

Evidence in Aircraft Accident Investigation and its Evaluation

AIR CMDE SK. MUKHERJEE, * VSM

Introduction

A jet trainer aircraft with dual seats got airborne with an instructor and a pupil on board for a low flying sortie. A normal R/T call was made 5 minutes after take off. There was no further R/T transmission. The aircraft crashed 12 minutes after take off at a point 15 NM from the airfield. Both the pilots were killed instantaneously. The aircraft was extensively damaged due to force of impact and fire. The body of the instructor was in the wreckage and was charred. The body of the pupil was close to the ejection seat 15 feet from the main wreckage. His seat had fired automatically on ground impact.

Examination of the crash site and the components of the crashed aircraft failed to establish the cause of the accident. There were no eye witnesses. Post mortem examination of the pupils body showed cherrypink staining of the tissues, blood carboxyhaemoglobin content of 42 per cent, presence of soot particles in the trachea and no skin burns. The cause of the accident was established to be due to pilot incapacitation as a result of carbon monoxide intoxication by inhalation of smoke or fumes in flight. The finding led to the critical examination of the fuel conduction system and institution of specific check for fuel seepage during daily flight servicing.

On the morning of 10 Jan 54 a comet airliner took off from Rome for London with 35 people on board. It attained an altitude of 30,000 feet. About 25 minutes later, it crashed into the sea. There were no survivors but within about 4 hours 15 bodies were recovered from the sea in an area some 1½ miles in diameter. On the evening of 8 Apr 54 a similar

aircraft disappeared on a routine flight from Rome to Cairo with 21 people on board. It was flying at 30,000 feet. The following evening 5 bodies were found floating on the sea. The 6th body was washed ashore ten days later. Many intricate investigations were carried out to determine the basic cause of the disasters. There were no live witnesses, only a part of the wreckage could be salvaged in one case and there were the bodies of the victims. The only tangible evidence were the bodies. Extensive post mortem examinations including detailed histopathology establish the cause of the accidents as structural failure of the cabin and explosive decompression. The findings were corroborated by exposing laboratory animals and full scale clothed human dummies to similar experimental situation. This is a classical example of the importance of aeromedical investigation which ultimately led to the improvement in the design and structure of an aircraft.

I have mentioned but three of the numerous aircraft accidents which would have passed as "Cause undetermined" but for the contribution of experts in the field of aviation medicine of which Pathology is a part. The purpose of an aircraft accident investigation is to determine all factors, human and material which directly or indirectly contributed to the accident. The purpose of medical investigation is more deep. Its purpose is to evaluate physical and psychological factors of all personnel connected directly or indirectly with the accident and also to make observations upon forces and objects which contributed to injury or death. Further, the details observed during the course of a particular investigation may not lead

* Joint Director of Medical Services (S), Air Headquarters (VB), New Delhi-110 011

to a specific recommendation in that case but compilation of such observation over a period of time and their analysis may lead to specific recommendations in future. Such studies are being conducted in the Air Force.

Human factors as causes of accidents are well known. But to establish the factors involved in a particular accident requires intelligent and expert analysis of all factors surrounding the accident. An aircraft accident is investigated by personnel of all disciplines who investigated their specific fields viz structures and aerodynamics, power plants, electrical, armament and escape systems, flying operations and aeromedical. The medical investigation has the widest field as he has to analyse human factors involved amongst all categories of personnel viz aircrew, ATC, supervisors, maintenance and medical personnel.

There are three basic sources of evidence in an aircraft accident :

(a) Information from persons having knowledge pertaining to the accident. These persons are the aircrew themselves, passengers, eyewitnesses and the airtraffic controllers.

(b) Wreckage, scene of the accident and records and documents pertaining to the aircraft, aircrew, weather, flight and ATC records.

(c) Persons who know the environment and the pilot. These are the supervisory personnel in the squadron, colleagues, meteorological personnel, doctors and the often forgotten members of family of the aircrew. I shall deal specifically with those evidence with which the medical examiner is concerned.

Examination of Wreckage and the Scene of Accident

For proper investigation, all possible evidence connected with an accident, must be collected. Evidence of living persons may be inaccurate but the wreckage and scene of accident do not lie and provide the most valuable clue. True and realistic representation of the crash is vital for correct analysis of accident cause factors and photography has the most important part to play in it. Photographs must be taken as soon as possible before the wreckage and bodies are disturbed and locations of survivors are marked on it later. The general wreckage is photographed from various directions

and along the wreckage trail. The photographs must record every detail—the instruments, cockpit, fuel cocks, switch positions, position of under carriage and flot jacks, control surface position, trim settings, suspicious breakages and bends, power plant control lever positions, seat harnesses and any other details which may help in assessing the actions of the pilot prior to the crash. Colour photography helps immensely in these situations because it affords scope for better interpretation than what the black and white photographs can provide. It brings out the colour coding of switches, levers and instruments and records any possible remnants of tissues and blood in the cockpit.

