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
CENTRE WING TANK
Wing Center Section

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

Steel strain relief clamp shown rotated out of position

0.45 inch
PTFE insulation thinned and split through to the conductor.

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
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 RECOMMENDATION

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 CONSEQUENTLY 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
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