No. 11

ANSETT-A.N.A., Viscount 832 aircraft, VH-RMI, accident near Winton, Queensland, Australia, on 22 September, 1966. Report released on 4 October 1967, by the Minister for Civil Aviation, Australia.

1. - Investigation

1.1 History of the flight

On 22 September 1966, the Viscount 832 aircraft registered VH-RMI, was engaged on a regular public transport service, designated Flight 149, from Mt. Isa to Longreach in Queensland, Australia, with a crew of four and twenty passengers on board. The flight departed from Mt. Isa at 1208 hours Australian Eastern Standard Time climbing to Flight Level 175 with an expected time interval of 73 minutes to Longreach.

The flight progressed, apparently uneventfully, until 1252 hours when the Longreach Flight Service Unit heard the crew of VH-RMI say that it was on an emergency descent and to stand by. Two minutes later the aircraft advised that there were fire warnings in respect of Nos. 1 and 2 engines, that one of these warning conditions had ceased and that the propeller of the other engine could not be feathered. At 1259 hours information from the crew of VH-RMI, relayed to Longreach through the crew of another aircraft in the vicinity, indicated that there was a visible fire in No. 2 engine and that the aircraft was diverting below 5 000 ft to Winton. The town of Winton is located some 20 miles to port of the planned track and is 90 miles short of Longreach.

No further communications were received from the aircraft but at 1303 hours a number of people located in the Winton area saw black smoke in the air west of the town, and it was subsequently established that this was associated with VH-RMI which had crashed in light timber on level ground some 13½ miles short of the Winton aerodrome.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	4	20	-
Non-fatal	-	-	-
None	-	-	

1.3 Damage to aircraft

The aircraft was destroyed by impact forces and fire.

1.4 Other damage

Apart from fire damage to some trees there was no damage to other property.

1.5 Crew information

The pilot-in-command of the aircraft, aged 41 years, held a valid First Class Airline Transport Pilot Licence endorsed for various types of aircraft including Viscount 832 aircraft. His total flying experience amounted to 14 288 hours, of which 10 003 hours had been flown in command including 1 025 hours in command of Viscount 832 aircraft. His last proficiency checks were carried out on 9 March and 2 April 1966, and the results of these checks were consistent with the very high standard of proficiency which he had exhibited throughout his flying career. He was last medically examined during April 1966, at which time he met the standards for the class of licence he held. There was nothing to suggest that the pilot-in-command was other than in good health and spirits on the day of the accident.

The co-pilot, aged 29 years, held a valid Second Class Airline Transport Pilot Licence endorsed for various types of aircraft including Viscount 832 aircraft. His total flying experience was 2 803 hours, most of which had been gained as co-pilot on airline aircraft including 249 hours as first officer on Viscount aircraft. The last proficiency check undertaken by the first officer was on 15 July 1966, when he was cleared to fly in this capacity on Viscount 832 aircraft. In a medical examination undertaken only two days prior to the accident, it was found that the co-pilot continued to meet the medical standards for the class of licence he held.

The cabin attendants (two hostesses) were properly trained for their duties.

1.6 Aircraft information

The aircraft, a Vickers Viscount 832, Serial Number 416, was manufactured for Ansett-A.N.A. in 1958-59. At the time of the accident it had flown a total of 18 634 hours since new, of which 6 586 hours had been flown since the last complete overhaul.

The aircraft was operating under a current Australian Certificate of Airworthiness which was last renewed on 10 April 1964. It was found in the investigation that this certificate, by virtue of the Australian Air Navigation Regulations, was deemed to be suspended at the time of the flight which culminated in this accident because of some irregularities which had occurred in the maintenance of the aircraft. None of these irregularities in any way contributed to this accident.

