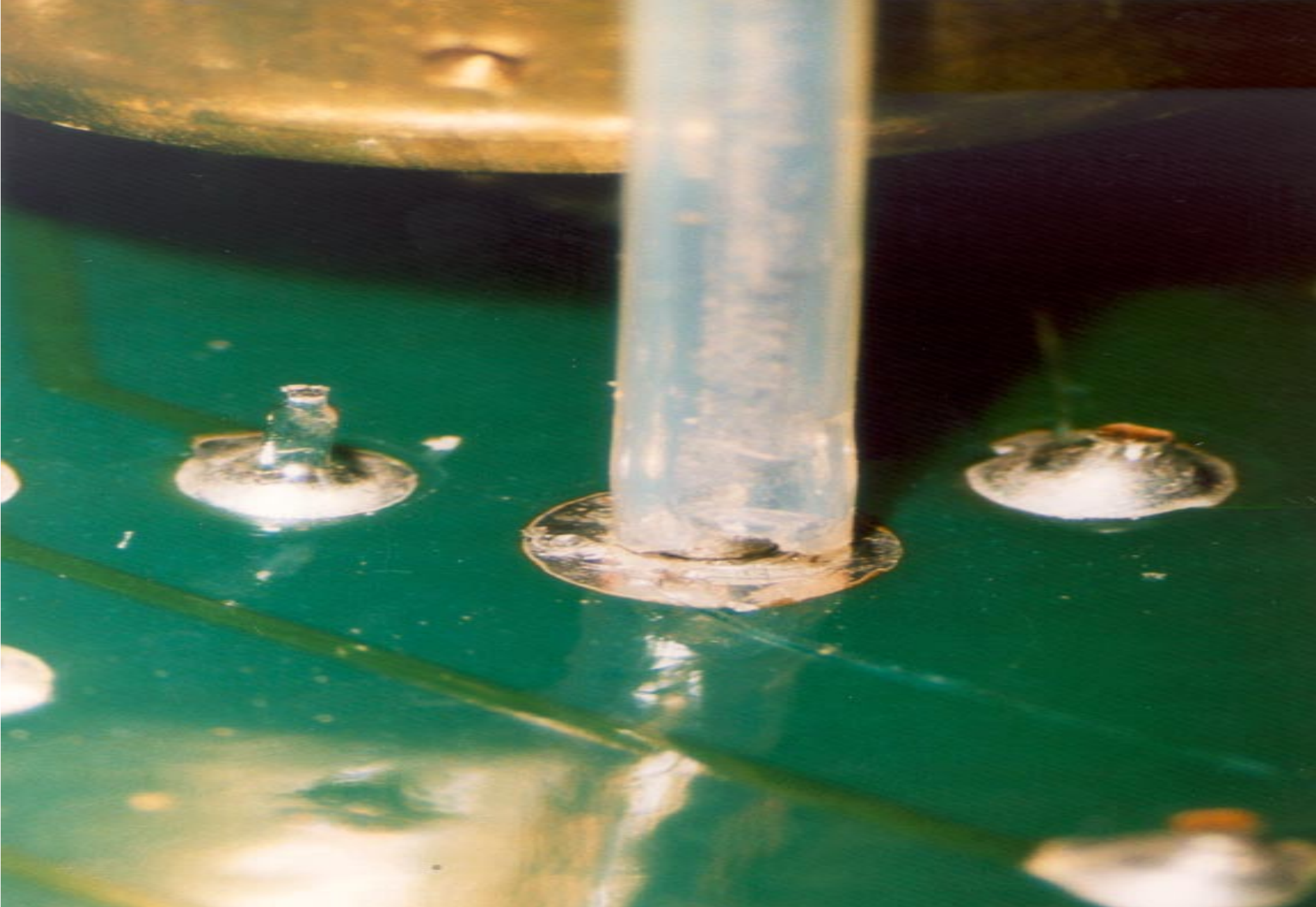
AFTER CONSULTATION WITH THE ATSB THE OPERATOR INSTIGATED A NEW PROCEDURE TSI-146-24-004

- *FITMENT OF HEAT SENSITIVE DECALS TO THE RCCB*
- *RECORDING THE OPERATING TEMPERATURES IN A DATA BASE TO ANALYSE TEMPERATURE TRENDS THIS METHOD TURNED UP ANOTHER FAULTY RCCB (PROACTIVE)*

