SLCAP 9999

Civil Aviation Authority of Sri Lanka

AIRCRAFT ACCIDENT INVESTIGATION PROCEDURE MANUAL

2ND EDITION - 2010

Issued by Civil Aviation Authority of Sri Lanka

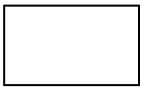
CIVIL AVIATION AUTHORITY OF SRI LANKA

ACCIDENT INVESTIGATION UNIT

LIST OF GUIDANCE MATERIAL ISSUED BY THE ACCIDENT INVESTIGATION UNIT

		
AIRCRAFT ACCIDENT INVESTIGATION PROCEDURE MANUAL (SLCAP 9999)		**AIRCRAFT ACCIDENT INVESTIGATION MANAGEMENT SYSTEM (SLCAP 9999_10)**
		
AIU POLICY MANUAL (SLCAP 9990)		

AIRCRAFT ACCIDENT INVESTIGATION PROCEDURE MANUAL

Control Number 

Record of Revision

Rev No	Date Entered	Entered by
00	01-09-2010	PA/AAI
01	27-10-2010	PA/AAI
02	17-10-2011	PA/AAI
03	15-11-2013	PA/AAI
04	01-07-2014	PA/AAI
05	31-07-2018	Mgr/AI
06	30-12-2019	Mgr/ASM

List of Effective Pages

Page	Eff. Date	Page	Eff. Date	Page	Eff. Date	Page	Eff. Date
i	01-09-2010	6-5	01-09-2010	16-7	01-09-2010	A5-3	01-09-2010
ii	30-12-2019	6-7	01-09-2010	16-8	01-09-2010	A6-1	01-09-2010
iii	30-12-2019	6-8	01-09-2010	16-9	01-09-2010	A6-2	01-09-2010
iv	30-12-2019	6-9	01-09-2010	17-1	01-09-2010	A6-3	01-09-2010
v	17-10-2011	6-10	01-09-2010	17-2	01-09-2010	A7-1	15-11-2013
vi	17-10-2011	6-11	01-09-2010	17-3	01-09-2010	A8-1	15-11-2013
vii	01-07-2014	6-12	01-09-2010	17-4	01-09-2010	A8-2	15-11-2013
viii	01-07-2014	6-13	15-11-2013	17-5	01-09-2010	A9-1	01-09-2010
ix	30-12-2019	6-14	01-09-2010	18-1	01-09-2010	A9-2	01-09-2010
x	27-10-2010	6-15	01-09-2010	18-2	31-07-2018	A10-1	15-11-2013
xi	17-10-2011	6-16	15-11-2013	18-3	31-07-2018	A10-2	15-11-2013
xii	15-11-2013	7-1	01-09-2010	18-4	01-09-2010	A10-3	01-09-2010
xiii	15-11-2013	7-2	01-09-2010	18-5	31-07-2018	A11-1	01-09-2010
xiv	15-11-2013	7-3	01-09-2010	18-6	31-07-2018	A11-2	01-09-2010
xv	15-11-2013	7-4	01-09-2010	18-7	01-09-2010	A11-3	01-09-2010
1-1	31-07-2018	8-1	01-09-2010	18-8	01-09-2010	A11-4	01-09-2010
1-2	01-09-2010	8-2	01-09-2010	18-9	01-09-2010	A11-5	01-09-2010
1-3	01-09-2010	8-3	01-09-2010	19-1	01-09-2010	A11-6	01-09-2010
1-4	01-09-2010	8-4	01-09-2010	19-2	31-07-2018	A11-7	01-09-2010
2-1	01-09-2010	8-5	01-09-2010	20-1	01-09-2010	A11-8	01-09-2010
2-2	15-11-2013	9-1	01-09-2010	20-2	01-09-2010	A11-9	01-09-2010
2-3	01-09-2010	9-2	01-09-2010	20-3	15-11-2013	A12-1	01-09-2010
2-4	15-11-2013	9-3	01-09-2010	20-4	31-07-2018	A13-1	01-09-2010
2-5	17-10-2011	9-4	01-09-2010	20-5	31-07-2018	A13-2	01-09-2010
2-6	01-09-2010	10-1	01-09-2010	20-6	01-09-2010	A13-3	01-09-2010
2-7	17-10-2011	10-2	01-09-2010	21-1	01-09-2010	A14-1	30-12-2019
2-8	01-09-2010	10-3	01-09-2010	21-2	31-07-2018	A14-2	30-12-2019
2-9	01-09-2010	10-4	01-09-2010	21-3	01-09-2010	A14-3	30-12-2019
2-10	01-09-2010	11-1	01-09-2010	21-4	31-07-2018	A14-4	30-12-2019
2-11	01-09-2010	11-2	01-09-2010	21-5	01-09-2010	A14-5	30-12-2019
3-1	01-09-2010	11-3	01-09-2010	21-6	01-09-2010	A14-6	30-12-2019
3-2	15-11-2013	12-1	01-09-2010	21-7	01-09-2010	A14-7	30-12-2019
3-3	15-11-2013	12-2	01-09-2010	21-8	01-09-2010	A14-8	30-12-2019
3-4	15-11-2013	12-3	01-09-2010	22-1	01-09-2010	A14-9	30-12-2019
3-5	31-07-2018	13-1	01-09-2010	22-2	01-09-2010	A14-10	30-12-2019
4-1	01-09-2010	13-2	01-09-2010	22-3	01-09-2010		
4-2	01-09-2010	13-3	01-09-2010	23-1	01-07-2014		
4-3	31-07-2018	14-1	01-09-2010	23-2	01-07-2014		
4-4	01-09-2010	14-2	01-09-2010	23-3	01-07-2014		
5-1	01-09-2010	14-3	01-09-2010	23-4	01-07-2014		
5-2	01-09-2010	15-1	01-09-2010	A1-1	01-09-2010		
5-3	01-09-2010	15-2	01-09-2010	A1-2	01-09-2010		
5-4	01-09-2010	15-3	01-09-2010	A2-1	31-07-2018		
5-5	01-09-2010	15-4	01-09-2010	A2-2	27-10-2010		
5-6	01-09-2010	15-5	01-09-2010	A2-3	15-11-2013		
5-7	01-09-2010	15-6	01-09-2010	A2-4	15-11-2013		
5-8	01-09-2010	16-1	01-09-2010	A3-1	01-09-2010		
5-9	01-09-2010	16-2	01-09-2010	A3-2	15-11-2013		
6-1	01-09-2010	16-3	01-09-2010	A4-1	31-07-2018		
6-2	15-11-2013	16-4	01-09-2010	A4-2	01-09-2010		
6-3	15-11-2013	16-5	01-09-2010	A5-1	31-07-2018		
6-4	17-10-2011	16-6	01-09-2010	A5-2	01-09-2010		

History of Revision

Revision Number	Source	Areas subjected to change	Effective date
01	AIG PQ s and recommendation of the ICAO Audit Team	Foreword	27-10-2010
01	AIG PQ s and recommendation of the ICAO Audit Team	Chapter – 6 - Investigation – General	27-10-2010
01	AIG PQ s and recommendation of the ICAO Audit Team	Chapter-18- Final Reports	27-10-2010
01	AIG PQ s and recommendation of the ICAO Audit Team	Chapter-19-Accident Prevention measures	27-10-2010
01	AIG PQ s and recommendation of the ICAO Audit Team	Appendix-2- Sample letters to be issued to investigators	27-10-2010
02	Civil Aviation Act No. 14 of 2010	Chapter-2- Roles & Responsibilities	17-10-2011
02	Annex 13 – Compliance Check List	Chapter-6- Investigation	17-10-2011
03	Annex 13 – Amendment No 14	Chapter-2- Roles & Responsibilities	15-11-2013
03	Annex 13 – Amendment No 14	Chapter – 6 - Investigation – General	15-11-2013
04	ICAO Doc 9962 -Chapter 12	Chapter 23	01-07-2014
05	Annex 13-Amendment No 15	Chapter 3,4,18 and 20	31-07-2018
06	ICAO Doc 9756	Appendix 14	30-12-2019

Table of Contents

Appendixes

Foreword

The importance of accident or incident investigations for the prevention of future accidents and incidents cannot be over emphasized. The objective is to identify direct and systemic causes and take remedial actions to eliminate such deficiencies.

The International Civil Aviation Organization, at its previous Assembly sessions had adopted several resolutions directing the Council to address those resolutions and adopt necessary changes to the Annex 13 for each of the Contracting States to apply.

The International Civil Aviation Organization (ICAO) has also published a new Manual of Aircraft Accident and Incident Investigation (Doc. No. 9756), superseding its previous Doc No. 6920 entirely, to encourage States to apply Standards and Recommended Practices (SARPs) contained in Annex 13 uniformly.

This Manual (SLCAP 9999) outlines the responsibilities and provides guidelines to CAA appointed investigators for accident and incident investigation, on the basis of Doc. No. 9756 and in compliance with the SARPs in Annex 13. Contents in the Manual are formulated in a manner to help investigators to easily identify, consider and apply various aspects when investigating Aircraft Accidents and Incidents. For reasons of conciseness, the terms “accident” and “accident investigation” used in this Manual apply equally to “incident” and “incident investigation” as well.

SLCAP 9999 will not only be a document for any Aircraft Accident Investigation Board, the Chief Investigator, other Investigators and any other officer, appointed by the Civil Aviation Authority of Sri Lanka or other involved in any other capacity in an investigation to follow but also will serve as valuable information guidance to all concerned.

Comments or proposals for implement of the procedures in this manual are welcome. It is the onus of The Accident Investigation Unit of the Civil Aviation Authority of Sri Lanka to update this Manual as and when necessary.

Civil Aviation Authority of Sri Lanka

Air Chief Marshal W.D.R.M.J. Goonetileke
Chairman

27 October 2010

Definitions

Accident - An occurrence associated with the operation of an aircraft which, in the case of a manned aircraft takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down, in which;

a) a person is fatally or seriously injured as a result of:

- being in the aircraft, or
- direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
- direct exposure to jet blast; or

b) the aircraft sustains damage or structural failure which:

- adversely affects the structural strength, performance or flight characteristics of the aircraft, and
- would normally require major repair or replacement of the affected component; or

c) the aircraft is missing or is completely inaccessible.

the above a) excludes the injuries from natural causes, self-inflicted or inflicted by other persons, or the injuries to stowaways hiding outside the areas normally available to the passengers and crew. The above b) excludes engine failure or damage, when the damage is limited to a single engine, (including its cowlings or accessories), propellers, wing tips, antennas, probes, vanes, tires, brakes, wheels, fairings, panels, landing gear doors, windscreens, the aircraft skin (such as small dents or puncture holes), or minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome)

Accredited representative - A person designated by a State, on the basis of his or her qualifications, for the purpose of participating in an investigation conducted by another State. Where the State has established an accident investigation authority, the designated accredited representative would normally be from that authority.

Act – Civil Aviation Act No. 14 of 2010.

ADREP - Accident/Incident Data Reporting.

Adviser - A person appointed by the Authority, on the basis of his or her qualifications, for the purpose of assisting an accredited representative in an investigation.

Aircraft - Any machine that can derive support in the atmosphere from the aerodynamic reactions of the air other than the reactions of the air against the earth's surface.

Aircraft Accident Investigation Board – The Accident Investigation Board appointed by the Authority in terms of Section 56 of the Civil Aviation Act No 14 of 2010.

Accident Investigation Unit – Unit established in the Civil Aviation Authority of Sri Lanka to coordinate activities related to aircraft accidents and incidents.

Authority - The Civil Aviation Authority of Sri Lanka, established by the Civil Aviation Authority of Sri Lanka Act, No. 34 of 2002.

Causes - Actions, omissions, events, conditions, or a combination thereof, which led to the accident or incident. The identification of causes does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

Chief Investigator - A person appointed by the Authority on the basis of his or her qualifications, and charged with the responsibility for the organization, conduct and control of an investigation.

Contributing factors - Actions, omissions, events, conditions, or a combination thereof, which, if eliminated, avoided or absent, would have reduced the probability of the accident or incident occurring, or mitigated the severity of the consequences of the accident or incident. The identification of contributing factors does not imply the assignment of fault or the determination of administrative, civil or criminal liability.

Fatal injury - An injury resulting in death within thirty (30) days of the date of the accident.

Flight recorder - Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

Incident - An occurrence, associated with the operation of an aircraft other than an accident, which affects or could affect the safety of operation.

Investigation - A process conducted for the purpose of accident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and/or contributing factors and, when appropriate, the making of safety recommendations.

Investigator - A member of the Aircraft Accident Investigation Board appointed by the Authority.

Lead Investigator – An Investigator of the Aircraft Accident Investigation Board, assigned by the Chief Investigator, to lead a team of investigators, or function as the investigator-in-charge of a group, assigned to investigate into a particular aspect of the investigation such as; Operational, Airworthiness, Air Navigation Services, On-site investigation etc.

Maximum mass - A maximum certificated take-off mass.

Operator - A person, organization or an enterprise holding an Air Operator Certificate or a Foreign Air Operator Certificate engaged in or offering to engage in aircraft operations, and includes any person who causes or authorizes the operation of an aircraft, whether with or without the control (in the capacity of owner, lessee, or otherwise) of the aircraft.

Owner - Where an aircraft is registered, the registered owner of that aircraft.

Police officer – A member of the regular police force and includes all persons enlisted under the police ordinance.

Preliminary Report - The communication used for the prompt dissemination of data obtained during the early stages of the investigation.

Safety recommendation - A proposal of an accident investigation authority based on information derived from an investigation, made with the intention of preventing accidents or incidents and which in no case has the purpose of creating a presumption of blame or liability for an accident or incident. In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies.

Serious incident - An incident involving circumstances indicating that there was a high probability of an accident and is associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down.

Serious injury - An injury which is sustained by a person in an accident and which:

a) requires hospitalization for more than 48 hours, commencing within seven days from the date the injury was received; or

b) results in a fracture of any bone (except simple fractures of fingers, toes or nose); or

c) involves lacerations which cause severe haemorrhage, nerve, muscle or tendon damage; or

d) involves injury to any internal organ; or

e) involves second or third degree burns, or any burns affecting more than 5 per cent of the body surface; or

f) involves verified exposure to infectious substances or injurious radiation.

State of Design - The State having jurisdiction over the organization responsible for the type design.

State of Manufacture - The State having jurisdiction over the organization responsible for the final assembly of the aircraft.

State of Occurrence - The State in the territory of which an accident or incident occurs.

State of the Operator - The State in which the operator's principal place of business is located or, if there is no such place of business, the operator's permanent residence.

State of Registry - The State on whose register the aircraft is entered.

State Safety Programme (SSP). An integrated set of regulations and activities aimed at improving safety.

Abbreviations

AAIB	-	Aircraft Accident Investigation Board
AASL	-	Airports and Aviation Services (Sri Lanka) Limited
ACT	-	Civil Aviation Act No. 14 of 2010
ADREP	-	Accident/Incident Data Reporting
AFTN	-	Aeronautical Fixed Telecommunication Network
AIG	-	Accident Investigation
AIU	-	Accident Investigation Unit
CAA	-	Civil Aviation Authority of Sri Lanka defined herein as “the Authority”
CVR	-	Cockpit Voice Recorder
ECCAIRS	-	European Co-ordination Centre for Aviation Incident Reporting Systems
FDR	-	Flight Data Recorder
FOD	-	Foreign Object Damage
ICAO	-	International Civil Aviation Organization
SARP	-	Standards and Recommended Practices
SCBA	-	Self Contained Breathing Apparatus
SLAF	-	Sri Lanka Air Force

CHAPTER 1 –

GENERAL

1. General

1.1 Objective of an aircraft accident investigation

The sole objective of an aircraft accident or incident investigation is the prevention of future accidents and incidents. It is not the purpose to apportion blame or liability. Any judicial or administrative proceedings to apportion blame or liability should be separate from any investigation conducted under the provisions of Annex 13. Thus, the emphasis of an aircraft accident or incident investigation is on remedial actions.

An aircraft accident provides evidence of hazards, errors or deficiencies within the aviation system. The purpose of an investigation is to therefore identify all immediate and underlying systemic causes of an accident and recommend appropriate safety actions aimed at avoiding the hazards, errors or eliminating the deficiencies. The investigation may also reveal other hazards, errors or deficiencies within the aviation system not directly connected with the causes of the accident. Thus, a properly conducted accident investigation is an important method of accident prevention.

An investigation should also determine the facts, conditions and circumstances pertaining to the survival or non-survival of the occupants of the aircraft. Recommendations for improvements to the crashworthiness of the aircraft are aimed at preventing or minimizing injuries to aircraft occupants in future accidents.

The achievement of successful outcomes could rest on the properly planned and managed accident investigation programme. The main part of an investigation must be planned so that team members are aware of their various tasks and period of completion together with the appropriate qualifications to perform them. Therefore it is not the factor of the size of the aircraft involved in the investigation process, the pre-investigation planning is essential.

The final report, which is released by the CAA at the completion of an investigation, constitutes the official conclusions and record of the accident. The Authority will reopen the investigation, if new and significant evidence becomes available. Where an aircraft which was considered missing following an official search is subsequently located, consideration may be given to reopening the investigation.

1.2 Responsibilities and Guidelines contained in the Manual

Responsibilities, powers, functions and other requirements contained in this Manual are principally based on the provisions of Annex 13 and the Act. Further clarification or explanation shall be sought, as necessary, by reference to the said Annex and/or the Act or Regulation. In the event of any discrepancy and/or disagreement of a requirement specified in this Manual, the interpretation given in the Act, Regulation or the Annex, as the case may be, shall prevail in which case the Act has the overriding power.

All other contents in the Manual are provided as guidelines to Investigators mainly with reference to the documents listed in 1.4 below.

Powers vested in *the Authority* to conduct an accident investigation.

a) Appointment of the Chief Investigator, Accredited Representatives and the Aircraft Accident Investigation Board.

b) Delegation of powers to the Aircraft Accident Investigation Board.

c) Formalize notification and reporting links.

d) Pre-planning to manage the Accident Investigation.

e) Liaison with other service providing Authorities.

f) Avoiding the risk of investigators' exposure to biological hazards.

g) Cooperation with the media.

h) Securing of records, recordings and samples.

i) Ensuring the safety at the accident site and security of wreckages.

j) Planning for specialist examinations, tests and analyses.

k) Post-investigation system for identification of deficiencies and re-opening of investigation, if required.

l) Publication of the Report.

m) Disseminating accident and incident information.