The aircraft was powered by four Rolls Royce Dart 525 gas turbine engines and the air for cabin pressurization, ventilation and temperature control was supplied by three Godfrey Type 15 blowers mounted on the engine-driven accessory gear boxes for Nos. 2, 3 and 4 engines and located aft of the airframe firewall. The No. 2 blower installed in VH-RMI at the time of the accident was fitted to the aircraft on 30 April 1966, and had completed 915 hours since the last overhaul. The unit was manufactured by Godfrey Precision Products Ltd., of England in 1959 and had completed 14 427 operating hours since new. The oil metering unit filter associated with this blower was removed and cleaned during the course of a 6 000-hour aircraft inspection carried out in late June of 1966, and the last general inspection of the No. 2 engine gear box area was carried out in Sydney two days prior to the accident.

Although the operator introduced a number of unauthorized modifications to these blowers during his overhaul of the units, it was found that none of these modifications contributed in any way to the accident. It was also found that the No. 2 blower had been assembled with the rear vent plug incorrectly positioned in the uppermost position and it was deduced that this could lead to an accumulation of some 20-25 c.c. of oil in the rear vent chamber of the blower. There was no conclusive evidence that this accumulation of oil in any way adversely affected the operation of the blower or contributed to this accident.

The aircraft was flown from Brisbane to Mt. Isa on the day prior to the accident by the same crew as was involved in the accident. No report or record of any mechanical defect was made following this flight and there is no evidence of any contamination of the aviation kerosene added to the aircraft to fill its tanks prior to the departure from Mt. Isa.

The gross weight of the aircraft at the time of take-off at Mt. Isa was 64 068 lb, which was 8 432 lb less than the maximum permissible gross weight for take-off. The weight of fuel consumed up until the time of the accident is estimated as being 2 850 lb, and thus the gross weight of the aircraft at the time of the accident was 2 782 lb less than the maximum permissible gross weight for landing. The position of the aircraft's centre of gravity at the time of the accident is estimated to have been 24.2% of standard mean chord which is within the permissible limits of travel.

1.7 Meteorological information

En route between Mt. Isa and Winton the aircraft was probably above most of the 4/8ths alto-cumulus cloud cover. The wind at Flight Level 175 was westerly at approximately 15 kt and the temperature at this height would have been minus 8°C. The weather conditions in the area of the accident were fine with broken alto-cumulus cloud having a base of 12 000 ft. The visibility was unlimited and the surface wind light and variable, swinging from the south-west through south to the south-east.

1.8 Aids to navigation

At the time of the accident there were no radio navigation aids installed at Winton and, in the critical period of this flight, the crew were able to navigate by visual reference to the terrain.

1.9 Communications

Communications between Longreach and VH-RMI were conducted direct on a VHF frequency until the aircraft's descent carried it to below 10 000 ft where terrain shielding prevented further direct VHF communication. Subsequent communications from the aircraft were relayed through other aircraft in the area and, although no record was available of the details of transmissions, a reliable reconstruction of the import of the communications from the aircraft was obtained from the recollections of the several people who overheard these communications.

1.10 Aerodrome and ground facilities

There were no aerodrome or other ground facilities relevant to this accident.

1.11 Flight recorders

The aircraft was equipped with a UDC type F-542B flight data recorder manufactured by United Control Corporation, USA. This recorder was installed in the forward belly locker of the aircraft and it recorded vertical acceleration, altitude, heading and airspeed, in addition to time. The recorder was recovered in the main wreckage area on the sixth day of the investigation. It had been buried beneath other wreckage including components of No. 3 engine and had been subjected to very severe impact damage and an intense ground fire. The recorder, along with other components, was embedded in a mass of metal which had melted and solidified around it.