Another important evidence is the wreckage, distribution and ground marks. The wreckage diagrams must be made out as soon as possible. Valuable evidence may be lost by delays due to shifting of objects, trampling by personnel, effects of rains etc. The diagram is made on a scale showing distances and bearing of the main wreckage, scattered parts, survivors, bodies and all impact and ground markings. Such a chart accurately prepared may give clues as to sequence of events and failure patterns. The impact marks and distribution of wreckage and extent of distortion may give information about the flight path, angle, altitude and speed of aircraft at the time of impact. If the wreckage is widely scattered there is possibility of structural disintegration in the air.

Examination of Witnesses

Evidence of witnesses provides the most important information on the circumstances and the cause of the accident. Indeed, in some instances, the only clue as to the cause of the accident may come from the eyewitness accounts for example, when an aircraft suddenly and for no apparent reason, plunges into the sea and is lost with neither the plane nor the pilot being recovered, the assignment of the cause must be based on the testimony of the fellow pilots in the formation who may have had a chance to observe the deceased's actions immediately prior to the crash. The purpose of the interview is not only to get first hand knowledge of the circumstances surrounding the accident but also to determine the airworthiness of the aircraft and the background of the crew in terms of medical fitness and competence for flying the sortie.

Recording of evidence of witnesses may appear to be a simple procedure, but in fact it is not so. How

often valuable evidence is lost because of lack of understanding and tact of the investigator and reservations, ignorances and fear of the witness. I am enumerating a few of the simple but important hints for meaningful evidence :

- (a) The statements must be taken as early as possible after the accident to ensure maximum recall.
- (b) The investigator should be able to gain confidence of the witness and put him at ease. He must be convinced that the purpose of the interview is to gather information to prevent further accident.
- (c) The witness should be advised to relate in complete detail everything he personally saw or heard.
- (d) It is better to examine the witness at the place where he was at the time of the accident.
- (e) If necessary, he should be given a model aircraft and told to show the aircraft flight path and altitudes.
- (f) The witness should be allowed to tell his story without interruption. The investigator should adopt an attentive and interested attitude and make mental or written notes for later questioning.
- (g) As far as possible the evidence should be recorded as stated by the witness in his own words (directly or through interpreter) and not what the investigator believes he said. It tends to bring in the bias of the investigator without he being aware of it.
- (h) Questions may be asked for clarification, only when the witness has nothing further to say. These should be direct and to the point and should not be leading.
- (i) The investigator must not only use his ears but his eyes and mind as well. The expression and altitude of the witness have a strong bearing on the credibility of his evidence.

Evaluation of Evidence

In the case of an aircraft accident, events occur with extreme rapidity and are least conducive to reliable accounting. If reports can be obtained from two or more observers of the same event, considerable reliance can be placed upon those portions of

the reports which are in concurrence. One must appreciate that the same event may be represented differently by different witnesses who had observed it from different locations. For example, the height, altitude and final flight path of the aircraft may appear to be different to observers who had seen from different locations against the background of the sky or any other reference objects on ground like a tall tree, high building etc.

The testimony should be evaluated in terms of realities of the situation for example, if the circumstances of the crash indicate that the pilot may have been guilty of some violation of safety practices, it may be expected that he or his fellow pilots may attempt to protect their friend and may give wrong evidence. Similarly, aircrew may give evidence with a view to safeguard the prestige and image of their colleague or the squadron. Another important consideration is the apprehension of punishment and loss of face. One of the terms of reference in aircraft accident inquiry is to find out the cause of accident and apportion blame if any. Blame is attached with losses in terms of career, finance and prestige. One naturally tries to safeguard against these. From the point of view of arriving at correct conclusions, it is worth considering if the clause of apportioning blame is worth deletion from the terms of reference. No body wants to create an accident. Lapses by and large are unintentional. Breaches of discipline like deliberate low flying, carrying out manoeuvres against instructions and such like actions of showing off or performed to derive thrill are negligible against the wide statistics of aircraft accidents.

Cases are on record where evidence has been given by an eyewitness who on detailed inquiry was found not to have witnessed the accident at all. His action was prompted to create an impression of importance. I have personal experience of one such case where the aircraft had disappeared into a river and there was no other evidence or eyewitness.

Each specialist member undertakes special investigation in respect of his area, but the medical member must closely associate with them because a human is involved in their field of investigation. There may be a failure of the power plant because of lapses in maintenance or damage due to foreign object e.g. by a tool, which could have been avoided. There may be failure in structures and aerodynamics

because of lapses of maintenance personnel. The ejection system might have malfunctioned due to omission or lapses of armament maintenance personnel. Systems investigation may bring out certain unsafe features of instruments which need change of design. Performance varies from person to person and in the same person in different situations. Environment bears upon the efficiency of work. Fatigue due to long hours of work, improper lighting, unfavourable thermal conditions like extremes of heat and cold, missing or inadequate meals due to rush and long hours of work, poor physical condition, background worries,—all affect the work

efficiency. These are the areas where the medical investigator has lot to contribute.

Whatever may be the contributory cause, the accident happens when the pilot is in control of the accident. Examination of aircrew is the most sensitive part of the investigation and the investigators will have to be extremely tactful to elicit correct evidence. His medical fitness, total flying experience and experience on type of aircraft and on similar exercise, evidence of flying fatigue, evidence of stresses due to domestic reasons of health, social and financial condition—all require careful investigation.