1.3 Definitions

Definitions and Abbreviations used are given at the beginning of this document. Any specific term or terminology remaining undefined shall have the same meaning as defined in ICAO Annexes or in ICAO Doc.8400 relating to Codes and Abbreviations.

1.4 Reference documents

a) Civil Aviation Act No 14 of 2010
b) Civil Aviation Authority of Sri Lanka Act No.34 of 2002.
c) Aircraft Accident and Incident Investigation Regulations of Sri Lanka
d) ICAO Annex 13 – Aircraft Accident and Incident Investigation.
e) Manual of Aircraft Accident and Incident Investigation; ICAO Doc 9756.
f) Accident/Incident Reporting Manual (ADREP Manual); ICAO Doc 9156.
g) Accident Prevention Manual; ICAO Doc 9422.
h) Manual of Aircraft Accident Investigation – Doc 6920
i) Manual of Civil Aviation Medicine; ICAO Doc 8984.
j) Human Factors Training Manual; ICAO Doc 9683.
k) Cir298-AN/172-Training Guidelines for Aircraft Accident Investigators- 2003

1.5 Review and amendment procedure

This Manual is amended as and when required to meet the National, International and Industrial requirements. The amendments shall be effected in a timely manner whenever an amendment to Annex 13 is received. Individual or group comments are welcome to facilitate the updating and amending of the Manual. Such suggestions could lead to improve the standards of this Manual and to take appropriate action for consideration of safety standards and enforcement of preventive measures, objective of which is to avoid future aircraft accidents.

If the Authority will adopt accident and serious incident investigation regulations from another State, it shall ensue that those regulations comply with relevant Civil Aviation Regulations and ICAO Annexes initially and on an ongoing basis subsequent to an Annex amendment or an amendment of Civil Aviation Regulations. In this case the Authority will follow procedure that evaluates the amendments are made by the originating State & Civil Aviation Regulations are amended on a timely manner.

This Manual is declared as a control document of the Authority to be used by the Accident Investigators as a procedure and guidance material. The Manual should be kept updated on a timely manner in accordance with the guidelines provided by ICAO Annexes, relevant documents and the same received through suggestions from any appropriate authority. The Authority will ensure that the investigators engaged in accident and serious incident investigation will use the latest amendment of this Manual distributed to them through a control process of distribution. Manager/Aircraft Accident & Incident Investigation will ensure updating the Manual on timely basis as per the above requirement and distribute the current Manual to the investigators.

CHAPTER – 2

ROLES & RESPONSIBILITIES

2. Roles & Responsibilities

2.1 Responsibilities and Powers

This Manual of procedures has been written in keeping with the provisions of the Annex 13 to the Convention on International Civil Aviation and the Civil Aviation Act No. 14 of 2010. According to the Act, the Civil Aviation Authority of Sri Lanka (CAA), also referred to as *the Authority* in this Manual, shall assume responsibility to institute investigations in to Aircraft Accidents and Incidents and shall appoint an Aircraft Accident Investigation Board (AAIB) with necessary powers, as stated below in this paragraph 2.1, to Investigate and report.

Authority will institute on investigation into the circumstances of aircraft accidents and serious incidents in accordance with the provisions of Civil Aviation Act, Aircraft Accident and Incident Investigation Regulations of Sri Lanka and ICAO Annex 13. But Authority may delegate the whole or any part of the conducting of such investigation to another State or a regional accident investigation organization by mutual arrangement and consent as prescribed in the Act and Regulations.

The Authority will ensure to conduct investigations into different types of occurrences including major accident, serious incidents, fatal or non-fatal accidents, public transport or general aviation, etc. Depending on the seriousness/severity of the accident or serious incident Authority will appoint investigators upon their speciality or may delegate as mentioned above. For major aircraft accident involving fatalities etc. reference should be taken from Aircraft Accident investigation Management System.

Notwithstanding the decision of the Authority to institute an investigation in to any particular Accident or a Serious Incident, the Director General of Civil Aviation shall hold responsibility to institute required preventive programs, including investigation in to incidents as necessary, in accordance with the provisions in Annexes 6, 8 and 13.

2.1.1 Responsibility of the Authority

Section 55 of the Civil Aviation Act No. 14 of 2010 assigns responsibility on *the Authority* to institute an investigation into any Accident or Incident occurring within the territory of Sri Lanka or is in respect of any aircraft registered in Sri Lanka. Authority shall have the independence as an accident investigation authority in charge for conducting aircraft accident and serious incident investigations.

For this purpose the Authority shall appoint an Aircraft Accident Investigation Board, specific to each such aircraft accident or incident as the case may be, consisting of such number of persons as may be determined by the Authority, one of whom shall be appointed to act as its Chief Investigator. The Authority shall, when appointing an AAIB, stipulate the terms and conditions to be complied with by the members of the Board in conducting an investigation, in addition to requiring the members of the AAIB to sign a declaration of secrecy before commencement of the investigation. The Terms & Conditions for investigators of AAIB attached in Appendix 2.

In the event that an accident or incident occurs outside Sri Lanka's territory in respect of an aircraft registered in Sri Lanka, the Authority shall authorize, as necessary or if specifically requested by the State of Occurrence, an accredited representative to participate in any investigation or inquiry carried out by the State of Occurrence. The Authority shall provide the State of Occurrence with any relevant available information regarding the aircraft and flight crew involved in the accident or serious incident.

When an accident or a serious incident has occurred in the territory of a non-Contracting State which does not intend to conduct an investigation in accordance with Annex 13, the Authority may endeavour to institute and conduct an investigation in cooperation with the State of Occurrence but, failing such cooperation, may itself conduct an investigation using available information and seeking assistance, if necessary, from the State of Design and State of Manufacture.

2.1.2 Responsibilities of the Chief Investigator

The Chief Investigator, in consultation with the Authority, shall take all reasonable measures to protect the evidence and to maintain safe custody of the aircraft and its contents for such a period as may be necessary for the purposes of an investigation, including protection against further damage, access by unauthorized persons, pilfering or deterioration.

Protection of evidence will include the preservation, by photographic or other means of any evidence which might be removed, effaced, lost or destroyed including those of a transitory nature of wreckage. Safe custody shall include protection against further damage, access by unauthorized persons, pilfering and deterioration.

Protection of flight recorder evidence requires that the recovery and handling of the recorder and its recordings be assigned only to qualified personnel.

If a request is received from a State of Registry, the State of the Operator, the State of Design or the State of Manufacture, that the aircraft, its contents and any other evidence remain undisturbed pending inspection by an Accredited Representative of the requesting state, the Chief Investigator shall take all necessary steps to comply with such request, so far as this is reasonably practicable and compatible with the proper conduct of the investigation; provided the aircraft or debris may be moved to the extent necessary to extricate persons, animals, mail and valuables, to prevent destruction by fire or other causes, or to eliminate any danger or obstruction to air navigation, public health, to other transport or to the public, and provided that it does not result in undue delay in returning the aircraft to service where this is practicable.

Because of the constrain of resources in Sri Lanka, the Authority will approach the Chairman of Airport & Aviation Services (Sri Lanka)Ltd or any other authority to provide necessary space including hangers/ storage facilities to ensure protection of evidences as outlined in above.

Subject to above responsibilities the Chief Investigator, in consultation with the DGCA, shall release custody of the aircraft, its contents or parts thereof as soon as

they are no longer required in the investigation, to any person or persons duly designated by the State of Registry or the State of the Operator, as applicable.

The duties and task that should be covered during an investigation by Chief Investigator and other investigators are laid down in Aircraft Accident Investigation Management System- SLCAP 9999_10.

2.1.3 Powers to Investigate

The Chief Investigator shall have unhampered access and control over the scene of the accident/incident, wreckage and all relevant material/evidence including flight recorders and air traffic service (ATS) records.

While ensuring the above, the Authority will take into account the local environment, including aspects of legal and judicial systems that may limit the ability to fully meet some of the provisions contained in Aircraft Accident and Incident Investigation Regulations and ICAO Annex 13.

The AAIB in the course of an investigation into an accident or incident shall have, in terms of Section 58 of the Act, the power to;

a) summon under its Chief Investigators hand, and call before it and examine all such persons whom it considers necessary;

b) require any person summoned to answer any question or furnish any information or produce any books, papers, documents or articles which the Board may consider relevant, and to retain any such books, papers, documents and articles, until the completion of the investigations;

c) take statements from all such persons as it considers necessary and to require any such person to make and sign a declaration relating to the truth of the statement made by him;

d) have access to examine an aircraft involved in the accident and the place where the accident occurred, and for that purpose to require any such aircraft or any part of equipment thereof to be preserved unaltered, pending examination;

e) examine, remove, test, take measures for the preservation of, and otherwise deal with the aircraft or any part thereof or anything contained therein;

f) enter and inspect any place or building where it appears to be requisite for the purposes of the investigation; and

g) take all measures necessary for the preservation of evidence.

h) Carry out detailed examination of relevant material/evidence without delay.

i) Arrange the medical and toxicological examination of the crew, passengers and any aviation personal involved in any accident or incident. (pls refer Appendix 10)

j) In case of a fatal accident arrange a complete autopsy examination of fatally injured flight crew, passengers and cabin crew. (pls refer Appendix 10).

2.1.4 Responsibility of Accident Investigation Unit

The Authority will identify any differences of the provisions of the Civil Aviation Act/ Regulations with that of the ICAO Annex 13 and Accident Investigation Unit will have the responsibility to notify to ICAO about the differences on a timely manner. Accident Investigation Unit of Authority is appropriately supply with the required documents to effectively accomplish its functions and responsibilities.

The Unit will ensure that these relevant documents will be kept updated on a timely manner in accordance with the guidelines provided by ICAO Annexes, relevant documents and the same received through suggestions from any appropriate authority. The Unit also will ensure that the investigators engaged in accident and serious incident investigation will use the latest amendment of this Manual distributed to them through a control process of distribution. Programme Assistant of Accident Investigation Unit will ensure updating the manuals on timely basis as per the above requirement and distribute the current manuals/guidance materials to the investigators.

These documents will not only be documents for any Aircraft Accident Investigation Board, the Chief Investigator, other Investigators and any other officer, appointed by the Civil Aviation Authority of Sri Lanka or other involved in any other capacity in an investigation to follow but also will serve as valuable information guidance to all concerned. All investigators should be familiar with the Accident Investigation Procedure Manual to accomplish the investigation duties.

The list of documents available in the Accident Investigation Unit is as follows;

1. Air Navigation Regulations of 1955
2. Civil Aviation Authority of Sri Lanka Act No. 34 of 2002
3. Civil Aviation Act No. 14 of 2010
4. Aircraft Accident and Incident Investigation Regulations of Sri Lanka
5. CAA Implementing Standards
6. Aircraft Accident Investigation Procedure Manual – SLCAP 9999
7. Aircraft Accident Investigation Management System – SLCAP 9999-10
8. AIU Policy Manual – SLCAP 9990
9. ICAO Annex 13 - Aircraft Accident and Incident Investigation, 10th Edition, July 2010, Amendment 13
10. Doc 9756 - Manual of Aircraft Accident and Incident Investigation
    a. Part I - Organization and Planning – 1st edition, 2000
    b. Part III - Investigation
    c. Part IV - Reporting – 1st edition, 2003

11. Doc 6920 – Manual of Aircraft Accident Investigation –AN/855/4 – 4th edition, 1970
12. ICAO Doc 9156 - Accident/Incident Reporting Manual (ADREP Manual) - 2nd edition, 1987
13. Doc 9859 - Safety Management Manual – 1st edition, 2006
14. Doc. 9734 – AN/959 – Safety Oversight Manual – Part A
15. Doc 9683 – AN/950 - Human Factors Training Manual
16. Doc 8984 – AN/895 - Manual of Civil Aviation Medicine
17. Doc 9422 – AN/923 – Accident Prevention Manual
18. Cir 240 - Investigation of Human Factors in Accidents and Incidents
19. Cir 285-AN/166 - Guidance on Assistance to Aircraft Accident Victims and their Families – 2001
20. Cir 298-AN/172- Training Guidelines for Aircraft Accident Investigators –2003
21. Cir 314-AN/179 - Hazards at Aircraft Accident Sites – 2008

2.2 Interaction and cooperation with other Agencies

The Chief Investigator should assume responsibility for liaison with all other agencies. When investigating aircraft accidents, the importance of good liaison during the investigation with Airport and Aviation Services (Sri Lanka) limited (AASL), Sri Lanka Police, Judicial Authorities, Sri Lanka Air Force (SLAF), Hospitals, Ambulance Services, Fire Services and any other local authority are of vital importance.

In most cases aerodrome officials, local inhabitants and/or police will probably be the first persons to arrive at the scene of an aircraft accident. It is, therefore, extremely important to enlist the cooperation of the police and aerodrome officials to ensure the security of the wreckage. This prevents vital evidence being lost by unnecessary interference with the wreckage before the arrival of the investigation team.

If it is suspected that the aircraft may have carried dangerous cargo-such as radioactive material, explosives, ammunition, corrosive liquids, gases, liquids, solid poisons or even bacterial cultures- special precautions should be taken in placing security personnel at a safe distance from the wreckage. This is particularly important if a fire has occurred. The precautions required be taken by the investigation team are described in chapter 5 of this Manual.

Recognizing the obligation and independent role to be performed by the judicial authorities (especially the police and court) the Authority as the State conducting the investigation will facilitate effective, cohesive and harmonius coordination (e.g Procedures or MOUs) between the Chief investigator and such judiciary authorities.

Particular attention shall be given to evidence which requires prompt recording and analysis for the investigation to be successful, such as the examination and identification of victims and read-outs of flight recorder recordings. MOUs could be related to: securing and custody of evidence, identification of victims, flight recorder read-outs, examinations and tests.

Coordination between the two process would likely be required at the accident site and in the gathering of factual information, with due consideration to the provisions laid down in Chapter 6.4 of this Manual.

Possible conflicts between investigating and judicial authorities regarding the custody of flight recorders and their recordings may be resolved by an official of the judicial authority carrying the recordings to the place of readout, thus maintaining custody. Format of MOU is shown in Appendix 9.

Possible conflicts between investigating and judicial authorities regarding the custody of the wreckage may also be resolved by an official of the judicial authority accompanying the wreckage to the place of examination and being present at such examination when a modification of the condition of the wreckage is required, thus maintaining custody.

2.3 Organizations involved in handling of Accidents

2.3.1 Accident/Incidents at the Airport

- CAA.
- AASL.
- Fire and Emergency Services.
- Medical Services.
- Sri Lanka Police.
- Sri Lanka Air Force.
- The airline concerned.
- Any other party nominated by the Government.

2.3.2 Accident/Incidents in an urban Area

- CAA.
- Local Governmental Authority.
- Fire and Emergency Services of AASL/ Local Government Authority.
- Medical Services.
- Sri Lanka Police.
- Military forces present in the area.
- The airline concerned.
- Any other party nominated by the Government.

2.3.3 Accident/Incidents at Sea

- CAA.
- Sri Lanka Air Force.
- Sri Lanka Navy.
- Sri Lanka Police.
- Military forces present in the area.
- Emergency services as applicable.
- The airline concerned.
- Any other party nominated by the Government.

2.3.4 Accident/Incident on land outside urban area

- CAA.
- Sri Lanka Air force.
- Sri Lanka Police.
- Sri Lanka Army.
- Medical Services, if available.
- Provincial Council or other Government Agency.
- Fire and Emergency services as applicable.
- The airline concerned.
- Any other party nominated by the Government.

2.4 Responsibilities of other agencies

The following information is provided to enable Investigators to have an understanding of the procedures generally followed by Local Authorities and other agencies when notification is received of an aircraft accident.

2.4.1 Airport and Aviation Services (Sri Lanka) Limited (AASL)

All licensed aerodromes are required to have an “Emergency Response Procedures Manual” that contains documented procedures detailing the responsibilities and actions of the relevant emergency response agencies in the event of an aircraft accident.

AASL is the agency responsible for managing the Aerodrome and for provision of Air Traffic Services. They do follow a documented *Emergency Response Procedures* and are generally responsible inter alia for the following;

- Inform accident as appropriate to the responsible authorities.
- Ensure and upkeep the serviceability of the aerodrome.
- If first on the scene, establish a command post until necessary arrangements have been made with police, generally a suitable distance away from crash site.
- Assist the police and other agencies as appropriate, including, the safe passage of emergency vehicles and necessary equipment to the command post.

2.4.1.1 Emergency rescue unit of AASL

- Isolates the crash site, admitting only essential fire-fighting personnel and equipment.
- Ascertains from the senior fire officer on the scene when the area is safe for other emergency services to enter.
- Directs appropriate support, as required, into the area.
- Establishes contact with the aircraft operator's representative.
- Accounts for all persons on board including casualties and the deceased.
- Where possible, photographs and marks the position of the deceased prior to removal.
- Guards the wreckage until the CAA investigation team assumes responsibility.
- Establishes central information center for media links and notifies the next of kin.
- To ensure minimum movement of the dead, wreckage or debris in the course of their rescue and firefighting operations and before photographic records have been made.
- Provide post-crash fire protection.
- Liaise with the Chief Investigator on assistance in identifying survivors, witnesses for interview.

2.4.1.2 Air Traffic Control Unit

- Provide information on condition of radio, navigation and visual aids and ATC facilities at the time of the accident.
- Assist Chief Investigator in impounding ATC tapes, flight plans, strips, meteorological forecast provided to flight crew, etc.
- Liaise with the Chief Investigator on toxicological examination and drug testing and interview of air traffic controllers involved, where necessary.

2.4.2 Local Police

- Provide cordon for the entire accident site and protect the wreckage and its contents from disturbance, loss or further damage.
- Photograph the dead before they are removed from the scene.

- Provide information on witnesses and their statements.
- Assist in identifying and locating witnesses who have seen or have taken photographs of the accident (through the mass media, if necessary).
- Provide Police escort as required (e.g. for escorting flight crew members to undergo medical examinations, for escorting accident investigators to impound documents, etc., where necessary).
- Provide manpower to comb accident site for missing parts, if necessary (depending on the terrain and vegetation of the accident site, one person for every 2m to 3m may be required).