When the recording medium was exposed, it was found that it had been torn from edge to edge in the vicinity of the scribe bar, the take-up spool cover had been dished inducing some mechanical damage to the medium, there had been considerable penetration of the take-up spool chamber by heat, molten metal and ash and most of the stylus actuating units and stylii had been dislodged. It was also found that the recording medium had been heavily discoloured by oxides and other contaminants and no useful amount of engraving was visible under the microscope. A cleaning process using hot, diluted nitric acid followed by light polishing in some areas was adopted and, after several months of painstaking effort, the heading, altitude and airspeed records for the whole of the flight until within two minutes of the ground impact were determined. The vertical acceleration and time traces remained substantially unreadable but the former was of little significance in the investigation and the latter was determined by calculation from the known foil transport speed.

The flight data record indicated that the aircraft reached Flight Level 175 at 1240 hours, and cruised at this level for the subsequent seven minutes with the automatic pilot engaged and the height lock facility in use. At 1247 hours, or 18 minutes prior to the point at which descent would normally have been commenced into Longreach, the automatic pilot was disengaged and the aircraft commenced a descent which was described by the flight crew five minutes later as an emergency descent. This descent was continued at an average rate of approximately 1 000 ft per minute and at an average airspeed of 180 knots until shortly before the accident occurred. A great deal of useful information was derived from a close examination of the descent profile of the aircraft. In conjunction with other evidence such as the communications from the aircraft and the results of wreckage examination, it was possible to define the sequence and times of the principal events which the aircraft experienced during this descent. By 1301 hours, or two minutes prior to impact with the ground, the aircraft had reached an altitude of 5 000 ft and was flying towards Winton at an indicated airspeed of 170 knots. The mechanical damage to the recording medium precluded the determination of any certain information relating to the last two minutes of flight, but it was possible to determine the height and heading of the aircraft at the time of structural failure by analysis of the wreckage trail.

A cockpit voice recorder was not installed in the aircraft.

1.12 Wreckage

The principal impact of the aircraft occurred on flat terrain 640 ft above mean sea level and components of the aircraft were found scattered through light timber over a distance of 6 170 ft leading to the main impact area. A wind drift analysis was carried out in relation to selected items of wreckage, and this led to a determination in conjunction with other evidence that there was a structural failure of the aircraft whilst it was on a

heading of 070 degrees in a steady descending flight path at an indicated airspeed close to 170 knots and when the aircraft was between 3 500 and 4 000 ft above ground level. At this point in the flight path, the port wing failed upwards between Nos. 1 and 2 engine nacelles, struck the top of the fuselage, which at the same time was cut open by the blades of No. 1 propeller, and fell away from the remainder of the aircraft. The cabin shell above floor level was quickly broken away by air loads until eventually the rear fuselage and empennage also separated from the aircraft. The remaining forward fuselage, with the lower mid fuselage, starboard wing and engines and port wing stub with No. 2 engine still attached, struck the ground at the edge of a clay pan and was immediately engulfed in flame. The port wing section with No. 1 engine attached also burned after striking the ground.

The wreckage examination indicated that the port wing spar upper boom had been heated to a temperature of approximately 320°C at wing station 188, and that it had failed in compression when its residual strength was approximately 12 per cent of the required material specification. The point of failure in this boom was immediately adjacent to the overwing louvred air exit whence is discharged the air normally circulating inside the wing during flight. There were clear signs that an intense fire had been burning above the fuel level in cell 2 of fuel tank No. 2 which is located between Nos. 1 and 2 engines forward of the wing main spar. There were also unmistakable signs that an in-flight fire had existed in the adjacent port main landing gear bay and there were signs in some components of the rear nacelle immediately forward of this bay that they had been affected also by heat in flight. The No. 2 cabin blower which is installed in this area was recovered and it was found that it had experienced a major mechanical failure.

