

# AIRCRAFT ACCIDENT INVESTIGATION



## Purpose of Accident & Incident Investigation

- Determine the cause or causes of the accident & incident,
- Identify any unsafe conditions, acts or procedures which contributed in any manner to the accident or incident .
- Recommend corrective action to prevent similar accidents & incidents.

### HOW DID IT HAPPEN ?

- (causes)
- Human
  - Weather
  - Etc.



### WHY DID IT HAPPEN ?

- (Root causes)
- Unsafe acts
  - Pre-conditions
  - Etc.



### WHAT TO DO TO PREVENT IT

- (Measures, countermeasures)

## Aircraft accident investigation stages

- Identification & notification

- Evidence gathering

- Critical examinations

- Analysis

- Reporting



## Stage 1: Identification and Notification

**Identification and notification phase involves identification of aircraft involved in accidents and notification of respective authorities**

When a major commercial aviation accident occurs :

- A group of experts, which is called **go-team**, led by an investigator-in-charge (IIC) is formed and dispatched in a short time.
- Until go-team arrives, an investigator from the nearest field office secures the crash site with the help of local authorities

## Stage 2: Evidence Gathering (on-site investigation)

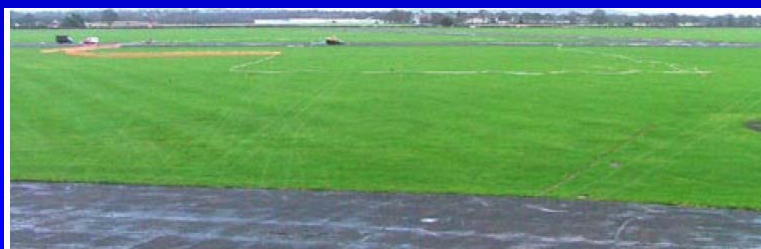
- **Accident site safety**
- **Documentation**
- **Collecting fluid samples**
- **Identification and tagging components**
- **Witness interview**
- **Collecting Records**



### a. Accident site safety

The first thing to do when you arrive the accident site is to take the safety measures. Followings are some of the these measures.

- **Accident site should be cordoned.**
- **The emergency locator transmitter should be deactivated**
- **All precaution should be taken against POSSIBLE HAZARDOUS MATERIALS ( such as fuel, explosive, etc).**



## b. Documentation

Before moving the wreckage, documentation of the accident site in the way of notes, measurements, photographs, video, diagrams, etc., is necessary. The documentation will help the investigator to determine:

- THE PROBABLE FLIGHT PATH BEFORE IMPACT.
- THE IMPACT ANGLE AND SPEED.
- ETC.

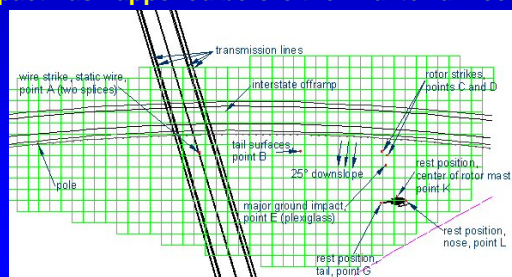


## Documentation

### Wreckage Diagrams

- Drawing of the distribution of the wreckage is important in analyzing the accidents.
- Types of Diagrams
  - A- Rough
  - B- Polar
  - C- Linear
  - D- Grid
- The diagrams should also indicate obstructions such as trees, wires, buildings, terrain, poles, etc around the accident site. This will help to understand if any impact has happened before the final terrain contact.

### Grid diagram



## Documentation

In addition to photos and diagrams, measurements and readings from instruments should be noted. These include:

- **Flight control surface position**
- **Switch and control handle positions**
- **All cockpit instrument readings/conditions**
- **Condition of seats/structure**



## c. Fluid samples

- **FLUID (FUEL, HYDRAULIC, ETC) IS VERY TIME SENSITIVE AND MUST BE TAKEN EARLY IN THE INVESTIGATION**
- **THE FLUID SAMPLES SHOULD BE TAKEN FROM EVERY TANK OR RESERVOIR.**
- **Fluid samples will help the investigator to check for any contamination or improper servicing that may be contributed to the accident**

#### d. Component identification and tagging

- All identifiable parts should be tagged. Aircraft's Illustrated part catalogues should be used for this purpose.
- The flight data and cockpit voice recorders should be located and secured.