2.4.3 Fire Service

- Proceeds to the scene of the occurrence.
- Establishes a liaison officer at the command post
- Establishes fire control.
- Secures a 'Safe Area' around the crash site.

2.4.4 Ambulance Service

- Reports to the crash site command post
- Notifies hospital services of requirements
- Establishes an ambulance/medical control post adjacent to the command post.
- Handles casualties.

2.4.5 Airline/Operator Company

- Provides relevant details about the accident to the CAA forthwith.
- Dispatches an officer to the command post.
- Advise the police of the number of persons on board and of any dangerous cargo.
- Liaises with investigation personnel prior to any action.
- Arranges for the removal of the aircraft when advised by the command post, if necessary after defueling in liaison with Ceylon Petroleum Corporation.
- Provides transport for passengers.
- Implements the Accident Victim Relief Programme.
- Send an engineer to remove the CVR/FDR/QAR as soon as possible.
- Send flight crew members to undergo medical examinations at [where] accompanied by an accident investigator and a Police officer.
- Send flight crew members for interview by accident investigators immediately after their medical examinations.
- Identify and gather survivors for interview by the accident investigators.

The location for the interview shall be arranged with the chief Investigator. Foreigners who have to leave the Sri Lanka soon should be arranged to be first. If necessary, the details of the survivors could be interviewed noted so that they could be contacted for interview later.

Dispatch a senior representative to liaise with the Chief Investigator on the following;

- Assistance in the removal and weighing, if necessary, of cargo/baggage from the accident aircraft.
- Provisions of diagrams of the location of the CVR/FDR/QAR on the aircraft (for aircraft crash at sea).
- Sea salvage of the wreckage (for aircraft crash at sea).
- Assistance in impounding documents on board the aircraft and maintenance records.
- Assistance in technical investigation and in other engineering expertise.

2.4.6 Sri Lanka Air Force

SLAF May attend in accordance with their procedures. Assistance for search and rescue may also be requested.

CHAPTER – 3

NOTIFICATIONS

3. Notifications

3.1 General

The proper conduct of an investigation requires prompt arrival of investigators at the accident site. Any delay in their arrival may well result in the deterioration or disappearance, of essential evidence due to: theft, displacement or improper handling of the wreckage, adverse weather conditions, post-accident corrosion of the wreckage, impairment of eyewitnesses' accounts through discussion amongst themselves, etc. Therefore immediate notification to the Authority of an aircraft accident is essential.

3.2 Notification to the Authority

The Authority should be notified immediately upon occurring of an accident or a serious incident within the territory of Sri Lanka into any aircraft or in foreign territory to an aircraft registered in Sri Lanka. The notification is required to be passed to the AIU of this Authority by the quickest means and giving, as far as possible, the required information mentioned in paragraph 3.3 below. This notification could be in the form of a telephone call, facsimile, e-mail, AFTN. In the event of an occurrence, it is most probable that one or more of the following will notify Authority:

(a) the owner, operator, hirer, lessor, agent or the pilot-in- command/surviving crew members of the aircraft at the time the accident or incident as the case may be, occurred;
(b) where the accident or incident occurs on or adjacent to an aerodrome in Sri Lanka, the owner or operator of such aerodrome or the Air Traffic Service Provider ;
(c) where the accident or incident occurs in Sri Lankan airspace, the ATS provider;
(d) where the accident or incident occurs during a flying display or festival being held within Sri Lanka, the organizer of such flying display or festival; or
(e) where the accident or incident occurs during a demonstration flight in Sri Lanka, the handler or organizer of such demonstration flight.

a) Handling agent/Maintenance organization
b) Police/Local Authority
c) Eyewitness
d) State of Occurrence, in the event of an occurrence in foreign territory to an aircraft registered in Sri Lanka

The legal responsibility for notification of an accident rests first with commander of the aircraft or, if he be killed or incapacitated, then the operator.

3.3 Recording of Notification

The recording should be made using an Accident/Incident Recording form format of which is given in Appendix 3.The recording must contain following information.

a) for accidents the identifying abbreviation ACCID, for serious incidents INCID;

b) manufacturer, model, nationality and registration marks, and serial number of the aircraft;

c) name of owner, operator and hirer, if any, of the aircraft;

d) name and qualification of the pilot-in-command, and nationality of crew and passengers;

e) date and time (local time or UTC) of the accident or serious incident;

f) last point of departure and point of intended landing of the aircraft;

g) position of the aircraft with reference to some easily defined geographical point and latitude and longitude;

h) number of crew and passengers; aboard, killed and seriously injured; others, killed and seriously injured;

i) description of the accident or serious incident and the extent of damage to the aircraft so far as is known;

j) an indication to what extent the investigation will be conducted or is proposed to be delegated by the State of Occurrence;

k) physical characteristics of the accident or serious incident area, as well as an indication of access difficulties or special requirements to reach the site;

l) identification of the person sending the notice and where the accident or incident occurred outside Sri Lanka, the means by which the investigator-in-charge and the accident investigation authority of the State of Occurrence, may be contacted at any time; and

m) presence and description of dangerous goods on board the aircraft.

3.4 Responsibility of the Authority

3.4.1 Responsibility as the State of Occurrence

Upon receipt of notification as per 3.2 and 3.3 above, the Authority shall decide whether to investigate the event as an accident or a serious incident or an incident. Action shall therefore be taken immediately to and immediately take action to:

a. notify Chairman/Board of Directors of CAA and get a suitable AAIB, or an Accredited Representative, as the case may be, appointed.

b. authorize and assign a trained Airworthiness/Flight Operations Investigator, pending appointment of AAIB, to initially coordinate investigative activities such as securing of site, safeguarding of evidence etc.

When an accident or a serious incident occurs within the territory of Sri Lanka into any aircraft the Authority, shall forward a notification message with a minimum of delay and by the most suitable and quickest means available, in accordance with Chapter 4 of Annex 13 as appropriate to:

a. the State of Registry, in the event of occurrence in Sri Lanka to a foreign aircraft;
b. the State of the Operator;
c. the State of Design;
d. the State of Manufacture; and
e. the ICAO, when the aircraft involved is of a maximum mass of over 2250 kg, or is a turbojet powered aeroplane.

using the form for notification of an accident/serious incident shown in Appendix 4 by including the information provided in the format given in Appendix 3 & 5 hereto, which are prepared in accordance with the specifications, for the notification of all accidents or serious incidents, given in Chapter 4 of Annex 13.

The Authority shall ensure that the format and content of notifications of accidents and serious incidents forwarded to relevant States and/or ICAO are clear and concise and are prepared in English language. In case the recipient is not familiar with English language the Authority will endeavour to translate the text of the notification in such language that is familiar to the recipient.

Telephone, facsimile, e-mail or the AFTN are the most suitable means of communication, and more than one means of communication must be used.

In the case of an occurrence in a non-Contracting State or outside the territory of any State, into an aircraft registered in Sri Lanka, the Authority as the State of Registry, shall forward of accident/serious incident notifications to the States involved and, when applicable, ICAO in the situations where Sri Lanka is not the State of Occurrence. When the State of Occurrence is not aware of a serious incident, the Authority as State of Registry or State of the Operator, shall forward notifications to the States involved and, when applicable, ICAO in accordance with Chapter 4 of Annex 13.

3.4.2 Responsibility of the Authority as the State of Registry/Operator

In the event that an accident or a serious incident occurred, to an aircraft either registered or operated by an operator in Sri Lanka or designed or manufactured in Sri Lanka and a notification to the effect has been received from the State of Occurrence;

a. Acknowledge receipt of the Notification.

b. As soon as possible, arrange for the Director General to provide the State of Occurrence or any other State which propose to conduct an investigation, with any relevant information available regarding the aircraft concerned and the flight crew involved in such accident or incident;

c. With a minimum of delay and by the most suitable and quickest means available, provide the State of Occurrence or any other State which propose to conduct the investigation, details of dangerous goods, if any, which were on board the aircraft; and

d. Inform State of Occurrence or any other State which propose to conduct the investigation, whether it intends to appoint an accredited representative and if such a person is appointed, the name and contact details; as well as the expected date of arrival if the accredited representative will travel to the State of Occurrence.

3.4.3 Responsibility of the Authority as the State of Operator

Where the Authority receives a notification of an accident or an incident which has occurred in a Non-Contracting State or outside the territory of any State, involving an aircraft operated by an Air Operator of Sri Lanka or designed or manufactured in Sri Lanka, the Authority shall take necessary arrangements to carry out the same task as above 3.4.2.

3.5 Contact Information

The Authority shall deal with notifications of accidents and incidents (forwarded within the State or forwarded by other States) during office hours as well as out of office hours on a 24-hour basis. To this effect, all concerned are to view the web site (www.caa.lk) wherein there is a linkage for Accident Investigation Unit, which will provide the contact details (Tel/Fax) of the following to whom the notification has to be made;

- Accident Investigation Unit of CAA, Sri Lanka
- DGCA
- Deputy Director General / Flight Safety Regulation
- Deputy Director General / Airspace & Security Regulation

Further to this reference may be taken of the AIC A01/18 (25 May 2018), which the Authority has issued to all concerned for notification of an aircraft accident or serious incident.

The Authority will provide ICAO with contact information, which is operational 24 hours a day and also establish means to ensure that the up-to-date contact information of aircraft accident investigation authorities in other States is made available to the relevant personnel & the CAA web site. The amendments are made based on the contact list published on the ICAO FSIX website.

To this effect, the Authority will first visit the CAA Sri Lanka web site (www.caa.lk) wherein there is a linkage for Accident Investigation Unit which will further provide the linkage to the ICAO FSIX web site(automatically updated), that provides the up to date contact information of aircraft accident investigation authorities in all States of the world. All relevant personal of the Authority including accident investigators are too avail the facility as and when required.

List of addresses of aircraft accident and incident investigation authorities also can be found in Appendix 2 to Chapter 4 of ICAO Doc. 9756 – Part I Organization & Planning.

Provision for the notification of a distress phase to the State of Registry by the rescue coordination center is contained in Annex 12.

CHAPTER – 4

PLANNING AND ORGANIZING THE INVESTIGATION

4. Planning and Organizing the Investigation

4.1 General

Aircraft accident investigation is a highly specialized task that should only be undertaken by trained personnel possessing many qualities, not the least important of which are an inquisitive nature, dedication, diligence, and patience. The Investigator must have a sound working knowledge of aviation and factors that affect operations as a whole.

To achieve its purpose, an investigation should be properly planned, organized, coordinated and supervised. It is essential that the magnitude of the task and the scope of the investigative resources be planned, and appropriate skills marshaled and allotted to their various tasks.

In some investigations, the areas on which the investigation should focus will become evident at an early stage, and the main investigation effort can then be effectively channeled into these relatively specialized areas. Nevertheless, it is still essential that investigators progress symmetrically through all aspects of the accident. Whether or not the causes are apparent, the investigation should determine any underlying systematic factors that may have contributed to the accident as well as any non-causal deficiencies that could contribute to future accidents.

Taking in to consideration the specific situation, it may be required to obtain the services of manufactures of aircraft and its components, country of type design. Aircraft type specialists and experts such as metallurgists, industrial chemists, psychologists etc. The proper conduct of an investigation requires the timely arrival of the investigation team on-site, fully prepared and adequately briefed, ready to perform the investigation. Any delay may well result in the deterioration or disappearance of essential evidence. Immediate notification of the aircraft occurrence and the receipt of important information at the initial stages are essential.

4.2 Investigation groups

In major accidents, the formation of following group members in to the investigation team lies on the appointed Chief Investigator depending on the requirements.

1. Flight operations
2. Maintenance and aircraft records
3. Site survey
4. Cabin safety
5. Medical and Human factors
6. Structures
7. Systems
8. Power plants
9. Flight recorders
10. Meteorology and Air Navigation Services.

The Chief Investigator should be the person responsible for communication with the other representatives.
The Chief Investigator is responsible for;

1. Securing aircraft or the wreckage and ensuring the crashworthiness of the aircraft.
2. Documents relating to maintenance and operations of the aircraft.
3. Conducting the investigation and reporting the results.
4. Collection and preservation of evidence.
5. Notifying and suggesting remedial measures for legislative breaches.

The Chief Investigator will ensure that others understand the regulatory purpose of the investigation at the site so that there is no confusion or ambiguity.

4.3 Planning

4.3.1 Site considerations

Preparation for an accident or incident investigation begins before going on site and includes planning of followings.

1. Consideration of the terrain at the occurrence site
2. Weather and location
3. Magnitude of the task
4. Resources necessary for the investigation. If possible to make aerial photographs and sketch the wreckage whilst flying over the site before arrival.

4.3.2 Pre-departure considerations

1. Associated data and appropriate documentation
2. The collection of initial data
3. Perusal of the aircraft information and company files.
4. Obtain appropriate equipment, tools, check lists, and clothing.
5. Preparation of support equipment needed at the site
6. Carriage of CAA credentials/identity card.
7. Carriage of a communication facility, such as a mobile telephone, VHF radio set.
8. Arrangement for necessary transport
9. Arrangement of accommodation and site support
10. Contacting AOC holder/State of Registration/Pilot/Maintenance organization as applicable

Note - Basic equipment and tooling that may be necessary to be carried for on-site investigation are available at the CAA Accident Investigation Unit located at the head office in Katunayake.

4.4 Specialist Examinations

1. Obtain necessary judicial authorities, if applicable, to remove wreckages for specialist examinations.
2. Specialist examination may range from microscopic to chemical analysis
3. Choosing and labeling of components moved from aircraft for analysis.
4. Precaution of components needed for the shipment for analysis under foreign specialist facility.

CHAPTER -5

OCCUPATIONAL HEALTH & SAFETY

5. Occupational Health & Safety

5.1 Purpose

Civil Aviation Authority of Sri Lanka acknowledges its responsibilities in regard to the health and safety of its employees engaged in aviation occurrence investigation and wreckage examination. The Authority will make reasonable arrangements to ensure compliance with occupational health and safety legislation/universal safety precautions during the investigation process and maintain a working environment for employees, which is safe, and without risk to health. The Authority shall provide investigators with protective equipment and guidelines to address biological hazards and other hazards at accident sites. The list of such personal protective equipment has been shown in paragraph 21.5 of Chapter 21.

These guidelines apply to all employees who are likely to face exposure to potentially infectious or injurious substances or objects when conducting occurrence investigations. Each employee has a responsibility to ensure that he or she works safely, and also protect others in the work place. Adherence to the work practices described, together with the use of appropriate personal protective equipment, will reduce on-job risk for all staff exposed to occurrence site hazards. All Investigators and support staff are strongly advised to follow guidelines given in this Chapter to avoid possible exposure to conditions that may pose a safety and health hazard.

5.2 Pathological Hazards

Contact with human and animal remains and body fluids is serious health hazard because of the risks of bacterial viral and fungal contamination. Exposures to pathogens are unpredictable and since infection can be transmitted through direct contact with the eyes, nose and mouth, an open cut, dermatitis rash/chafed skin, or open skin sore.

The Authority Management requires that all Investigators while working on-site take *Universal Safety Precautions* where the potential for exposure exists. *Universal Safety Precautions* is an approach to infection control, which assumes that all human blood and certain human body fluids are known to be infectious for HIV, HBV and other blood-borne pathogens and are handled accordingly. See guidelines given below under *universal safety precautions*.

5.3 Bio Hazards

Biohazards are blood-borne pathogens that cause disease in humans. The precautions that should be taken against them are described below. Blood-borne pathogens are microorganisms which, when they enter human blood, can cause disease in humans. Infectious pathogens can be found in fatally injured persons as well as injured survivors. These pathogens include, but are not limited to:

a) Hepatitis B Virus (HBV)
b) Human Immunodeficiency Virus (HIV)
c) Malaria
d) Syphilis

e) Tetanus

The same universal and workplace infection control procedures apply to both HBV and HIV. Infection transmissions of other pathogens are interrupted by the procedures adopted for HBV/HIV.

HIV – HIV affects the immune system, weakening it to the point where the individual becomes more susceptible to other infections – for example, pneumonia, tuberculosis or cancers.

In the early and mid-1980s, it was generally believed that the HIV virus would not survive long outside the body. Recent studies have changed this thinking. In some cases, dried plasma held at room temperature retained infective virus for more than three days. In aqueous preparations held at 23-27^{0}C, just above room temperature, infective virus was retained after 15 days. Temperatures above 56^{0}C shorten the survival time of HIV virus to less than three hours.

No cases of insect transmission are presently known. A vaccination against HIV infection is not available to date.

HBV - Hepatitis B Virus causes inflammation of the liver, and may result in an individual becoming an HBV carrier with the potential to infect others. Liver failure and death can follow infection. HBV can remain viable outside the human body for some days and can exist in dried blood/body fluids. The disease, because of its abundance in a given infected blood sample, relative to HIV, is potentially many times more infective and therefore the greater site risk.

The best defense against Hepatitis B infection is vaccination. Should a known exposure occur it is usual medical practice to give a Hepatitis B Immuno Globulin (HBIG) injection within 24 hours.

Malaria - Except for one strain of malaria, human malarias are generally not life threatening, but produce a repetitive series of shaking chills and rapidly rising temperatures followed by profuse sweating over several days. Relapses may occur at irregular intervals and infection may persist for upwards of 50 years.

Transmission is by the bite of an infective mosquito. Personal protection on the work-site will be achieved by regular use of an insect repellent in addition to wearing the protective clothing provided.

Syphilis – This disease can occur concurrently with HIV infection and is spread in a similar way, namely through contact with infectious body fluids and secretions. Syphilis is characterized by skin lesions and a rash involving the palms and soles. As the disease develops it attacks the central nervous system and cardiovascular system.

Transmission of infection will be interrupted by procedures adopted for HIV protection.

Tetanus - An acute disease characterized by painful muscular contractions primarily around the jaw and neck followed by contractions of the trunk muscles. Around the

world, case fatality rates range between 30% and 90%. The disease is introduced into the body through a puncture wound contaminated with soil, street dust or animal/human faeces. Often the wound is unnoticed or too trivial for medical consultation.

Active immunity can be obtained from an immunization, which lasts nominally 8 to 10 years.

Tetanus control is best achieved by active immunization since it is rarely possible to recover and identify the organism at an infection site.