The rate of flow of oil to the four main bearings of the cabin blower is controlled by an oil metering unit attached to the rear end cover of the blower. The oil metering unit was missing from the No. 2 cabin blower when it was recovered and it was found separately in the wreckage. From an examination of the five studs and nuts which normally secure the oil metering unit to the cabin blower, it was established that the nuts and studs had loosened during operation allowing the oil metering unit to move rearward from the blower end cover, thus releasing the outer race of the driven rotor rear roller bearing. With the loss of radial restraint, there was an immediate failure of this bearing and gross contact between the rotating and stationary elements of the blower occurred. Since the oil metering unit continued to supply oil to the roller bearing area after the bearing failure but before it separated from the blower, an oil fire was ignited by the high friction temperatures generated. This fire escaped from the blower and ignited the resin in a fibre glass air duct which normally carries air from the blower outlet to the wing ducting system commencing in the port main landing gear bay.

It was also established in the wreckage examination that, at the time of their respective contacts with the ground, the No. 1 propeller was windmilling with the blades resting on the high pitch lock, No. 2 propeller was feathered, whilst Nos. 3 and 4 propellers were at blade angles consistent with substantial power being delivered. Furthermore, it was discovered that the low pressure fuel valves serving Nos. 1 and 2 engines were shut at the time of impact and those serving Nos. 3 and 4 engines were open. Both the undercarriage and the wing flaps were in their retracted positions at impact and a thorough examination of the remainder of the aircraft did not reveal any other evidence of defect which might have contributed to the accident.

1.13 Fire

The evidence indicates that, in flight, but at different times, fire warnings were received by the crew in respect of Nos. 1 and 2 engines. It was determined that both fire extinguishing shots available on the port side of the aircraft had been discharged into No. 1 engine. The wreckage examination did not reveal any evidence of fire occurring in flight in either of these engines, and it was concluded that the fire warnings were induced by the effects of heat on the conductor insulation for the fire warning systems contained in the electrical looms installed adjacent to the No. 2 nacelle and the port main landing gear bay. The evidence did indicate, however, that a severe fire occurred in flight aft of the No. 2 airframe firewall, in the port main landing gear bay and in the cell 2 of fuel tank No. 2. There are no fire detection or protection systems provided in these areas.

Severe ground fires broke out immediately upon impact in the main wreckage area and in the port wing to which was attached No. 1 engine. There were no fire-fighting facilities immediately available and the first fire-fighting units arrived at the scene of the accident approximately one hour after it had occurred. Their activities were confined to damping down the fire in the main wreckage area.

1.14 Survival aspects

The accident occurred close to a station homestead and it was reported by telephone to the Winton Police Station within a few minutes of its occurrence. During the in-flight structural break-up, sixteen of the occupants of the aircraft were discharged from it, eleven of them still strapped in their seats and the remaining eight occupants were carried into the main wreckage area. There were no survivors of the accident since it was non-survivable.

1.15 Tests and research

A great number of laboratory tests and experiments were carried out during the six months of intensive investigation which followed this accident. A number of these tests contributed materially to results of the investigation whilst some produced no useful information. The results of the useful tests and experiments are reflected in the wreckage examination results and in the conclusions derived.

1.16 Other pertinent information

During the course of the investigation of this accident, information relating to aircraft fires, provided by the Manufacturer from his records, referred to two earlier occurrences which proved to be of some significance. On 12 May 1964, at Toronto, Canada, a Viscount 724 aircraft operated by Air Canada experienced a severe fire in the No. 2 nacelle and port wheel bay area when a fire commenced in a cabin blower during a ground run. Detailed reports of the investigation of this occurrence carried out by the Operator were obtained through the Canadian Department of Transport.

Although it was apparent that the oil metering unit had been forced from the blower as a secondary effect in this occurrence and there were other circumstances which were dissimilar to the features established in the VH-RMI investigation, there were, on the other hand, a number of similar or significant circumstances revealed. There had been a fire inside the blower and it ignited the fibre glass duct attached to the blower outlet. The fire burned rearwards in a very short time and entered the wheel bay where its intensity

was sufficient to cause the engine fire extinguishing bottle to explode violently. The fire in No. 2 nacelle severed the aluminium alloy high pressure fuel cock control rod and burned a large hole in the thermal anti-icing crossover duct. In its initial stages, the fire was ignited and sustained by the normal oil supply to the bearings and the total oil loss arising from the fire was only some 2½ pints.