#### e. Witness interview

**Witnesses to the accident are another source of information. Followings are some practical tips for interviewing witnesses.**

- **Set up the Interview**
  - Atmosphere
  - Non-threatening
- **Tape Record the Interview**
- **Start at a Point Prior to the Accident Event**
- **Recreate the Scene**
  - Help Witness Concentrate
  - Encourage Witness to Talk
  - Bring Up Related Issues
- **Don't Correct/Interrupt**
- **Language**
  - Customs
  - Don't Talk Down

## f. Collecting related records

Other source of evidences for the accident are the various records. Those records include the followings:

- Operation reports
- Maintenance reports
- Safety reports
- Administrative reports
- Weather Reports



## Stage 3 : Critical Examinations

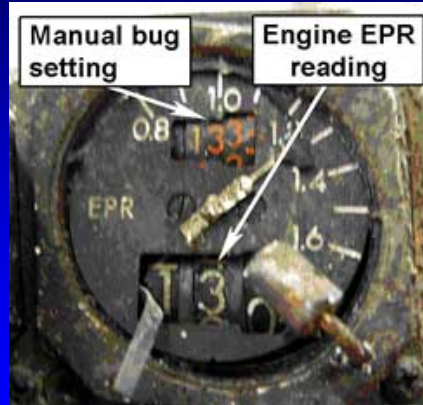
During the investigation, certain evidence will require more detailed examination. These examinations can be divided generally into following groups:

- Engine/ equipment examination
- Structural/metallurgical examination
- Examination of recorders
- Fire examination
- Survivability / egress examination

## Critical Examinations

- **Engines/equipments examinations**

- Were they operable condition?
- How were their performance?



**EPR = Engine Pressure Ratio**

## Critical Examinations

- **Structures/metallurgical examinations**

- Damage caused by failure or impact
- is there any missing part?



## Structural/metallurgical examination

### Examples of various failure types



UH-1N Turbine: Helical shaft failure



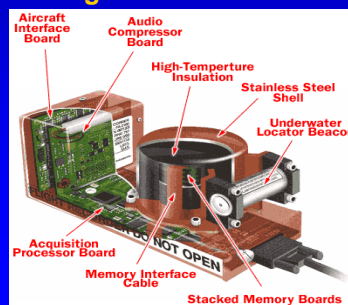
F-18 Engine Shaft  
Torsional Buckling

### Torsion Failures (ductile material behavior)

## Critical Examinations

### Examination of recorders:

- it is necessary to examine recorders to perform detailed analysis on instruments or parts of the aircraft in order to ascertain what were indicating, or their condition, before the event. These recorders include;
  - Cockpit voice recorders (CVR)
  - Flight data recorders (FDR),
- The data from these recorders provide the investigators with a profile of an aircraft during the crucial last minutes of flight.



## Stage 4: Analysis

- SHEL(L) MODEL
- HFACS MODELS
- 5-M MODEL



## Stage 5 : Reporting

- Every investigation concludes with a report being made public.
- The final accident report includes
  - A list of factual findings concerning the accident.
  - Analysis of those findings.
  - A probable cause statement.
  - Recommendations to prevent a repetition of the accident.

## Reporting

### Reports Must Be:

- **Thorough** (include accepted and rejected factors)
- **Easy to read/access information**
- **Created and stored in a “standard” format**
- **Timely**
- **Recommendations Must Directly Address EACH Cause Factor**
- **Attempt Three Recommendations per Cause Factor**  
(short/medium/long term fixes)
- **Avoid Generalizations** (review, study, etc.)