5.4 Universal Safety Precautions

Universal Safety Precautions shall be observed to minimize exposure to infectious materials. Risk reduction precautions shall include the following;

a. Investigators shall avoid direct contact with any potentially infected wreckage or soil.

b. Until properly protected, Investigators shall avoid any investigative, procedure on potentially infected wreckage or soil which might tend to splash, spray, generate droplets or otherwise dispense contaminated particulate matter

c. Investigators shall not eat, drink, smoke, apply lip balm or skin cream or handle contact lenses while in potential biohazard areas.

d. Each Investigator shall use antiseptic hand towelettes, or equivalent means of cleaning, immediately after leaving the biohazard area and removing personal protective equipment.

e. Investigators shall wash their hands with antiseptic soap and running water as soon as possible after using the antiseptic towelettes.

f. Any personal investigative equipment (Cameras, notebooks etc.), which may become contaminated with infectious materials, shall be examined and either decontaminated or disposed of as appropriate, prior to removal from the biohazard area.

g. Decontamination shall be with antiseptic towelettes or by a 10% solution of household bleach in water (10 minute minimum contact).

h. Investigators shall wash their skin or flush mucous membranes with water as soon as feasible following contact of their body areas with potentially infectious materials.

i. No staff members with a pre-existing condition that would facilitate the spread of a blood-borne pathogen for example open hand or facial cuts, skin rashes, open sores- will be permitted access to the bio-hazard area.

5.4.1 Vaccinations/Immunizations

The Authority strongly advises all participating investigators and support staff to take the Hepatitis B vaccination series including the antibody check two months after the test vaccination. All must take tetanus toxoid immunization.

The Authority management recommends and encourages all investigators to complete the HBV series and ensure that their tetanus immunization is current. Investigators must also take the routine booster vaccinations as required. Investigations in regions affected with known infective diseases may require inoculations against such diseases. Investigators are advised to seek medical advice regarding protections to visit such sites.

5.5 Work Practice Controls

5.5.1 General

All investigators shall treat all occurrence sites as potentially hazardous areas and control entry to the site in accordance with the provisions of this Manual. Control may be revised once the potential hazards have been eliminated.

From time to time the Authority will require the use of laboratory facilities with outside contractors. Many of hazards found at an occurrence site, whilst minimized prior to transport, may still be present or further exposed during laboratory testing.

The relevant workplace risk minimization procedures set out for an occurrence site shall continue to be applied in the laboratory setting.

5.5.2 On-site Occupational Health and Safety Responsibility

An occurrence site presents a number of potential hazards, each of which requires that appropriate procedures be established and followed. Terrain, environmental conditions, wreckage, and hazardous materials such as chemical, explosive, biological and radioactive items all have considerable potential to cause serious physical injury. In addition, critical incident stress has the potential to cause both emotional and physical damage to individuals during and following an occurrence site visit.

For the purpose of Occupational Health & Safety (OH & S) issues it could be considered that the wreckage includes that area of ground encompassing all parts of aircraft wreckage and including an additional buffer zone of a further 50% of the actual wreckage area.

The Authority will only have responsibility for an occurrence site once it has been handed over by the emergency responder's site commander. This may be the AASL site Commander, or the local Police O.I.C. The Chief Investigator of accident should seek the site Commander's advice on occupational health and safety matters prior to hand over.

In a less severe occurrence, CAA will probably have immediate responsibility for the wreckage and, consequently OH & S responsibility. This responsibility includes the entire area encompassing the wreckage.

In the event of an occurrence on airport land & premises the AASL and the site Commander will have joint responsibility for OH & S until control of the site is handed over to the Authority Chief Investigator. Once the site is handed over, the Airport Authority will maintain the responsibility for the property around the occurrence site and will therefore control all access to the site.

The Chief Investigator is responsible for OH & S activities of the investigation team while the members are under the Chief Investigator's direct control whether at the occurrence site or not.

The support of the fire department and the dangerous goods specialized should be enlisted, as necessary, to evaluate existing and potential hazards and to brief the investigation team, as appropriate. It should be noted that the role of investigators is to investigate the accident, not to fight fires or remove hazardous materials.

5.5.3 Personnel on Site

To limit exposure to potentially hazardous situations, only personnel who have a need to be on-site as part of the investigation team should be allowed access to the occurrence site and then too, only for the minimum possible period.

The aircraft Manufacturer and Operator may be requested to advice the Chief Investigator on possible hazards associated with the aircraft or its cargo.

As part of the on-site safety process, the Chief Investigator may conduct pre entry briefings as necessary for all personnel entering the occurrence site. The intent of these briefings from a safety point of view is to inform all the Investigators, the Authority staff and approved visitors of potential hazards and ways of avoiding or combating them, including wearing of minimum protective clothing.

If any Investigator suffers from exposure to any hazard, the Chief Investigator must take appropriate action immediately after the on-site phase.

5.6 Site Precautions

5.6.1 General

Personal Safety at the occurrence site is a combination of common sense and proper procedures. Although the Chief Investigator of accident is ultimately responsible for the safety of personnel assigned to the investigation team, all Investigators must be familiar with the OH & S regulations and guidelines and established safety procedures. Each Investigator must take every precaution to prevent personal injury. Investigators must exercise caution and use all appropriate protective devices when working at the occurrence site.

An Investigator should not work alone at an occurrence site unless the site location and circumstance adequately provide for his or her personal safety.

5.6.2 Hazardous Sites

Entry and exit must always be via the controlled entry point. The Chief Investigator must ensure that a log is kept indicating when personnel enter and leave the site. Entry requires appropriate protective equipment, exit requires leaving contaminated outerwear in designated receptacles.

5.6.3 Isolated Sites

Investigators should not normally work alone at an isolated occurrence site. An isolated site is defined as one, which would involve more than two hours travel time to an appropriate medical facility or which would otherwise present difficulties if immediate removal of an Investigator were necessary.

5.6.4 Precautions against fire

There should be no smoking permitted within the guarded area and the fire-fighting equipment should be readily available while a high fire risk remains. Aircraft batteries should be disconnected as soon as possible and if aircraft fuel tanks are still intact, they should be emptied. The quantity of fuel removed from each tank should be measured and recorded. If there has been a large spillage of fuel, the investigators must control any activity that could increase the possibility of ignition. Care should be exercised to control possible sources of ignition. The operation of radio or electrical equipment or the use of salvage equipment should be avoided until the fire risk has been assessed and eliminated.

5.6.5 Precautions to dangerous cargo

The Authority should ascertain whether or not dangerous goods were carried aboard the aircraft. A preliminary check of the freight manifest and an inquiry to the operator should resolve this question. Dangerous goods may include such items as radioactive consignments, explosives, ammunition, corrosive liquids, liquid or solid poisons or bacterial cultures. If radioactive materials are carried, steps must immediately be taken to have them removed by qualified personnel before any harm is caused to persons working in close proximity to the wreckage. Limitations on the quantity of radioactive material, authorized to be carried on-board an aircraft, the strength of its packaging and shielding will minimize the possibility of container damage in an aircraft accident. However, a post-impact fire could damage the packaging and shielding, and the ensuing heat may cause the radioactive material to change into gaseous form, in which case radiation may spread. In such cases, all participants in the rescue and fire-fighting operations should be checked, decontaminated and placed under medical observation, as necessary. No examination of the wreckage should be initiated until the level of radiation has been measured and the site declared safe.

5.6.6 Physical Conditions

Investigators are responsible for ensuring that they are fit enough to endure the sometimes arduous conditions found at an occurrence site. Each Investigator should be aware of the effects of fatigue long before Exhaustion sets in.

In addition to being aware of the current condition of the site, the Lead Investigator needs to be aware of the condition of the participants in the investigation. The Lead Investigator should ask all participants if they are aware of any medical (including psychological) or physical reason why they should not be assigned normal on-site workload.

Precautions should be taken against the possibility of dehydration, heat stroke and sunburn. Early symptoms of dehydration are thirst, lack of appetite, slow reactions,

nausea, drowsiness and high body temperature. Further symptoms are dizziness, headache, difficulty in breathing, tingling in the arms and legs, indistinct speech and an inability to walk. Dehydration can be fatal. Drink plenty of water to prevent dehydration – even if not really thirsty.

The symptoms of heat exhaustion are a pale face, cold sweat and shallow breathing. Heat exhaustion is considered to be shock from exposure to heat. Place the individual on their back in a shady spot elevate their feet and loosen tight clothing. Apply cool, wet cloths.

Symptoms of heatstroke are red, hot, dry skin, high body temperature, rapid pulse, slow and noisy breathing, confusion or unconsciousness. This condition is serious and must be treated immediately. Seek shade, place the individual on their back and undress down to the underwear. It is especially important to cool the head. Have the individual drink fluids and rest.

To protect Investigators exposed to the effects of UV radiation and windburn, sunscreen lotion should be applied generously and frequently before going out in the sun. A sun-blocking product, for example, zinc cream-should be applied to the nose, lips and ears.

Sunburn can be caused even on hazy or cloudy days. Investigators should observe the precaution of wearing long sleeves and a broad brimmed hat.

When temperatures drop, be on guard against hypothermia. If an individual becomes exhausted, is wet**,** exposed to strong winds, and the temperature drops to between 5^0 C to 10^0 C, hypothermia can set in, resulting in coma and possible death. Be alert to symptoms such as irritability, slow breathing, casual attitude and slow movements. In freezing conditions do not touch metal parts with bare hands as your skin might stick to the part.

5.7 Hazardous Material

Hazardous materials (Hazmats) jeopardize the health and safety of all personnel at the occurrence site and are found in various forms: toxic, flammable corrosive, radioactive, biological and other substances.

When expert advice is needed on dangerous goods at the occurrence site, contact the state organization responsible for the provision of support. They can provide advice on chemicals, drugs and insect or other bites.

Adhere to the following guidelines:

a) Assume that hazardous materials are present at the occurrence site. Suspect all freight, mail and passenger baggage until positively identified.

b) Always assume that pressure vessels are explosive until rendered inert.

c) Before examining any wreckage, perform a personal site-safety check.

d) If a danger has not or cannot be neutralized, use alternative methods for gathering evidence such as photography, or witnesses.

e) Aircraft always contain hazardous materials such as fuel, oil and hydraulic fluid. When possible, clean any serious contamination of fuel and lubricant from the wreckage using a detergent wash and rinse, and when necessary, an approved absorbent. Be aware of the ever-present danger of fire and explosion when cleaning contaminated wreckage.

f) Burning or smoldering aircraft interiors and modern composite materials emit noxious and highly toxic gases and possible carcinogenic particles. While the aircraft wreckage is still burning or smoking, only fire fighters and rescue personnel equipped with Self Contained Breathing Apparatus (SCBA) should enter the wreckage. If it is essential for an Investigator or any other person to enter such an environment, SCBA equipment must be worn and, in case of difficulties, one or more assistants who are similarly equipped and ready to evacuate must assist the person.

CHAPTER – 6

INVESTIGATION

6. Investigation

6.1 General

The Authority as the State of Occurrence will institute an investigation into the circumstances of the accident or the serious incident and be responsible for the conduct of the investigation.

The Authority may delegate the whole or any part of the conducting of such investigation to another State, or a regional accident investigation organization by mutual arrangement and consent. In any event the Authority may use every means to facilitate the investigation.

The Authority will ensure to conduct investigations into different types of occurrences including major accident, serious incidents, fatal or non-fatal accidents, public transport or general aviation, etc. Some examples of serious incidents, which will be required to investigate by the Authority, have been outlined in Appendix 8.

As the State conducting the investigation the Authority will designate the investigator-in-charge or chief investigator of the investigation and initiate the investigation immediately. Depending on the seriousness/severity of the accident or serious incident Authority will appoint investigators upon their speciality or may delegate as mentioned above. In addition, depending on the depth and scope of the investigation the Authority will simultaneously designate the other members of the Aircraft Accident Investigation Board through an empowerment letter. The empowerment letter is shown in Appendix - 2 to this Manual. In the case where the CAASL inspectors are appointed as investigators to the AAIB, the DGCA will release these inspectors from routine day to day duties for the period of investigation. The letter be issued in this regard is shown in Appendix 2.

For a major aircraft accident investigation involving fatalities etc. reference should be taken from Aircraft Accident investigation Management System, SLCAP 9999_10.The AAIB and the Chief Investigator shall be granted the responsibilities, the power and independence, as outlined in Chapter 2, in the conduct of the investigation and the investigation shall be initiated immediately. Depending on the circumstance the Authority will make arrangements to conduct an audit on subjected Operator after an accident/serious incident to find out all risk factors.

The Authority shall ensure that relevant and timely information on the progress of the investigation will be provided to the families and accident survivors. More details about this given in Appendix 12 to this Manual.

6.2 Medical

In the event of a fatal accident, ensure that arrangements have been made for complete autopsy examination of fatally injured flight crew and subject to the particular circumstances, of fatally injured passengers and cabin attendants, by a pathologist, preferably experienced in accident investigation. The examinations shall be expeditious and complete.

When appropriate, the Authority will make arrangements for expeditious medical examination of the crew, passengers and involved aviation personnel, by a physician, preferably experienced in accident investigation. Such examinations

should be expeditious and may also determine whether the level of physical and psychological fitness of flight crew and other personnel directly involved in the occurrence is sufficient for them to contribute to the investigation.

Guidance for conducting of autopsies and medical examinations is given in Appendix 10 to this Manual. The list of tasks which would be carried out during autopsy & medical examination has been laid down in event check list no: 4,18,32,48 & 51 of Aircraft Accident Investigation Management System Manual, SLCAP 9999_10.

The Authority shall take into consideration the instructions as laid down in general circular letter no: 02-59/2007 issued & signed by Director General of Health Services of Ministry of Healthcare & Nutrition of Sri Lanka, to obtain the assistance on medical examinations and autopsy examinations in case of an aircraft accident/serious incident. The document has been shown in Appendix 10 of this Manual.

More Guidance for conducting of autopsies and medical examinations is also given in Docs 8984 and 6920 mentioned in paragraph 1.4.

6.3 Legal

The separation from any judicial or administrative proceedings can be achieved by the investigation being conducted by the Authority experts and any judicial or administrative proceedings being conducted by other appropriate experts.

The Chief Investigator shall coordinate with judicial authorities, as necessary; with particular attention to evidence that requires prompt recording and analysis. The coordination with judicial authorities has laid down in the Chapter 2.2 to this Manual.

If in the course of an investigation it becomes evident, or it is suspected, that an unlawful interference was involved, the Chief Investigator shall immediately inform the Police or initiate action to inform relevant security authorities to deter the security threats and bring back the safety of the flight, equipment and personnel. In this regard the Authority will seek the assistance of government departments, airport administrations and tenants who are responsible for preparing individual contingency plans applicable to their organizations wherein such plans are usually coordinated amongst the organizations for cohesive implementation by issuing staff instructions, installing communications systems and undertaking training, in order to respond to such act of unlawful interference.

6.4 Non-disclosure

The Chief investigator, any member of the AAIB, or any other officer shall not make the following records available for purposes other than accident or incident investigation, unless the appropriate authority for administration of justice determines that their disclosure outweighs the adverse domestic and international impact such action may have on the investigation or any future investigations;

a) all statements taken from persons by the investigation authorities in the course of their investigation;
b) all communications between persons having been involved in the operation of the aircraft;

c) medical or private information regarding persons involved in the accident or incident;

d) cockpit voice recorder(CVR) recordings, flight data recordings, recordings from air traffic control units and transcripts from such recordings; and

e) opinions expressed in the analysis of information, including flight recorder information.

f) any record not relevant to the analysis of the accident or incident.

These records shall be included in the final report or its appendices only when pertinent to the analysis of the accident or incident. Parts of the records not relevant to the analysis shall not be disclosed. The Authority shall not be disclosed the names of the persons involved in the accident or incident to the public.

It is Important to note herein that non-disclosure of records will help future investigations, where the integrity of persons who volunteer to contribute valuable information to an investigation process is valued, respected and undisclosed which encourages such contribution from volunteers in the event of future accidents.

Information contained in those records which could contain information given by volunteers interviewed during an investigation could be used inappropriately, by means of disciplinary, civil, administrative and criminal proceedings. In the event of that happening such voluntary contribution most probably will not forthcome in future. Lack of access to such information would impede the thorough investigation. Thus affect assurance of flight safety.

6.5 Site considerations

On- site investigation is to collect as much evidence as possible before the wreckage has been disturbed. Sometimes the time available for an on-site investigation may be limited by factors outside the Investigator's control, such as weather, or a hazardous location. Therefore it is required to concentrate on collecting relevant evidence rather than trying to analyze the occurrence on-site.

The Chief Investigator or Lead Investigator should contact the local police or Airport security as applicable to ensure the security of the wreckage until their arrival. The Investigator must ensure that the security or police is aware of site security requirements including the possibility of hazards from dangerous cargo.

6.5.1 At the Site

The Lead Investigator must attend to the following immediately on arrival.

Establish who has control of the crash area. Check with them whether there has been any disturbance of the wreckage during any rescue operations and record the extent of the disturbance.

Make arrangement for the medical examination of crew, passengers and involved aviation personnel by a physician, preferably experienced in accident investigation. See also paragraph 15.2.2.

It is required that persons, such as the landowner or local authority agencies, do not disturb the site. Be mindful of the normal functional use of the occurrence site.

Review arrangements for guarding the site and impress on any guards the importance of their duties, in order to;

1. Prevent disturbance of the wreckage.
2. Protect and preserve, where possible, any impact marks made by the aircraft.
3. Admit only those persons or vehicles authorized.

6.5.2 Precautionary Measures

Observe the availability of following precautionary measures.

Attendance of emergency services and assures that any fire has been extinguished. Precautions must be taken to prevent an outbreak of fire. In particular the investigator should check that electrical power is not still applied to any system.

If residual fuel has to be drained from the aircraft as a precautionary measure, the quantity removed and from which tank(s) it was removed must be recorded.

During subsequent examination of the wreckage beware of causing further fire/explosion hazard by rupturing any system component- for example, oxygen supply lines.

Other hazards, which may be present at the site, particularly after a fire has occurred, are associated with the following.