On 20 September 1964, a Viscount 772 aircraft en route between Piarco, Trinidad and Seawell, Barbados and operated by British West Indies Airways experienced a fire in the No. 4 nacelle area aft of the airframe firewall. Not a great deal is known of this occurrence, but the Manufacturer's records and further inquiries show that the fire occurred in the cabin blower as a result of a loosening of the nuts and studs attaching the oil metering unit to the blower. Although the aircraft landed within approximately 15 minutes, there was considerable fire damage in the area. Since, on this occasion, the fire occurred in an outboard engine nacelle, there were some dissimilarities of environment but, nevertheless, this was another case of an oil metering unit separating in flight from the cabin blower and inducing an internal fire which erupted and was sustained outside the cabin air supply system for a sufficiently long time to endanger the aircraft.

2. - Analysis and Conclusions

2.1 Analysis

The wreckage distribution pattern with support from other evidence clearly indicates that this accident involved a structural break-up of the aircraft, commencing at a height between 3 500 and 4 000 ft above ground level. The examination of the structure revealed that the initial failure occurred in the port wing main spar between Nos. 1 and 2 engines and metallurgical tests showed that, at the time of failure, the upper boom of this spar had been reduced in strength by heat to a level of some 12 per cent of material specification. Obviously, this condition assumed great significance in the light of the advice from the flight crew that there was a visible fire in the area of No. 2 engine during the emergency descent which they were conducting.

The examination of the No. 2 cabin blower showed that the mechanical failure had been followed by a fire within the blower. It was apparent that the fibre glass duct downstream from the blower outlet had also burned in flight, and thus it was difficult to avoid the conclusion that the fire within the blower propagated either internally or externally to ignite the fibre glass duct. Since this duct enters the wheel bay, there was a ready explanation for in-flight fire which the wreckage examination indicated had occurred in this area.

The main landing gear bay is normally separated from the adjacent outboard fuel cell bay by a closing rib but there is not a complete seal between these areas since, inter alia, along the rear face of the wing leading edge member, cut-outs are provided in the rib web to allow the passage of engine control rods and electrical cables to the No. 1 engine nacelle. In this area immediately aft of the engine accessories, it is not uncommon for the electrical looms to become oil soaked in service and thus a means of carrying the fire from the wheel bay to the fuel tank bay immediately outboard was readily available. This situation provides a feasible explanation as to the source of the fire which quite obviously raged in fuel cell 2 of tank No. 2 during the flight of the aircraft.

The normal internal air circulation pattern in flight was at all points conducive to the movement of the fire from the blower to the wing spar along this path. It was also apparent, however, that the crew had the wing thermal anti-icing system in operation during the flight and this would provide an augmentation of the air flow within the fuel tank bay. Once the fire was introduced to this bay, it would have been fanned by a forced draught of air exiting through the overwing louvre which is placed forward of but immediately adjacent to the upper boom of the main spar. In these circumstances, the principal effects of the fire in the fuel tank would have been directed against the upper boom of the spar in the area where it finally failed. In this way, a very feasible explanation became available as to how the mechanical failure in the No. 2 cabin blower produced a visible fire which the flight crew associated with No. 2 engine and induced the fuel cell fire which ultimately led to the structural failure of the port wing in flight.

This explanation of the sequence of events also provided tenable explanations for several otherwise puzzling items of evidence. For instance, the activitation of the fire warning systems for Nos. 1 and 2 engines apparently arose from a cable insulation break-down occurring when fire burned in the oil soaked looms which pass through the No. 2 nacelle and landing gear bay areas. Similarly, the inability of the flight crew to feather the No. 1 propeller can be attributed to the effects of fire on the electrical feathering control cables and to the fact that the aluminium alloy control rods crossing the No. 2 nacelle area towards No. 1 engine had been burned through, as occurred in the earlier Air Canada ground fire. An examination of the remainder of the wreckage failed to reveal any other significant defect in the aircraft or to produce any other tenable explanation of the accident.