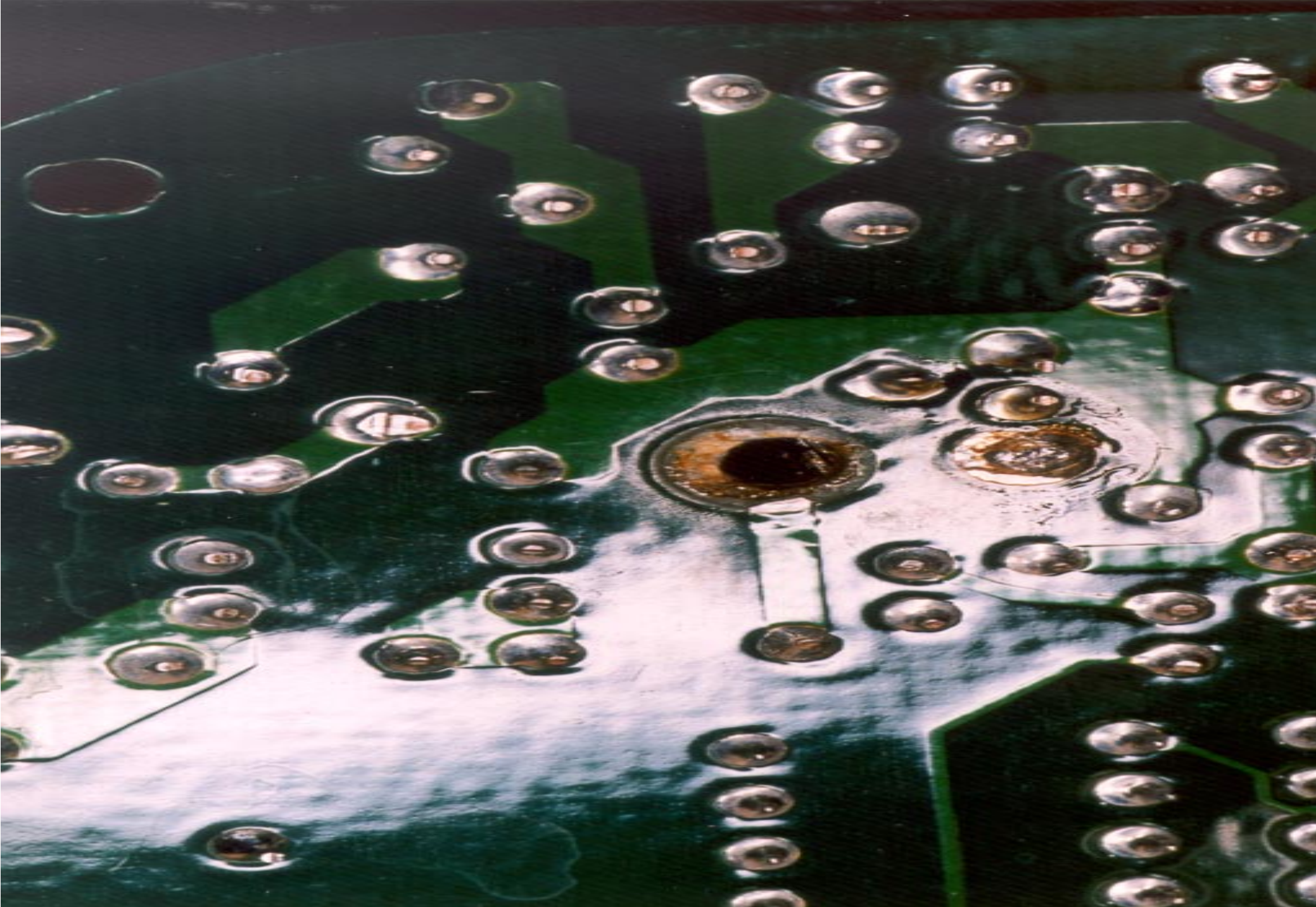
EMERGENCY LOCATOR BEACONS (ELT'S)

EXAMINATIONS OF ELT'S RETURNED FROM ACCIDENT SITES HAVE REVEALED FAILURES OF DIFFERENT TYPES IN THIS CASE THE UNIT DID NOT TRANSMIT A SIGNAL DUE TO A ELECTRONIC FAULT

WHEN TESTED THE UNIT OPERATED INTERMITTENTLY EXAMINATION OF THE CIRCUIT BOARD REVEALED A DRY JOINT AT THE "G" SWITCH



WITH CLOSER EXAMINATION OF THE CIRCUIT BOARD IT WAS FOUND THAT MODIFICATIONS HAD BEEN DONE TO REPAIR A DAMAGED SOLDER PAD



AD
NM74C
7555

THE HEAT TRANSFERED WHEN SOLDERING CAN EFFECT OTHER PARTS OF THE CIRCUIT EXTREME CARE MUST BE TAKEN WITH REPAIRS

ADVANCES IN TECHNOLOGY HAVE MADE IT POSSIBLE TO ACHIEVE AMAZING FEATS IN CONTROL OF FLIGHT SURFACES, MONITORING AND AIRCRAFT NAVIGATION

HOWEVER AGEING AIRCRAFT AND NEW TECHNOLOGIES PRESENT A CONSTANT PROBLEM WITH THE AMOUNT OF TIME AND MONEY REQUIRED TO KEEP THESE SYSTEMS OPERATING AT THEIR FULL POTENTIAL

SOME OF THE ELECTRONIC OR ELECTRICAL FAULTS CAN BE MAINTENANCE INDUCED:

- *REWIRING IN A NON-APPROVED MANNER*
- *UNPLUGGING AN ELECTRICAL OR ELECTRONIC CONNECTOR*

ELECTRICAL , ELECTRONIC CONNECTORS AND PLUG HOUSINGS CAN BECOME DEGRADED BY TEMPERATURE EXTREMES, VIBRATION OR CHEMICALS

IT IS POSSIBLE TO PUSH A VITAL CONNECTOR PIN COMPLETELY OUT OF THE CONNECTOR BY SIMPLY RECONNECTING, RESULTING IN INTERMITTENT, SHORT OR OPEN CIRCUITS

QUESTIONS ?

THANKS FOR YOUR TIME