1) Inflated tyres
2) Compressed springs
3) Hydraulics/Pneumatics
4) Oleos
5) Igniters
6) Oxygen system- fixed and portable
7) Fire extinguishers
8) Evacuation chutes
9) Life rafts and jackets
10) Composite materials

Dangerous cargo may have been in the aircraft. The aircraft operator may confirm this. In this case, examination of the wreckage must not commence until there is confirmation by an expert that the site is safe for personnel to work in. This applies particularly to radioactive or biological cargo.

6.6 Initial Site Survey

The primary consideration is to establish;

1) A probable flight path
2) Impact angle
3) Impact speeds
4) Whether or not the aircraft was under control
5) Whether structural failure occurred prior to impact

The Investigator is not required to attempt a detailed examination at this stage. The initial aim is to obtain as complete and clear a picture as possible of the circumstances under which the accident occurred.

This is needed to establish a reference point, and then follow the subsequent path of the aircraft by searching for marks or scars on the ground, on buildings, trees, shrubs, rocks, etc.

General survey of the wreckage and the knowledge gained of the terrain will assist the Lead Investigator in planning the investigation and assessing priorities in the work to be undertaken.

6.7 Preservation of Evidences and Records

a) All physical evidence and deductions made by Investigators or groups responsible for various aspects must be recorded. As a guide, a pocket-sized notebook will be convenient for recording details at the accident site.

b) Determine and record the precise location of the accident site. In difficult terrain this could be done using a Global Positioning System.

c) Determine the site elevation and significant terrain gradient, as both may be relevant to the accident.

d) Preservation of impact marks is very important, careful note should be made of all ground marks so that guard arrangements may be amended where necessary to provide additional security.

e) Ensure that all aspects of the wreckage trail are preserved, photographed and their description and location have been recorded.

f) Ensure that flight recorders are left in place until specialists advise on their removal is obtained. Special handling and preservation precautions are needed if the recorders are recovered from the sea. Refer also paragraph 6.9 below.

The officers should pay special attention to handle various articles, which may be required as evidence. These articles may consist of documents or aircraft components or material. Investigators must therefore:

a) Ensure that the integrity of these potential exhibits is preserved

b) Try to handle evidence as little as possible.

c) Retain the item as closely as possible in its original condition.

d) Make immediate arrangements for appropriate preservation and safe storage. This may include oiling, greasing, wrapping or sealing.

6.7.1 Collection and Handling of Fluid Samples

If there is any likelihood of the fluid samples, including fuel and oil, being required as evidence, they should be obtained in accordance with the following procedures;

a) At least three samples in the presence of the person giving permission and are sealed securely. Each fuel sample should be at least one litre.

b) Each bottle should be marked with the source, date, time and place of the taking of the sample and should be signed by the officer concerned.

c) The three sample bottles should then be distributed as follows;
   I. One to the owner or, with the owner's permission to pilot or any other as applicable
   II. One for analysis
   III. One to be retained with the Investigator as control

Note: When on-site investigation has been completed the lead Investigator will hand over the aircraft wreckage to the owner or their representative so that salvage/clean-up operations can commence. It is requested to record the movement of the evidences. Record the position of personal effects found at the site of an occurrence. Hand them to police, obtaining a receipt for significant items.

6.8 Task Allocation

The importance of timely discussion with other members of the team when key evidence is discovered should be emphasized. Additionally, regular meetings of the team should be held to review the progress of work and to permit a free interchange of ideas and information by team members. The team members assigned to the groups depending on their special qualifications.

All investigators should be permitted reasonable rest periods and their welfare must be looked after. The Chief Investigator should impose on realistic targets.

6.9 Photographing

Take photographs as soon as possible before removal of wreckage and bodies. Photograph impact marks as a first priority as these may be obliterated by later activity at the accident site. If possible, aerial photograph(s) should be taken to supplement the Wreckage Distribution Chart. Since many photographs will be taken, it is essential that they are labeled and indexed in some way to assist later analysis. A simple title-board written with a felt pen and sheet of paper can be used to identify close-up photographs.

Free use of digital photography is recommended for ease of duplication, transfer and preservation in a computer. Good quality of photograph should be ensured by examining the results before disturbing the evidence. More than one camera should invariably be used for safety of photographs.

Photographs should cover general views of the scene from four directions and also back along the wreckages trail to the first point of contact. A good coverage of the wreckage in the condition in which it is found and before it is disturbed is essential.

Record the location and direction of each photograph, paying particular attention to the following:

a) Engine(s), before anything is moved, showing details of condition and damage from all angles, to include:

I. Engine control lever positions at the engine
II. Engine components, and accessories
III. Engine instrument readings and positions of control levers and switches
IV. Nature of damage to engine compressor and turbine blades indicating FOD or blade material failure
V. Nature of damage to propeller blades indicating rotation at the time of impact

b) Instrument settings and readings

c) Position of controls in the cockpit

I. Radio settings
II. Autopilot setting
III. Fuel selectors
IV. Switch positions
V. Undercarriage and flap selector positions
    a. Control surface positions
    b. Trim tab settings

d) Suspicious breakages or bends

e) Propeller/rotor blades showing pitch positions

f) Fire damage

g) Impact marks

h) Seats and seat belts

Consideration should be given to the use of overlapping photographs, which are sometimes of particular value for both aerial and close photography. Consider also any photographs or video imagery taken by witnesses.

6.10 Wreckage Distribution Chart

After the initial study of the general scene of the accident and photographs taken, one of the steps is to plot the distribution of the wreckage from a convenient datum. This task must be carried out carefully and accurately, as the study of the completed chart may later suggest possible failure patterns or sequences. This data can be referred frequently during the investigation and it will supplement the written report. While preparing the chart pay attention to any components such as control surfaces, wheels, which may be conspicuous by their absence.

In most accidents the chart should record the following:

a) Location of all major components, parts and accessories
b) Freight
c) Location at which any accident victims were found
d) The initial contact markings and other ground markings, with suitable reference to identify the part of the aircraft or component responsible for the markings
e) Pertinent dimensions, descriptive notes and also the locations from which photographs were taken add to the completeness of the chart.

6.11 Examination of Impact Marks and Debris

Determine which part of the aircraft impacted first. This can usually be done by locating the marks of the first impact of the aircraft, and examining the distribution of the wreckage. From these marks it is usually possible to form a preliminary picture of:

a) The direction, angle and speed of descent
b) Whether it was a controlled or uncontrolled descent
c) Whether the engines were powered at the time of impact
d) Whether the aircraft was structurally intact at the point of first impact

6.12 Wreckage in the Water

6.12.1 General

Wreckage in salt water can deteriorate quickly, particularly magnesium and, to a lesser extent, aluminium. As this process accelerates on exposure to air, wreckage collected from salt water must be washed thoroughly with fresh water as soon as it is raised. Further preservation action will be required for any components that must be subjected to metallurgical examination. Water displacing fluid, oil or inhibited fluid may be used as an interim preservative solution. Components such as CVR and FDR should not be dried but kept in fresh water until a specialist can assume responsibility.

6.12.2 Locating the wreckage

For aircraft crash at sea, the chief investigator should try to obtain the best technical expertise available. The Navy, Maritime and Port Authority, marine salvage services and accident investigation of other States known to have experience in this field (e.g. US NTSB, UK AIU, Canada TSB) should be consulted. Advice may also be obtained from people (e.g. fishermen) with local knowledge of sea beds and currents, etc.

The first step is to ascertain the most probable point of impact basing on floating wreckage, witness reports, search and rescue reports and radar recordings. Buoys should be positioned at the estimated point of impact.

If the water is shallow (less than 60 m), search methods using divers can be effective. If the wreckage is located in deeper water, or conditions make it difficult to use divers, use of the following equipment should be considered:

Underwater equipment used to locate underwater locating devices on the flight recorders.

- Underwater videos and cameras.
- Side-scan sonar equipment.
- Manned or unmanned submersibles.

6.12.3 Decision to recover the wreckage

The circumstances and location of an accident will determine whether salvage of the wreckage is practicable. In most cases, wreckage should be recovered if it is considered that the evidence it might provide would justify the expense and effort of a salvage operation.

A decision to discontinue recovery operation should be made in consultation with the parties concerned (the accident airline in particular).

6.12.4 Wreckage distribution

Once the wreckage has been located, a chart plotting the wreckage distribution should be prepared. In shallow waters, this can be achieved by divers. In deep waters, underwater video cameras from remotely controlled submersibles may be used.

The state of the various pieces of wreckage, their connection by cables or pipes, the cutting of these connections for the salvage operations, etc., should be recorded before lifting the various pieces of wreckage from the bottom. As divers will not be experienced in accident investigation, they will need detailed briefings.

6.12.5 Preservation of the wreckage

The rates at which various metals react with salt water vary considerably. Magnesium components react quite violently and, unless recovered within the first few days, may be completely dissolved. Aluminium and most other metals are less affected by immersion in salt water. However, corrosion will rapidly accelerate once the component is removed from the water, unless steps are taken to prevent it.

Once the wreckage has been recovered, its components should be thoroughly rinsed with fresh water. It may be convenient to hose the wreckage as it is raised out of the water prior to it being lowered onto the salvage vessel. Freshwater rinsing does not stop all corrosion action. When large aircraft are involved, it may not be practicable to take further anti-corrosion action on large structural parts. However, all components that require metallurgical examination will require further preservation. The application of a water-displacing fluid will provide additional corrosion protection; fracture surfaces should then be given a coat of corrosion preventives such as oil or inhibited lanolin.

When organic deposits, such as soot deposits or stains, require analysis, organic protective substances should not be used. Freshwater rinsing should be employed followed by air drying. When the component is completely dry, it should be sealed in a plastic bag with an inert desiccant such as silica gel.

Flight recorders should not be dried but should be kept immersed in fresh water until the assigned flight recorder specialist assumes responsibility for them.

6.12.6 Precautionary measures

When recovering the wreckage, consideration should be given to deflating tyres and pressure containers as early as possible. Corrosion of magnesium wheel assemblies can progress rapidly to the extent that the wheel assemblies become safety hazards. Other pressure containers should be discharged as soon as their contents have been evaluated.

The operation of recovery equipment and the supervision of salvage personnel should be left to the salvage contractor. The investigator may provide advice on how to attach cables, hooks, etc., to the wreckage to ensure that it is not unnecessarily damaged during the recovery.

When salvage barges, which are equipped with large machinery, hoists, cables, nets, rigging equipment, etc., are used, investigators should exercise caution and, in particular, should remain clear of equipment and sling loads.

6.12.7 Debris tagging and documentation

6.12.7.1. Debris data system

Proper records should be kept of the items found from the recovery operation. The records should contain details related to each piece, such as recovery location, extent and type of damage, photographs, sketches, and the manufacturer's engineering drawings showing the part's location on the aircraft.

A debris data management team should be set up to systematically record all the wreckage pieces recovered. The team should be headed by an investigator or a member of the Structures group. The team should comprise or be supported by members of the Structures group, who will examine the debris items to try to identify the portions of the aircraft where they may have come from.

6.12.7.2. Tagging of wreckage pieces

All large and small wreckage items recovered from the sea that are identifiable and considered significant should be tagged for reference. The tag should carry a reference number and the following information:

a) Location where the wreckage piece was found
b) Date/time of the recovery
c) The recovery team involved

If necessary, colour-coded tags may be used to readily identify the different zones of the debris field from which the items have been recovered. For example, the debris fields may be divided into the Red, Green and Yellow Zones and red, green and yellow tags are then used respectively for the items recovered from these zones.

Tags are usually attached to the items promptly upon recovery and before the items are transported to the shore or storage area. Nevertheless, items found and brought in by other parties (e.g. volunteers) may not carry any tags.

6.12.7.3. Logging into a debris database

After the specialists of the data management team has examined the items and identified the portions of the aircraft where they have come from, the items are assigned a log number for input into a debris database together with any other details and sketches or photographs. The log number is written on the wreckage piece itself and on a separate tag that is to be attached to the piece.

It is possible that one tagged item may spawn many more log numbered items. For example, during salvage and reconstruction efforts it may occasionally become necessary to cut or separate objects (previously tagged as a whole) into more than one piece; some objects may have been extracted from an entangled group of debris (recovered and tagged as a unit); pieces may have been received in a bag, net or box full of other items with one tag assigned to the container; or some parts may have broken during handling and transport. In all of these situations, the recovery position information on the original tag must be transferred to the log numbered tags assigned to the separated objects.

For easier referencing, a classification system for the log numbers may be created. For example, the following nomenclature was used by NTSB for the TWA 800 wreckage (XX denotes the number assigned to an individual piece):

LF-XX	Left fuselage
RF-XX	Right fuselage
LW-XX	Left wing
RW-XX	Right wing
H-XX	Horizontal stabilizer (both sides)
LE-XX	Left elevator
RE-XX	Right elevator
V-XX	Vertical stabilizer
R-XX	Rudder
CW-1XX	Wing centre section - upper skin
CW-2XX	Wing centre section - lower skin
CWS-10XX	Wing centre section - rear spar
CWS-11XX	Wing centre section - butt line zero rib
FBM-XX	Floor beam
LG-XX	Landing gear

6.13 Participation of other States into the investigations conduct by the Authority

The Authority will accept the participation of accredited representatives appointed by a State of Registry, State of Operator, State of Design, State of Manufacture and any other State which on request provides information facilities or experts, when conducting an investigation.

However, the Authority will invite to participate in the investigation the Operator, when neither the State of Registry nor the State of the Operator appoints an accredited representative and the organizations responsible for the type design and the final assembly of the aircraft, when neither the State of Design nor the State of Manufacture appoints accredited representatives.

The Authority may also be invited to appoint an accredited representative to participate in the investigation, from any State that provides an operational base for field investigations, or is involved in search & rescue or wreckage recovery operations or is involved as a State of a code-share or alliance partner of the operator.

In this effect, the Authority will ensure that it entitles accredited representatives to participate, under the control of the Chief investigator, in all aspects of the investigation, entitled to:

1) Visit the scene of the accident
2) Examine the wreckage
3) Obtain witness information and suggest areas of questioning
4) Have full access to all relevant evidence as soon as possible
5) Receive copies of all pertinent documents
6) Participate in read-outs of recorded media
7) Participate in off-scene investigative activities such as component examinations, technical briefings, tests and simulations
8) Participate in investigation progress meetings including deliberations related to analyses, findings, causes, contributing factors and safety recommendations
9) Make submissions in respect of the various elements of the investigation

States which have special interest in an accident by virtue of fatalities or serious injuries to its citizens will, upon making a request to do so, be permitted by the Authority as the State conducting the investigation, to appoint an expert who will be entitled to:

1. Visit the scene of the accident
2. Have access to the relevant factual information, which is approved for public release by the State conducting the investigation and information on the progress of the investigation; and
3. Receive a copy of the final report

The Authority will allow advisers assisting accredited representatives (under accredited representatives supervision) to participate in an investigation to the extent necessary to make the representatives participation effective.

However, participation of States other than the State of Registry, the State of the Operator, the State of Design and the State of Manufacture may be limited to those matters which entitled such States to participation.

The facilitation of the entry of the accredited representatives, their advisers and equipment is covered in Annex 9.

6.14 Participation in investigations conducted by other States

The Authority, as a State participating in an aircraft accident or serious incident investigation, shall make arrangements to provide the State conducting an investigation with all the information and elements which are required throughout the investigation process. On request from the State conducting the investigation of an accident or an incident, the Authority will provide all the relevant information which is available.

When the facilities or services of Sri Lanka have been, or would normally have been used by an aircraft prior to an accident or an incident, the Authority will provide to the State conducting the investigation any information it has arising out of such usage of facilities and services which may be pertinent to the investigation. The Authority will call for such information from any person or any organization that possess such information and such person or organization will comply with the call by the most expeditious means.

When an aircraft registered in Sri Lanka or operated by an Operator of Sri Lanka involved in an accident or a serious incident and lands in a State other than the State of Occurrence, the Authority will, on request from the State conducting the investigation, furnish the that State with the flight recorder records and, if necessary, the associated flight recorders. Whereas the aircraft is operated by an Operator of Sri Lanka and registered in another State and if the Authority has no legal jurisdiction to furnish flight recorder records and associated flight recorders, the Authority will request the State of Registry to comply. The Authority may request any other appropriate State in the retrieval of the flight recorder records.

The Authority, on request from the State conducting the investigation, will provide pertinent information on any organization whose activities may have directly or indirectly influenced the operation of the aircraft.

When the State conducting an investigation of an accident to an aircraft of a maximum mass of over 2 250 kg specifically requests participation of the Authority as either the State of Registry or the State of the Operator or the State of Design or the State of Manufacture, the Authority will appoint an accredited representative. The Authority may also appoint an accredited representative at the request of the State conducting an investigation when the power-plant or major components of the aircraft have been designed or manufactured by organizations certified by the Director General whenever the State conducting the investigation believes that a useful contribution can be made to the investigation or when such participation might result in increased safety.

When an accident occurred to an aircraft registered in Sri Lanka, the Authority shall arrange for representation of one or more advisers, proposed by the Operator and appointed by the Authority, to assist its accredited representative.
The Authority will authorize the State of Design and the State of Manufacture to appoint one or more advisers, proposed by the organizations responsible for the type design and the final assembly of the aircraft, to assist their accredited representatives.

However, the Authority as having suffered fatalities or serious injuries to its citizens, will, upon making a request to do so, may appoint an expert to send to the State of Occurrence. In this regard, the Authority will make necessary arrangement to provide

relevant details of the expert including name, organization, address, by whom he/she will be accompanied, with what mandate and guidance, etc.

6.15 Press release on appointment of accredited representative and advisers

The below format may use as and when necessary.

The Civil Aviation Authority of Sri Lanka has sent a team of specialists to assist in the investigation by [name of foreign investigation authority] of the accident at _____ on _____ involving an [ABC Airlines] [aircraft model] aircraft [e.g. during landing].

The team is led by _____, a senior investigator, who has been named Sri Lanka's Accredited Representative in accordance with the procedures of the International Civil Aviation Organization. Mr. _____ is joined by this Authority as a specialists in [e.g. aircraft engines, aircraft systems, flight operations and survival factors], plus [an] investigator(s) from [the [State's CAA], ABC Airlines, etc.].

All information on the progress of the investigation will be released by the [name of foreign investigation authority].