It seems most likely that, although the flight crew were no doubt puzzled by the occurrence of fire warnings for Nos. 1 and 2 engines in quick succession and by their inability to feather No. 1 propeller by the two means available, it seems improbable that they could have had any real appreciation of the seriousness of the internal fire in the wing of the aircraft. The management problems with two engines and the subsequent visible signs of fire obviously prompted their decision to divert to Winton which was the nearest suitable aerodrome. At the time of the structural failure the flight crew would have had Winton aerodrome well in sight and would have been expecting to land within the next five minutes. The preparation of the passengers for an emergency evacuation after landing indicates that the existence of an emergency situation was well appreciated, but it seems that the structural failure in flight was not an event which they expected to occur. Having regard to the information available to the flight crew, it does not seem reasonable that they should have expected such a catastrophic event at this time and it seems that the command decisions were properly taken on the information available to the captain.

2.2 Conclusions

Findings

The crew, comprising two pilots and two hostesses, were adequately and properly trained to operate the aircraft. The pilots were properly certificated and apparently medically fit to undertake the duties of the flight.

Weather was not a factor in this accident.

There was a current certificate of airworthiness for the aircraft and, at the commencement of the flight, there was no evidence of any defect in the aircraft.

The aircraft was loaded within safe limits.

The crash of the aircraft followed the failure in an upward direction of the port wing between No. 1 and No. 2 engines at approximately 1302:30 hours Eastern Standard Time when the aircraft was at a height of 3 500 ft to 4 000 ft above ground level.

The port wing failed as a result of a weakening of the main spar due to a fire in No. 2 cell of No. 2 fuel tank.

The fire originated in the No. 2 cabin blower and travelled through the rear of No. 2 engine nacelle and port wheel bay to the fuel tank.

The fire in No. 2 cabin blower was initiated as a result of a rotor break-up, the blower subsequently being driven in an out-of-balance condition by the quill shaft long enough for the metering unit to become separated from the rear end cover by the resulting vibration.

The metering unit continued to be driven after separation and lubricating oil continued to be supplied. The driven rotor lost its rear stub shaft radial location and caused metal-to-metal contact which generated a temperature sufficiently high to ignite the oil in that area.

It is not possible on the evidence to determine what was the cause of the rotor break-up.

Cause or
Probable cause(s)

The probable cause of the accident was that the means of securing the oil metering unit to the No. 2 cabin blower became ineffective and this led to the initiation of a fire within the blower, which propagated to the wing fuel tank and substantially reduced the strength of the main spar upper boom. It is probable that the separation of the oil metering unit arose from an out-of-balance condition induced by rotor break-up but the source of the rotor break-up could not be determined.

3. - Recommendations

Arising from matters revealed in the course of the investigation of this accident, the Department of Civil Aviation in Australia has taken the following precautionary action in respect of all types of Viscount aircraft:

(a) Required the engine-driven cabin air blowers to be inspected for looseness and possible leaks in the oil pipe banjo assemblies and required the area surrounding the blowers, the auxiliary gear box compartment and the wheel wells to be inspected for oil leaks and accumulations of inflammable fluids.

(b) Required the cabin air blower quill shaft to be modified or replaced in accordance with Dowty Rotol Service Bulletin Number 83-210 which provides for a lower torque value at the sheer neck.

(c) Required that the nuts and studs securing the oil metering unit and the bearing cover plate to the rear end of the cabin blowers be positively locked in a manner such as lock wiring through drilled studs and castellated nuts.

(d) Required the replacement of the banjo type connection between the oil metering unit filter assembly and the oil supply line serving the cabin air blower by a more positive type connection.