6.16 Tasks of Accredited Representative from Sri Lanka

1. The accredited representative shall bear in mind that he is a representative of the government of Sri Lanka.

2. The accredited representative shall ensure that he and his advisers act professionally.

3. The accredited representative and his advisers:

4. will provide the State conducting the investigation with all relevant information available; and

5. shall not divulge information on the progress and the findings of the investigation without the express consent of the State conducting the investigation

6.17 Actions at the accident investigation command centre

6.17.1 Setting up of the Accident Investigation Command Centre (AICC)

If directed by the authority, an AICC will be set up at the AIU office. The AICC will arrange for an adequate number of telephone and facsimile lines.

6.17.2 Tasks of the AICC

The AICC will maintain links with the accredited representative and his team of advisers. The AICC also provide the necessary support, in particular:

1. To recall the other investigators.
2. To arrange for the security of the AICC, where necessary.
3. To keep an event log.
4. To monitor accident casualty information.
5. To coordinate with the operator involved in the accident.
6. To request for external assistance, as necessary (e.g. from local agencies and aerospace organizations).
7. To liaise with other organizations as necessary.
8. To provide other facilities and logistics support, etc., as necessary
9. To assist in making travel arrangement for the investigators.
10. To prepare any necessary information, updates, etc., to the [President, Minister].
11. To draft any necessary press release.

6.18 Reopening of investigation conducted by the Authority

As per the Sections 63 of Civil Aviation Act No 14 of 2010 and paragraph 19 of Accident and Incident Investigation Regulations of Sri Lanka.

CHAPTER – 7

OPERATION INVESTIGATION

7. Operation Investigation

7.1 General

This relates to the history of the flight and to the activity of the flight crew before and during the occurrence. The major areas involved in the operations investigation are;

a. Crew histories
b. Flight Planning
c. Weight and Balance
d. Weather
e. Air Traffic Services
f. Communications
g. Navigations
h. Aerodrome facilities
i. Aircraft Performance
j. Compliance with relevant instructions
k. Examining witness statements
l. Determination of final flight path
m. Sequence of flight

There is close link between the work in the Operations Investigation and that in other investigation areas, such as the flight path of the aircraft can be constructed from ATC data and witnesses and also from FDR data. These must be compared and crosschecked to properly execute the investigation.

7.2 Crew Histories

A study of all the facts pertaining to the crew forms an important part of both the Operations and Human Factors investigations. A high degree of coordination in the collection and evaluation of the relevant facts is required to achieve the best possible use of the information collected.

The crew histories should cover their overall experience, their activities, especially during the 72 hours prior to the occurrence, and behavior during the events leading up to the occurrence.

7.3 Flight Planning

A flight plan may have been prepared and filed with air traffic services. This will provide the Investigator with data such as the route, cruising altitudes and timings. It may also provide fuel load and fuel consumption etc. that may need to be examined in detail and correlated to the actual flight path. In the case of occurrences involving navigation factors or fuel consumption problems, it may be necessary to check flight plans and navigation logs to ensure that the data from which the flight plans were derived relevant to the particular circumstances of the intended flight, such as weather, aircraft type and model, cruising altitude etc.

In the case of light aircraft operated on private and training flights, it will be useful to ascertain the crew's intentions regarding the flight and any maneuvers planned.

7.4 Weight & Balance

A Weight & Balance sheet based on the planned flight may have been prepared. Commercial flights generally use a standard form for these calculations. In the case of light aircraft, a weight and balance sheet is rarely prepared.
Since weight, balance and load are critical factors that affect aircraft stability and control, considerable effort should be made to deduce the most probable weight of the aircraft at the time of occurrence, having regard to the flight time since take-off. Elevator trim settings may give a clue to the center of gravity at the time of occurrence.

7.5 Weather

Weather conditions at the time of occurrence may be obtained from actual observations or by a post-flight analysis requested from the Department of Meteorology.

7.6 Air Traffic Services

Operations or Air Traffic specialist must be included to investigate these aspects of an occurrence. This person is responsible for establishing, recording, and verifying the accuracy of all information relevant to Air Traffic Services in connection with the flight.

These include the following:

a) Relevant AIPs
b) NOTAM
c) Aeronautical Information Circulars
d) Flight plan
e) R/T transcripts
f) Radar plots
g) ATS procedures
h) ATS software

The various functions exercised by Air Traffic Services such as ground movement control, area control, approach control and aerodrome control may enable an Investigator to trace the progress of the flight from the planning stage up to the occurrence.

Communications between aircraft and ATS are normally recorded in the ATS tape. Since the tapes are recycled, an immediate request must be made to ATS, if access to them is required.

7.7 Navigation

The navigation equipment carried in the aircraft should be checked against the aircraft records and the remains of the navigational equipment recovered from the wreckage.

The serviceability and performance of navigation aids, which may have been in use, should be checked. The adequacy of current maps and the currency of the charts used in the aircraft should be checked.

7.8 Aerodrome Facilities

The status of aerodrome facilities used by the aircraft may have to be examined and verified.

7.9 Compliance with Instructions

A necessary part of the operational investigation is to establish whether particular directives were complied with. The directives should also be examined to distinguish what material has mandatory effect and what is advisory. The directives may have many different forms including the following:

1) Flight Manual
2) Operations Manual
3) NOTAM
4) Aeronautical Information Publications
5) Aeronautical Information Circulars
6) Aircraft Manufacture's Notices
7) Airworthiness Directives
8) Maintenance Control Manuals
9) Aviation Safety Notices
10) Maintenance systems

7.10 Final Flight Path

The reconstruction of the accident path necessitates close cooperation between the various groups or individuals involved in the investigation. If a separate team has been set up for Operation Investigation, this becomes its primary concern.

The intention should be to build up a complete picture of the final events as they occurred, in proper sequence, and to evaluate their interrelationships. The period of time to be covered will depend on the circumstances. Generally, the period should commence when the flight departs from safe (normal) operation and should terminate when the inevitability of the accident is indisputably apparent. This may or may not always be the point of impact – for example, in the case of an in-flight break-up.

CHAPTER – 8

FLIGHT RECORDERS/ ATS RECORDING

8. Flight Recorders/ATS Recording

8.1 General

The term 'Flight Recorders' encompasses three separate and distinct types of airborne recorders:

1) The Flight Data Recorder (FDR),
2) The Cockpit Voice Recorder (CVR)
3) The Quick Access Recorder (QAR).

Because of the sophisticated and expensive replay equipment required for analyzing recorded information, the Authority will seek assistance of the services of Manufacturer or Manufacturer's recommended facility if this information is necessary for an investigation.

As Sri Lanka doesnot have adequate facilities to read out the flight recorders, the Authority as the State conducting the investigation, will use the facilities made available to it by other States, giving consideration to the following:

a) the capabilities of the read-out facility;

b) the timeliness of the read-out; and

c) the location of the read-out facility.

The Authority will also arrange timely read-out of the flight recorders and the analysis of the data contained therein and recovery and handling of recorders, including damaged recorders and recorders recovered from water. For an expeditious recovery and handling of recorders including damaged recorders and recorders recovered from water by seeking assistance as applicable through the services of Police and other defence services such as Army and Navy. To this effect the Authority will issue necessary correspondence to these State agencies for expeditious recovery of the recorders for the purpose of investigation.

Procedures for handling of recorders has laid down in paragraph 8.4 below.

8.2 Recorder Types

8.2.1 Flight Data Recorder

The FDR, often referred to as the 'flight recorder', or Digital Flight Data Recorder (DFDR), is a system for recording the values of defined basic flight parameters in relation to a time base. The number of parameters recorded varies from aircraft type to aircraft type. The parameters recorded for a particular aircraft can be obtained from the operator. The digital recorders in use in the majority of aircraft have a limited recording cycle of 25 (operating) hours. If they are required for investigation, prompt action is required to ensure their removal from the aircraft.

Although FDRs are built to withstand rough handling, keep them away from any radiation (radar source) or strong magnetic fields.

8.2.2 Cockpit Voice Recorder

The CVR is a system for recording crew conversations and ambient noises in the cockpit, via a multi-directional microphone, the cockpit intercommunications system, the Public Address system, and radio (R/T) communications.

8.2.3 Quick Access Recorder

The QAR, or Flight Data Acquisition Unit, is a recorder installed in some aircraft, which uses the same information sources as the impact-protected DFDR (required by legislation). The difference, however, is that the operator is able to program this recorder to obtain higher resolution information for their own monitoring purposes.

8.3 ATS Recordings

The Authority shall ensure that in the event of an accident or serious incident, all air traffic services communication and radar data recordings and documents associated with the flight are secured and placed in safe keeping. Since as a part of International requirements to the implementation of the SARPs, all State Organization are required to ensure security and safe keeping of the ATS communication and radar data recordings. The Authority will ensure its access for the purpose of investigation, by providing necessary instructions to continue the security and safe keeping of the data.

Communications with Air Traffic Services are normally recorded and may be made available provided the tapes are requested before they are recycled through the system. If an opportunity to listen to a communications tape is made available, the Investigator should not only listen to any spoken words but also listen to background noises.

Other sources of communications evidence should not be overlooked although some may not be recorded. Other aircraft on the frequency and ground stations monitoring it may be useful.

Continuous recordings are made of communications on ATS frequencies as well as radar data. These tapes are re-used after a period.

The Authority has established the choice of the readout facility and the participation of the State of Design/Manufacture and the State of the Operator in the flight recorder readout analysis activities, which can be found in Appendix 1.

8.4 Procedures for handling Recorders

The FDR and the CVR must be handled in accordance with the following instructions.

CAUTION: UNDER NO CONDITIONS SHOULD ANY ATTEMPT BE MADE TO REMOVE OR TO PLAY A TAPE FROM AN FDR OR CVR IN THE FIELD. THE PATE COULD BE ERASED OR DAMAGED.

Protect the recorder from strong magnetic fields. It is important to remember that an X- ray transmitter at an airport security station may damage the data. If a recorder, tape or solid state memory unit is mailed, please mark the package "SENSITIVE FLIGHT RECORDING WITH CRITICAL DATA. DO NOT EXPOSE TO X- RAY RADIATION OR MAGNETIC FIELDS".

Do not open the recorder and do not allow anyone to remove the tapes or solid state memory unit under any circumstances.

If the recorder is dry and undamaged, use a shipping container obtained from the operator involved in the accident or incident, if possible. Otherwise package it carefully for shipment, unless it is to be hand-carried; it is not necessary to package an undamaged recorded for hand-carriage.

If the case is broken, do not remove the tape or solid state memory unit from the device. Wrap the entire recorder and its contents in polyethylene or similar material or heavy paper before packaging for shipment.

If the tape reels or solid state memory boards are separated from the unit, wrap them in polyethylene or paper before applying sealing tape. Never apply sealing tape directly to the recording medium. Do not remove the recording medium from the reels or enclosure.

If the recording is a tape and it is found separated from the recorded, try not to wrinkle or cease it. Carefully wrap it on a spool or cardboard tube or something similar. Wrap this in polyethylene or paper and pack it carefully. Enclose all fragments of tape, no matter how small. Never stuff the tape randomly into a box or container. Data are easily degraded; creases and wrinkles can cause electronic noise and permanent data loss.

If the recorder if found in water, do not attempt to dry it. Observe the following instructions;

Rinse it in fresh water, preferably distilled, then arrange to ship the recorder immersed in water to the lab in a watertight container. Make sure the recorder stays immersed in water until it arrives at the laboratory. Pack it very securely. If the recording medium is tape, it must not be allowed to dry out under any circumstances. (See Chapter 6.12)

8.5 Underwater recovery techniques

Flight data recorders and cockpit voice recorders must have an approved device to assist in locating them under water (underwater locator beacon or ULB's). These devices are ultrasonic beacons that operate at 37.5 khz. They are cylindrical in shape and are usually mounted on the face of recorder.

ULB receiver kits are available from the manufacturer. The ULB is supposed to operate for 30 days. However, searchers should be keenly aware that operation for a full 30 days is not assured. There are several circumstances that may adversely affect operating life. Because locator beacon battery operating time is limited and because flight recorders containing vital accident data deteriorate in a water environment, they should be given a very high priority in the recovery operation.

8.6 Obtaining Readouts for FDR's and CVR's

It is very important to secure these recorders as soon as possible after an accident or incident and deliver them intact to laboratory. So that the laboratory may obtain the best possible recovery of the relevant data in a controlled atmosphere using an experienced staff.

The following information will be needed when requesting FDR and CVR readouts.

a) type and condition of recorders

b) Circumstances of the accident or incident

c) Arrangements for method of shipping

For flight data recorders, the following information is required to facilitate the data readout;

a) Local altimeter setting at time of occurrence

b) Elevation at accident/incident site

c) Accident runway, if applicable

d) location of previous takeoff, runway used and field elevation

e) Local altimeter setting at time of takeoff

f) flight number

g) Coordinated Universal Time of departure

h) Coordinated Universal Time of accident

i) A flight itinerary, if the recorder is not pulled immediately after the event

CHAPTER 9-

SPECIALIZED EXAMINATIONS AND TESTING

9. Specialized Examinations and Testing

9.1 General

The Authority will take measures for examination and testing of aircraft parts or components in a thorough manner. To this effect the Authority will follow the guidelines provided in Chapter 8, 10, 11 & 12 of this Manual for examination/testing of aircraft parts, engines and systems. The Authority will also ensure that in conduct of the aforementioned examinations or tests will have adequate supervision.

Specialized examinations may include component testing, examination using scanning electron microscope, chemical analysis, systems testing, flight testing (with an actual aircraft or in a simulator), complete or partial reconstruction of the aircraft or specific systems.

Laboratory examination and testing generally entails the use of specialized equipment not available in the fields and often beyond the capability of an aircraft maintenance facility. Consideration should be given to using the component manufacturer's facilities where specialized equipment and trained personnel are readily available.

For flight testing in a simulator, the aircraft manufacturer's facilities may have to be considered.

Laboratory testing should not be limited to standards tests. In addition to testing for compliance with appropriate specifications, it is sometimes necessary to determine the actual properties of the specimen (such as metal, material, fuel and oil).

The Chief Investigator should assign an investigator to supervise the specialized examination and testing, or delegate the supervision to a suitable person (e.g. an accredited representative or one of his advisors, or an official of a foreign accident investigation authority).

Where necessary, non-disclosure agreement with the examination or testing service providers should be worked out.

9.2 Documentation

A test plan should be formulated for the test to be conducted. As far as possible, the test plan should identify the following:

1. Item/system to be tested
2. Objective of the test
3. Test venues
4. Test methods
5. Test equipment
6. Test conditions
7. Test procedures
8. Test schedule
9. Responsibilities of the various parties
10. Data to be collected from the test

Adequate records should be kept and reports compiled for the examination or testing. Photographs should be taken. Videotaping of the examination process should also be considered.

9.3 Practical Arrangement

9.3.1 General

When choosing a system and components for specialized examination and testing, it is desirable to include as many components of the system as practicable, e.g. wiring harnesses, relays, control valves and regulators. Tests conducted on a single component will reveal information about the operation of that particular unit only, whereas the problem may actually have been in one of the related components. The most valid test results will be obtained by using as many of the original system component as possible.

9.3.2 Information pertinent to failed parts or components to be examined

Each component should be tagged with its name, part number, serial number and the accident identifier. The investigators should maintain a listing, descriptive notes and photographs of all components which are to be tested. The components themselves should be kept in protective storage until ready for shipping.

When investigators forward failed parts or components for laboratory testing, they should provide as much information as possible relative to the circumstances contributing to the failure of such parts or components, including a detailed history of the parts or components and their own suspicions, if any. The information in respect of a part or component may include the following:

a. The date it was installed on the aircraft.
b. The total number of service hours.
c. The total number of hours since last overhaul or inspection.
d. Previous difficulties reported.
e. Any other pertinent data that might shed light on how and why the part or component failed.
f. Relevant manuals

The information provided by the investigator is intended only as a guideline to the specialist carrying out the examinations who should, nevertheless, explore all relevant aspects.

9.3.3 Transporting of parts or components

Components should be packed to minimize damage during transport. Particular care should be taken to ensure that fracture surfaces are protected by appropriate packing material so that they are not damaged by mating surfaces coming into contact with each other or with other parts.

Whenever possible, power plants should be shipped in their special stands and containers. Other heavy components, such as flight control power units, stabilizer screw jack assemblies and actuators, should be packed in protective wrapping and placed in separate wooden containers. Blocks or bracing should be installed inside the containers to prevent any movement of the component during transport.

Smaller and lighter components may be shipped in the same manner with more than one to a box but in a manner which will prevent them from coming into contact with one another.

Very light units may be packaged in heavy corrugated pasteboard cartons with sufficient packing material to prevent damage from mishandling during transport.

The investigators should label all boxes and cartons appropriately and should make an inventory list for each container.

9.4 Notes and test results

Notes concerning the specialized examinations should be kept by the facility personnel, and the results should be recorded on the standard forms used by the facility for such work. The investigator supervising the work should also take notes.

Prior to conducting the examinations, the supervising investigator should brief the investigators and the facility personnel involved on the type and extent of the examinations and tests to be carried out and review with them the test procedures to ensure their adequacy.

Any discrepancies found during testing should be photographed and documented with an explanation as to their bearing on the operation of the system or component. It should be kept in mind that the tolerances called for in the test procedures may only apply to new or overhauled components and that components which have been in service for some time may have acceptable limits outside these tolerances. If the nature of the discrepancy warrants, a component should be disassembled following completion of the tests to ascertain the cause of failure. Photographs should be taken of the parts prior to and during disassembly, and the findings should be documented.

Following completion of the examinations, the supervising investigator should review and discuss the results with the investigators and the facility personnel. When there is agreement that the data gathered present a true and factual picture of the component's condition and capabilities, the notes and test results should be reproduced to serve as a record of the examination and testing of the system or component.

CHAPTER – 10

AIRCRAFT STRUCTURE INVESTIGATION

10. Aircraft Structure Investigation

10.1 General

The aircraft structure investigation concentrates on the airframe, including primary and secondary structure, lift and control surfaces.

When investigating an accident caused by structural failure of the airframe or system, study the wreckage and evaluate separated components and fractured surfaces. Failure of the airframe structure, fittings, attachments, and other components are sometimes obscured by the ensuing accident. However, these may have been the primary cause of in-flight disintegration or ground impact in an out-of-control situation.