(e) Required replacement of the aluminium alloy high pressure cock/feather control rods and throttle/RPM control rods in critical unprotected areas to be replaced by rods made of fire-proof materials.

(f) Required that adequate drainage be provided from accessory gear box drip trays and that blower case vents be connected to the existing nacelle drain systems.

(g) Required that the fibre glass outlet ducts from the cabin air blowers be replaced by ducts having a fire resistance at least equal to that provided by aluminium alloy.

(h) Required that engine fire extinguisher bottles incorporate a pressure relief device.

(i) Required that, if a fire warning persists after the extinguishing and feathering drill has been completed and a visual inspection reveals evidence of fire or smoke, where the fire warning is associated with the corresponding cabin pressure overheat or airflow failure warning or airframe de-icer overheat warning, both airframe de-icing systems must be switched 'OFF'. Some discretionary judgement is allowed when the aircraft is flying in icing conditions.

(j) Required that the propeller of the applicable engine be feathered if an airframe de-icing system overheat warning light illuminates when both de-icing systems are selected 'OFF'. If this warning light illuminates when both systems are selected 'ON', the same action is required if the system is selected 'OFF' and the warning light remains 'ON' after one minute has elapsed.

(k) Required that, if a cabin blower air flow failure warning light illuminates or, in the case of Viscount 700 aircraft, the light illuminates with the spill valve closed, the flight crew is to select one of the other spill valves to the 'OPEN' position. If the air flow failure light remains 'ON', the spill valve for the affected blower must be opened and regular visual inspections made for evidence of fire. If there is evidence of fire, both airframe de-icing systems are to be switched 'OFF' and the applicable propeller feathered.

In addition to the foregoing requirements, the Australian Department of Civil Aviation, in conjunction with Viscount Operators, is also conducting a programme of evaluation for the incorporation of a temperature sensor in the cabin blower case linked to an indicating or warning device in the cockpit. A number of aircraft have been experimentally fitted and appropriate cockpit drills have been devised to be carried out when a cabin blower overheat warning condition exists.

In addition to the action undertaken by the Department of Civil Aviation, the Chairman of the Board of Inquiry made a number of observations and recommendations in his report to the Minister for Civil Aviation. The following matters were referred to:

(a) The Chairman said that the evidence indicated the need for the continuous maintenance of the utmost accuracy in manuals issued by manufacturers of aircraft components and in sketches and drawings included therein. The Chairman also said that when changes are made, whether in the text or the sketches and drawings of these manuals, attention should be drawn explicitly to their purpose and they should be circulated amongst interested parties with appropriate despatch having regard to their nature.

(b) The Chairman pointed out that it was essential that the organisation using manufacturers' manuals should ensure that the manuals and revisions are made available to and closely studied by those who are required to work in accordance with them. He went on to commend the ATA-100 specification for manufacturers' manuals as being a standard worthy of adoption in Australia.

(c) The Chairman said that, where doubt is entertained by responsible representatives of an operator as to the accuracy of any drawing, whether it be an assembly or installation drawing or as to any method or procedure of overhaul or repair, it should be referred to the manufacturer for determination.

(d) The Chairman referred to the need for operating companies to maintain a very high standard of accuracy in their aircraft maintenance records systems.

(e) The Chairman emphasized the desirability of the utmost consultation between the subsidiaries or agents of manufacturers and their principals in relation to any unique or unusual incident which may be revealed.

(f) The Chairman said that particulars of modifications which vary a manufacturer's design of an aircraft component, although made in accordance with airworthiness requirements, should be notified to the manufacturers of that component.

(g) The Chairman pointed out that the unusual, unexpected or unique accident or incident will at all times repay careful scrutiny and particularly where fire is involved. He said that any such accident or incident should be reported to the manufacturer of the aircraft, who in turn should seek such further information as may be necessary to determine its cause. The Chairman also said that, in the case of a vendor component, the manufacturer of such component should be notified.