Knowledge of the history of the flight, prevailing weather conditions, aircraft behaviour, and the probable type of air loads sustained during flight maneuvers will assist in determining failure areas.

10.2 Reconstruction of Wreckage

Reconstruction is employed for specific components such as a wing panel, tail surface or control system, although in some instances it has been necessary to reconstruct almost all major components.

First phase of the reconstruction process is to identify the various pieces and arrange them in their relative positions. Second phase is to examine in detail the damage to each piece, and establish the relationship of this damage to the damage on adjacent or associated pieces.

10.2.1 Preliminaries

Before commencing reconstruction work, complete the procedures as follows:
Photograph the entire site and wreckage
Complete the wreckage distribution chart (See paragraph 6.7)
Inspect and make notes on the manner in which the various pieces were first found, by walking around the site.

10.2.2 Identification of Pieces

The difficulty in reconstructing a component, such as a wing, lies in identifying the various pieces of wreckage. If the wing has broken up into a few large pieces, the task is relatively simple. If, on the other hand, the wing has broken into a number of small pieces as a result of high impact speed, reconstruction can be extremely difficult.

The most positive means of identification are:

1. Part numbers, which are stamped on most aircraft parts, which can be checked against the aircraft parts catalogue
2. Colouring (either paint or primer)
3. Type of material and construction

4. External markings
5. Rivet or screw size and spacing.

10.2.3 Reconstruction On Site

Collect parts from the suspected area, identify them and then arrange them on the ground in their relative positions.
Lay out major components such as the wing, tail and fuselage in plan form for ease of later examination.

Note: however, that if the suspected area is at the junction of the major components, these areas are sometimes reconstructed separately.

For ease of examination, lay out individual cable runs with their associated bell cranks, idlers and quadrants separately. If significant markings are found on any of these latter items, corresponding markings must be sought out in the relative positions in the wing, fuselage etc.

10.2.4 Reconstruction Off Site

In cases where, due to prevailing conditions, reconstruction is not feasible at the accident site, it may be decided to transport wreckage to another location. This decision is based on:

1. The type of accident
2. The facts developed up to that time
3. The importance and validity of the type of information that could be developed by reconstruction under more favourable conditions.

Since additional damage may be caused to wreckage during transportation, ensure that a complete set of notes on all significant smears, scores, tears etc is made prior to moving wreckage.

Prior to transportation, tag, identify and key all major pieces to the wreckage distribution chart. Keep disassembly to the absolute minimum.

If bolted assemblies must be disconnected, make a record of the sequence of the various parts. In cases where control cables have to be cut, take care to identify and tag all cuts.

If these precautions are not followed, valuable information may be lost.

10.3 Examination of the Aircraft Structure

10.3.1 Airframe

The first priority during the preliminary examination at the accident site is to determine if a structural failure occurred before impact. To do this, the first step is to separate impact damage from in-flight structural failure damage.

Valuable information can be gathered from a study of the various smears and scores found on different parts of the wreckage. Where possible, study these before the

wreckage is disturbed, since movement of the wreckage may destroy clues or create misleading ones.

10.3.2 Mainplanes, Fuselage and Empennage

One of the primary aims when examining the structure is to determine whether there is evidence that any part of the structure was not in its correct relative position at the time of impact.

Components such as cables, pulleys, hinges and tab mechanisms must be examined to determine whether the failure of any of these items was caused by wear, inadequate maintenance or impact.

10.3.3 Undercarriage

Examine the selector, link mechanism, up and down locks and position of the operating jacks or actuating cylinders to ascertain whether the undercarriage was up or down. If the gear had failed or separated, note the direction of the force that caused the failure or separation.

10.3.4 Flight Controls

Trace and carefully inspect all controls, both manually operated and power operated, to confirm that all component parts are accounted for.

Note tail plane incidence, tab and flap settings, and compare these with their respective setting indicators in the cockpit.

Check all operating levers and the attachment of control rods or cables to these levers to determine whether they were properly assembled, adequately lubricated and had not jammed.

Examine spoilers, where installed, to determine whether they were extended at the time of impact and whether any failure occurred in their mountings.

CHAPTER – 11

POWER PLANT INVESTIGATION

11. Power Plant Investigation

11.1 General

The failure or malfunction of one or more power plants is often the cause of an occurrence. For this reason it is essential that a careful examination of the power plants and their associated components be made to determine whether they are involved as a causal or predominant factor in the particular occurrence under investigation.

The purpose of power plant investigation and analysis is to determine:

a) The condition of the engine at the time of impact

b) The engine power or thrust at the time of impact or failure

c) The sequence of failure and cause of any engine malfunction or failure.

The power plant investigation should include a carefully detailed documentation of all evidence, to include:

a) A comprehensive survey of the impact site and extent of wreckage distribution giving references to the information recorded during the initial site inspection. Any additional details that the power plant investigation turns up should be added as overlays to the original site plan and wreckage-distribution chart, and later copied to the original.

b) An inventory of the engine(s) to ensure that all engine parts, components, and accessories are accounted for and aligned with each respective engine.

11.2 Guidelines to examine various engine components and systems

Check the original Site Plan and Wreckage Distribution Chart for the geographical location and scatter pattern of all engine, parts and accessories, and correct where necessary.

Note the identity and location of any part that may be moved (or removed from the crash site for any reason), altered, or affected by rescue, salvage, or weather conditions.

Few examples are:

a) Evidence of case penetration
b) Bum-through damage
c) Ruptured fuel or oil lines
d) Loose fittings
e) Any items that are suspected to be of foreign origin.

Collect any fuel, oil, and hydraulic fluid samples to minimize post-impact contamination or loss of the limited quantities that may remain.

Note: An immediate investigation should be made of the fuel servicing and storage facilities at the last refueling point.

Examine the fuel system, including:

a) All filters, screens and pumps
b) Check tanks and cells
c) Fuel lines and valves.

Examine propeller(s) for:

a) Impact damage and overall condition
b) Evaluate broken blades to determine the reason for failure - that is, impact, over speed, malfunction, or fatigue breakage.

Blade angle is a function of power being delivered by the engine. Therefore, blade angle may be one method that can be used to establish engine power or thrust. As a rule, propellers under high power at impact can be expected to bend or curl forward at the tips, while under low power, the blades should curl rearward at the tips. Wind milling or stationary blades should be bent rearward.

Record the condition in which the engine or component was found. Original condition should be indexed, marking the position of any control, valve, actuator, lever etc. Photographs of the original setting or position should be taken.

Where possible take statements from witnesses, noting any reference to engine sounds and aircraft performance.

CHAPTER – 12

AIRCRAFT SYSTEMS INVESTIGATION

12. Aircraft Systems Investigation

12.1 General

Systems Investigation covers investigating and reporting on the following areas.

a) Hydraulics
b) Electrics and electro-pneumatics
c) Vacuum
d) Pressurization and air conditioning
e) Ice and rain protection
f) Instruments
g) Air data computer
h) Flight director
i) Stall warning
j) Radio and navigation systems
k) Autopilot
l) Fire detection system
m) Oxygen system

There is inevitably a degree of overlap with systems covered under chapters relating to structures and power plants.

The technical information necessary to enable a detailed analysis of individual aircraft systems/components should be obtained from AMM or CMM published by the manufacturer

Each aircraft system must be accorded the same degree of importance regardless of the circumstances of the occurrence. There is no way to determine adequately the relationship of any system to the general area without a thorough examination.

The examination of the system will generally involve more than examination of components in-situ. It can involve the functional testing, under laboratory conditions, of an individual component, or of the complete system using off-the-shelf duplicates of the component or system.

Computer software fitted in some modem aircraft may be recovered and operated in a simulator to determine its role in the occurrence.

12.2 Guidelines to examine Aircraft Systems

Following guidelines may be followed investigating aircraft systems.

a) Obtain from the aircraft manufacturer or from the operator, appropriate detailed schematic diagrams or working drawings to determine what components are included in each system.

b) The diagrams will also be helpful in analyzing the effect of a malfunctioning component on the rest of the system.

c) Make every effort to account for all the components.

d) Each system can be broken down into different areas as shown below to ease the work need to perform.
   I. Supply
   II. Pressure
   III. Control
   IV. Protection
   V. Distribution
   VI. Application

Documentation of components should include:

I. Nomenclature
II. Component manufacturer's name
III. Part number
IV. Serial number
V. Specification number (where provided).

Some components having the same part number may be used in various parts of the same system, especially in the hydraulic and pneumatic systems. It may be necessary to obtain listings showing actual location of these components in the system by serial number.

The positions of switches and controls in the cockpit, together with the found position of any moving parts will have been photographed during the initial stages of the investigation. Obtain copies of these photographs and crosscheck the readings on all available instruments. If the original photographs are not ready, take an additional set of photographs to supplement your documentation.

CHAPTER 13-

FRACTURE INVESTIGATION

13. Fracture Investigation

13.1 General

Listed below are ten general areas of inquiry in any fracture investigation. Although these areas could be interrelated, the sequence in which these areas are considered is not important.

13.2 Surface of fracture

- What is the fracture mode? For example, shear, cleavage, intergranular, fatigue.
- Are the origins of the fracture visible? Are they located at the surface or below the surface?
- How many fracture origins are there? The answer concerns the relative magnitude of the actual stress to the actual strength of the part at the location of failure.
- Is there evidence of corrosion, paint or some other foreign material on the fracture surface? Possibility of a pre-existing crack prior to the fracture?
- What is the relation of the fracture direction to the direction of the stress that caused the fracture and to the normal or expected fracture direction?
- Was the stress unidirectional or was it reversed in direction? Is the assumption regarding the operation of the mechanism correct?

13.3 Surface of part

- What is the contact pattern on the surface of the part and on the surface of the mating parts?
- Has the surface of the part been deformed by loading during service or by damage after fracture?
- Is there any evidence of damage on the surface of the part from manufacture, assembly, repair or service? For example, tool marks, grinding damage, poor welding or plating, arc strikes, corrosion, wear, pitting fatigue, fretting.

13.4 Geometry and design

- Are there any stress concentration related to the fracture?
- Is the part intended to be relatively rigid, or is it intended to be flexible?
- Does the part have a basically sound design?
- How does the part and its assembly work?
- Is the part dimensionally correct?

13.5 Manufacturing and processing

- Are there internal discontinuities or stress concentrations that could cause a problem?
- Wrought metal - Does it contain serious seams, inclusions, or forging problems such as end grain, laps or other discontinuities that could have an effect on performance?
- Casting - Does it contain shrinkage cavities, cold shuts, gas porosity, or other discontinuities, particularly near the surface of the part?
- Weld - Was the fracture through the weld itself or through the heat-affected zone in the parent metal adjacent to the weld? If through the weld, were gas porosity,

undercutting, under-bead cracking, lack of penetration, or other problems a factor? If through the heat-affected zone adjacent to the weld, how were the properties of the parent metal affected by the heat of the welding?

- Heat treatment - Was the treatment properly performed? Evidence of inadequate heat treatment like too shallow or too deep a case depth, excessive decarburization, very coarse grain size, over tempering, under tempering, and improper microstructure?

13.6 Properties of the material

- Are the mechanical properties of the metal within specified range?
- Are the specifications proper for the application?
- Are the physical properties of the metal proper for the application? For example, coefficient of thermal expansion (for close-fitting parts), density, melting point, thermal and electrical conductivity.

13.7 Adjacent parts

- What was the influence of adjacent parts on the failed part? Possibility that the fractured part may not be the primary or original failure?
- Were fasteners tight?

13.8 Assembly

- Is there evidence of misalignment of the assembly?
- Is there evidence of inaccurate machining, forming, or accumulation of tolerances?
- Did the assembly deflect excessively under stress?

13.9 Service conditions

- Were there any unusual occurrences such as strange noises, smells, fumes, or other happenings that could help explain the problem?
- Is there evidence that the mechanism was over speeded or overloaded?
- Is there evidence that the mechanism was abused during service or used under conditions for which it was not intended?
- Did the mechanism or structure receive normal maintenance with the recommended materials (e.g. lubricants)?
- What is the general condition of the mechanism?

13.10 Environmental reactions

- What chemical reactions could have taken place with the part during its history (manufacturing, shipping, storage, assembly, maintenance and service)? For example, exposure to hydrogen (during acid pickling, electroplating, etc.), exposure to corrosive environment.
- To what thermal conditions has the part been subjected during its existence? For example, abnormally high temperature, localised electrical arcing, grinding damage, adhesive wear, frictional heat.

CHAPTER – 14

MAINTENANCE INVESTIGATION

14. Maintenance Investigation

14.1 General

The purpose of the maintenance investigation is to review the maintenance history of the aircraft in order to determine:

Information that could have some bearing on the occurrence, or which could point to a particular area of significance for regulatory investigation and action
Whether the aircraft has been maintained in accordance with the specified standards
Whether, having regard to information gained during the investigation, the specified standards are satisfactory.

14.2 Securing Aircraft and Maintenance Documentation

Following notification of the commencement of a regulatory investigation of an aircraft accident/ incident or occurrence, secure the related documents by applying to the operator to hand over the following:

- Aircraft log books
- A copy of the current, and if possible, expired Maintenance Releases
- Maintenance work-packages and any other appropriate certification documentation
- Approved Maintenance System, or the applicable accepted maintenance schedule for the aircraft.

14.2.1 Aircraft Log Books and Maintenance Release

Inspect the aircraft log books and both current and expired maintenance releases to ascertain the following information:

a. The operating history of the airframe, engines, and associated components; the hours flown, cycles, landings, and, where appropriate, the status of any life-limited components

b. The history of accidents, incidents, defects and irregular or abnormal operations which have been reported or which become known during the investigation and any subsequent rectification or other action taken

c. Whether all required maintenance, including applicable Airworthiness Directives, have been carried out

d. That all modifications incorporated have been accomplished in accordance with approved data

e. Whether the aircraft history has been entered in the log books in accordance with the applicable logbook instructions.

14.2.2 Maintenance Documentation

In addition to an inspection of the aircraft documentation, an examination of the maintenance organization's work packages and any other certification documentation relating to maintenance should be undertaken to determine:

a. That all maintenance and modifications have been carried out on the aircraft by authorized or approved persons

b. That all the maintenance carried out was certified-for in accordance with applicable legislation by authorized or approved persons

c. If the maintenance system has been followed correctly

d. Note down recordable discrepancies or omissions.

CHAPTER – 15

HUMAN FACTORS INVESTIGATION

15. Human Factors Investigation

15.1 Objective

The prime object of the Human Factors investigation is to obtain evidence through an examination, if any such evidence exists, of abnormal behaviors or fatigue of the operating crew, the cabin attendants and passengers, air traffic controllers, maintenance personnel and other ground staff, which may have caused or contributed to the occurrence. Specifically for the accidents or incidents which are related to cabin safety matters, the necessary guidelines which could be followed by investigators are mentioned in the Chapter 16 to this Manual.

15.2 Investigation

In a fatal accident it is necessary that medical specialist in this field make every effort to obtain any possible Human Factor evidences. In a non-fatal occurrence, however, specialist medical assistance may also be of value in analysing the evidence to provide a medical opinion that could:

a. Assist in the reconstruction of the occurrence
b. Assists in related human engineering, survival aspects, etc.

Human performance investigation centers on:

- Behavioural
- Medical
- Operational
- Task
- Equipment design
- Environmental
- Organizational culture

Human factors involved in the occurrence should be fully explored during the investigation. These aspects can then be discussed further with the appropriate specialist if necessary.

The focus on human performance can be directed toward any individual involved in the occurrence, but usually includes cockpit crewmembers, air traffic controllers or maintenance personnel. It may also be directed at larger system issues, such as company policy, training and design. Chapter 17, Organizational Factors Investigation covers this latter area. A checklist of human performance question is provided in paragraph 15.3. This checklist is by no means exhaustive.

15.2.1 Behavioural

72-hour History. A critical part of the human performance investigation is to trace the activities for at least 72 hours prior to the occurrence, of all individuals of importance to the occurrence, in order to determine:

1. Sleeping history
2. Eating history

3. Drinking history
4. Purpose of the flight
5. Preparation for the flight
6. Unusual activities or events
7. Mood of the crew
8. Interaction between the crew
9. Any other information that could prove critical to understanding the occurrence

Information related to the 72-hour history is considered 'perishable' since memory tends to become less accurate and less detailed over time. Persons who should be interviewed are those who have had close contact with the personnel involved during that period. Even evidence from these witnesses to the effect that everything seemed routine can be of considerable value to the investigation.

15.2.2 Medical

The medical records of the personnel involved may indicate whether any condition was known to exist which might have precluded the successful completion of any task demanded of them under the prevailing circumstances. Aviation Medicine may, on request, provide this information.

Particular attention should be given to any condition likely to have led to incapacitation in-flight or to deterioration in fitness and performance. Toxicological factors must also be considered, but to be conclusive, samples, must be obtained from the person as soon as possible after the event. Other specific areas, which should be considered, are sensory acuity, drug/alcohol ingestion and fatigue.

In the event actions and behaviour of the crew are required to be examined further, it is imperative that the crew medical examination is conducted immediately after the accident. The crew's medical examination should be conducted at a CAASL approved facility or hospital and must include blood and urine samples testing for presence of alcohol or any other stimulants which may have an effect on crew's faculties.

The Manual of Civil Aviation Medicine (Doc 8984), referenced in paragraph 1.4, contains guidance on medical examinations.

15.2.3 Operational

This topic is covered in Chapter 7. Specific areas relative to human performance are training, operating procedures, experience, familiarity, habit patterns, and company policy. Records should be obtained from the training school and/or company.

15.2.4 Task

Excessive workload at the time of the occurrence is a common cause of human failure. Although this may be related to training and competence, other factors such as task information, task components, task-time relationship and workload require investigation.

15.2.5 Equipment Design

Equipment design may apply to an aircraft cockpit, maintenance workshop or air traffic control console. The aspects that should be investigated are the human/equipment interface, display or instrument panel design, control design and even seat design and configuration.

15.2.6 Environmental

Environmental factors are often beyond the control of the individual involved. Aspects such as excessive noise/vibration/motion, extraneous or insufficient illumination and weather producing reduced visibility or turbulence, warrant examination.

15.3 Checklist of Human Performance Questions

This short checklist (see below) may be used selectively to interview individual witnesses. Additional questions often are suggested by the details of the specific occurrence. By listening closely to witness descriptions, and by asking simple questions to reach a "common-sense' understanding of the occurrence, the Investigator can often generate additional areas for greater human performance understanding.

Human performance interviews normally begin with very general questions that allow witnesses to describe what they know at length and without influence from the interviewer. As the interview progresses, more pointed questions are normally asked to focus the witness on topics that have not been fully addressed.

15.4 Human Performance Questions

a. Activities in the Last 72 Hours

- When was the last time you (pilot, Controller, LAME) worked before the occurrence?
- When did you work during the previous three days? What were your other activities during this period?
- When did you go to sleep the previous night (or previous three nights)? When did you wake up? Did you feel well rested?
- What is your normal work schedule? When are your days off, holidays? When was your last holiday?
- Describe your activities on the day of the occurrence up until it occurred. When/what did you eat? Any rest breaks?
- Was this an unusual schedule?
- How is your level of experience with this particular type of aircraft?

b. Occurrence History

- Have you been involved in any previous occurrences?
- Have you been disciplined for your performance/Have you been commended for your performance?

c. Life Changes in the Past Year

- Have you had major changes in your health (good or bad)
- Have there been major changes in your financial situation (good or bad)
- Have there been major changes in your personal life (for example, separation, divorce, birth, death, etc.)

d. Medical/drugs

- How is your health?
- What is the name of your personal doctor?
- How is your vision? Do you wear corrective lenses? Name of Eye doctor? Prescription?
- How is your hearing? Do you wear a hearing aid? Name of doctor?
- Do you take prescription medicine? What, how often? When was the last time you took it before the occurrence?
- Do you drink alcohol? When/what was your last drink before the occurrence? How many drinks did you have?
- Do you smoke tobacco? Last use before the occurrence?
- Do you use illicit drugs?
- In the 72 hours before the occurrence did you take any drugs, prescription or non-prescription that might have affected your performance?

a. Workload

- How was your workload on the day of the occurrence?
- Was your workload affected by the weather?

b. Environmental

- Any problems with the aircraft/vehicle?
- Any problem with noise, vibration, temperature?
- Any problems with visibility (instruments, signals, etc.)?

c. Mood

- What was the mood of the other crewmembers before the occurrence?
- During the occurrence? After the occurrence?
- Had the crewmembers flown together before?
- Did the crewmembers get along personally? Did they see each other socially?
- What did they talk about?
- How did the pilots get along with passengers/flight attendants?

d. Background – Other Sources

- What was the subject like personally?
- Was the subject married? Any children? What were the subject's living arrangements?
- What level of education did the subject complete?

- How did the pilot get interested in aviation? Where did the pilot train? What were his/her previous jobs?
- What did the pilot like about flying? About this job? About the aircraft?
- How familiar was the pilot with the route? With the airport?
- What was the deadline for completing the trip?
- What were the pilot's greatest strengths as a pilot? Were there areas in which the pilot could have improved?
- Did anyone ever complain about flying with this pilot?
- Did the pilot ever complain about the company or equipment?
- Did the pilot experience any emergency, incident or problem during a previous flight? What happened?
- Did the pilot receive training in Crew Resource Management?

Interviewing techniques for investigator has been given in Appendix 11 to this Manual.

CHAPTER 16-

CABIN SAFETY INVESTIGATION

16. Cabin Safety Investigation

16.1 General

To assist investigators in investigating cabin safety related accidents and incidents, the following guidelines could be used.

- Checklist for documenting cabin condition
- Checklist for information to be gathered from cabin crew
- Checklist for information to be gathered from passengers

The information gathered may be used in conjunction with the information gathered by other investigation groups (medical, human factors and operations) to determine the cause of the injuries and the survival aspects of the accidents and incidents, as well as to develop related recommendations.

16.2 Checklist for documenting Cabin Condition

16.2.1 General information

- Weather conditions
- Engineering drawing of interior that depicts seat layout, seat pitch galleys, lavatories and emergency exit(s)

16.2.2 Damage to cabin interior

- Document overall condition of cabin (e.g. intact, broken apart, fire damaged).
- Location of debris such as galley equipment, seats, luggage and areas with indication of fire or smoke damage.
- Use photographs to supplement written report

16.2.3 Cabin crew and passenger seats

- Manufacturer, model number, serial number, date of manufacture and rated loads.
- Evidence of impact.
- Description of the integrity of tie-downs and rails.
- Measurement and description of the deformation/separation of seats and tie-downs.
- Location of child restraint system (CRS), seat-loaded cargo, stretchers and bassinets.

16.2.4 Seat belts and shoulder harnesses

- Seat belt manufacturer, model number, serial number, date of manufacture and rated loads.
- Condition of seat belts and seat belt extensions (e.g. damaged, detached, intact and cut).

16.2.5 Stowage compartments

- Describe damage to storage areas, such as overhead bins, closets and compartments.
- Condition of latching mechanisms for storage areas.

16.2.6 Carry-on luggage

- Location of carry-on luggage found in cabin (e.g. overhead bins, under seat storage, closets and piled near exits)

16.2.7 Communication

- Conduct functional check of the PA system.
- Conduct functional check of the interphone system.
- Describe the positions of switches for emergency evacuation alarm systems (cockpit and cabin).
- Describe the positions of switches for the emergency lighting systems (cockpit and cabin).
- Describe the content of the pre-departure safety briefing and how the information is conveyed to passengers (PA system, recording, or video demonstration).
- In what language(s) was the briefing conducted?
- Describe the airline's procedures for exit row briefing.

16.2.8 Exits

- Describe the location of all exits (cockpit and cabin). Were they open or closed?
- Describe the location of emergency exit hatches.
- Describe the deployment of ropes, tapes or inertia reels.
- Describe the damage to exit and surrounding fuselage.
- Describe the position of arm/disarm lever or girt bar.
- Describe the position of exit opening handle.
- Describe the condition of power-assist device (record pressure, if appropriate).
- Describe the assist space available at exit.
- Measure the height of the exit sills above the terrain if the aircraft has an unusual attitude.

16.2.9 Evacuation slides and/or slide/rafts

- Position of the device (deployed, stowed, inflated, deflated, removed from aircraft).
- Name of manufacturer, date of manufacture, model number, serial number, Technical Standard Order (TSO) number, and date of last overhaul.
- Describe any damage to the slide.

16.2.10 Emergency equipment

Using a cabin crew manual as a guide, document the location and condition of emergency equipment in the cabin:

- Flashlights
- Megaphones
- Fire extinguishers

- Protective breathing equipment (PBE)
- Crash axe/pry bar
- Portable oxygen bottles
- First aid kits
- Medical kits
- Defibrillator
- Emergency location transmitters (ELT)
- Protective gloves
- Smoke barriers
- Smoke detectors
- Lavatory waste bin automatic extinguishers
- Emergency lights
- Floor proximity lighting system

16.2.11 Accidents involving water contact

Document the condition and location of:

- Life rafts or slide/rafts
- Life vests
- ELT
- Water conditions at time of accident (wave height, swell height and temperature)
- Survival kits

16.3 Checklist of information to be gathered from cabin crew

16.3.1 General information

- Weather conditions
- List of cabin crew members
- Passenger manifest with names and seat assignments of occupants (including lap-held infants)
- Cabin crew member manual (used to determine emergency procedures, cabin layout and emergency equipment location)
- Cabin crew member training records (initial, transition and recurrent)
- Safety briefing card
- Engineering drawing of interior that depicts seat layout, seat pitch galleys, lavatories and emergency exit(s)

16.3.2 Cabin crew member

- Name, business address and phone number
- Gender, age, height and weight
- Operational experience on the accident aircraft type in hours or years
- Work category-cabin crew member, purser, lead crew member, etc.
- Number of different aircraft types/models that the cabin crew member is qualified on
- Medical history and medication taken at the time of the event
- Current medical condition and medication taken at time of the interview
- Experience as a cabin crew member (in years) with current carrier/previous carrier

- Flight and duty schedule 72 hours prior to the event
- Food and beverage consumed during the 24 hours period before the occurrence
- Sleep/wake cycle for the 7 day period before the occurrence
- Travelling time to airport
- Were you injured? Describe your injuries. When and how were you injured?

16.3.3 Pre-flight/in-flight activities

- Describe the pre-flight crew briefing. What was covered? Who are present? Who conducted the briefing?
- Describe any cabin system(s) that was unserviceable at the beginning of, or during the flight?
- Describe observations of, or interaction with, maintenance, ground service personnel and flight crew that may be pertinent to the investigation.
- Describe the location of passengers with special needs/children travelling alone.
- Describe the location of infant/child restraint system(s).
- Describe the location of passengers with disabilities.
- Describe the passenger safety briefing. Were passengers attentive to the briefing?
- Describe the amount and stowage of carry-on baggage.
- Describe your pre-departure cabin activities.
- Was alcohol served before/during the flight? If yes, approximately how many drinks did you serve?
- When did you prepare your emergency exit(s) for departure?
- Where were you seated for take-off and landing?
- Describe the type of seat restraint system used at your jump-seat.

16.3.4 Occurrence information

- Describe if and how you were informed of a problem. If briefed by the Captain, what information were you given? If briefed by another crew member, what information were you given?
- Describe your location during occurrence.
- Describe if and how the passengers were informed of a problem? What was their reaction?
- Describe the pre-occurrence preparations (i.e. type of warning, cabin preparation).
- Describe the occurrence.
- Describe the impact.
- Describe the emergency commands you used, if any.
- Describe the passenger reaction to your commands.
- Describe the passenger's brace positions.
- Describe your brace position.
- Describe the security of cabin furnishings in your area.
- Describe any difficulties you may have had with your seat/seatbelt/shoulder harness.
- Describe any safety or emergency equipment you used. Why and how did you use it? Was it effective?
- Describe your view of the cabin. If your view was obstructed, please explain.

16.3.5 Evacuation

- How did you decide to evacuate?
- Captain's order?
- Personal judgment?
- Evacuation alarm?
- PA announcement?
- Firefighter's order?
- Describe the evacuation.
- Which exit(s) did you open?
- What was your assigned exit(s)?
- If you did not open an exit, explain why.
- Did you have a direct view of your primary/secondary exits from your jump-seat?
- Did you assess the conditions? How?
- Were there any difficulties assessing outside conditions? Opening the exit? Deploying or inflating the evacuation slide? If yes, please describe
- Did the emergency lights operate? Which emergency lights did you observe?
- Describe the illumination inside/outside the aircraft.
- Describe passenger reactions during the evacuation (calm, panic, etc.).
- Did the passengers attempt to take carry-on baggage during the evacuation?
- Did you have passengers' assistance at your exit? How did the passengers assist?
- Describe any problems with the passengers during the evacuation.
- Describe any difficulties with passengers with special needs or children travelling alone.
- Approximately how long did the evacuation take? What is the estimate based on? (Note: Time estimates may be unreliable)
- Did you see other cabin crew members evacuate the aircraft? Which exits did they use?
- Did you take emergency equipment with you? Which equipment? How was it used?
- Describe the flight deck crew activities outside the aircraft.
- Describe the rescue/fire fighting activities.
- Were you injured? Describe your injuries and how they were sustained.
- Were you transported to a hospital or medical facility?
- Approximately how long did the rescue efforts take?
- Describe your clothing and its suitability for the evacuation.

16.3.6 Training

- Describe your initial and annual emergency/safety training.
- Did your training include basic instructions in aerodynamics and aircraft performance?
- When was your last evacuation drill? Describe the drill. How often is the drill conducted?
- When was your last door drill? Describe the drill. How often is the drill conducted?
- Describe your fire fighting training.
- Describe your initial and annual ditching training.
- Do you participate in a wet ditching drill? Describe the drill.

- Describe your practical training with respect to the use of emergency/safety equipment.
- Did you participate in crew resource management training with pilots or other members of your company? Explain.
- Did your training prepare you for what happened?

16.3.7 Turbulence

- Describe your company's crew communication procedures for turbulence.
- Describe the crew communication procedure used in this event.
- Were you warned before you experienced the turbulence? How?
- Was the seatbelt sign on? If yes, for how long?
- Were passengers seated when the seat belt sign was on?
- Were you seated at your cabin crew member assigned seat? If you were not seated, why not?
- Where were you when the turbulence occurred?
- What announcement was made regarding the turbulence? Were passengers instructed to remain seated? When were the announcements made?
- Were there problems with stowing equipment before or after the turbulence event?
- Were you injured? Describe your injuries. Were you able to assist others following the turbulence?
- Describe injuries that you observed in other crew members or passengers.

16.3.8 Smoke/Fire/Fumes

- When did you become aware of smoke fire, or fumes?
- Where did you first observe smoke or fire? Describe what you saw and/or smelled (colour, density and odor)
- Where were you when you first became aware of fumes?
- Did the conditions increase, decrease or change during the occurrence?
- Did you have difficulty breathing? Did you use PBE or other protection?
- Did you have problems communicating with other crew members or passengers? If yes, describe the problems
- Did you use fire-fighting equipment?

16.3.9 Ditching/Inadvertent water landing

- Were there any problem deploying, inflating or boarding the slide/rafts or life rafts?
- Did you move a slide/raft or life raft from one location to another? Describe any difficulties
- What type of personal flotation device did you use? From where did you obtain it?
- Did you have any problems obtaining it or using it?
- What personal flotation devices did passengers use?
- Did passengers have any problems obtaining or donning their life preservers? (adults/infants/children)
- Who commanded the lift raft or slide/raft that you boarded? Were there other crew members in that raft?
- Describe the rescue operation.
- Describe sea survival procedures that were used.

- Did you retrieve an ELT? If yes, from where? Was the ELT used?

16.3.10 Additional comments

- Based on your experience, can you suggest any improvements to procedures or equipment?
- Do you have any further information that you think you may assist in the investigation of this occurrence?
- Do you know of any passengers who would like to or could provide information?

16.4 Checklist of information to be gathered from passengers

16.4.1 Personal data

- Name, gender, age, height and weight
- Address
- Phone number
- Occupation
- Seat number and location
- Aviation experience
- Any disability that could impair egress from the aircraft
- Languages spoken
- Were you injured? Describe your injuries. When and how were you injured?

16.4.2 Pre-flight preparations

- Describe the weight, size and stowage of your carry-on baggage.
- Describe the clothing and footwear that you were wearing when the accident occurred.
- Was there a pre-departure safety briefing? How was it provided (i.e. pilot, cabin crew member, video or other means)? Did you understand the safety briefing?
- Did you read the safety card?
- Did you understand the information on the safety card?
- Did you note the locations of more than one exit near your seat?
- Were you seated adjacent to an emergency exit?
- Were you briefed prior to departure on the operation of the exit? If yes, by whom?
- Describe the observations of maintenance, ground service personnel (de-icing) or flight crew that might be pertinent to the investigation.

16.4.3 Occurrence information

- How and when did you first become aware of a problem? Where were you when you first became aware of a problem?
- How did the crew prepare you for the emergency? Were you given instructions over the PA system? By an individual crew member? Shouted instructions?
- Did you hear any shouted commands? If yes, what did you hear? Did the information help you?
- Did you brace for impact? Describe your brace position.

- Were you travelling with infants/children? How were they restrained? Were there any problems?
- How tightly was your seat belt fastened? Did you have any problems releasing your seat belt? If yes, describe them
- Did you remove your shoes? Why? If you did not remove them, did they stay on during the impact and evacuation?
- Describe the impact sequence. What happened to you during the impact sequence?
- Did anything happen to your seat during impact?
- Did you remain seated until the aircraft stopped?

16.4.4 Evacuation

- Which exit did you use? Why?
- Did you encounter problems reaching your exit? If yes, describe.
- Did you attempt to take anything with you when you left the aircraft? If yes, what did you take?
- Did you assist anyone during the evacuation?
- Did anyone assist you?
- Did you open an exit? If so, which one? Did you experience difficulty operating or using the exit?
- Did you notice any lights on in the cabin? Where?
- Approximately how long did it take you to evacuate the aircraft? What is your estimate based on?
- What did you see when you got out of the aircraft?
- Did help arrives quickly? Describe the rescue efforts.
- Did a rescuer assist you? How?
- Did you sustain any injury? If yes, please describe your injury and, if known, its causes.

16.4.5 Turbulence

- Where were you when the turbulence occurred?
- Was your seat belt fastened? If not, whey not?
- Was the seat belt sign on?
- Did you hear any announcement regarding seat belts? If yes, describe what you heard.
- Who do you think made the announcement(s)? Flight deck crew and/or cabin crew members(s)?
- Were you injured? Describe your injuries. Were you given first aid by a cabin crew member or passenger?
- If you were travelling with an infant/child, what happened to the infant/child? How were they restrained?

16.4.6 Smoke/Fire/Fumes

- When did you become aware of smoke, fire, or fumes?

- Where did you first observe smoke or fire? Describe what you saw and smelled (colour, density, odor)
- Where were you when you first became aware of fumes?
- Did the conditions increase, decrease or change during the occurrence?
- Did you have difficulty breathing? If yes, what action did you take to protect yourself?
- Did you observe fire-fighting procedures? Describe.

16.4.7 Ditching/Inadvertent water contact

- What types of flotation devices were available?
- Did you obtain a life preserver?
- Where was it stored?
- Did you have a problem retrieving it?
- Did you put it on?
- When did you inflate it?
- Did it work properly?
- If you were travelling with an infant or child, was a life preserve provided for the child?
- Did you use the seat bottom cushion as a flotation device? Describe how the cushion was used and its effectiveness.
- Did you board a life raft or slide/raft
- Were there any difficulties?
- Describe the type of raft you boarded.
- What equipment in the life raft (slide/raft) was used?
- How many people were in the life raft?
- Describe the water conditions.
- Describe any sea survival procedures that were used.
- Describe the weather conditions.
- Describe the rescue effort.

16.4.8 Additional comments

- Based on your experience, can you suggest any improvements to procedures or equipment?
- Do you have any further information that you think may assist in the investigation of this occurrence?

16.4.9 Others

- Reports of follow-up component tests
- Photographs
- Written statements
- Interviewing techniques for investigator has been given in Appendix 11 to this Manual.

CHAPTER – 17

ORGANIZATIONAL FACTORS INVESTIGATION

17. Organizational Factors Investigation

17.1 Introduction

It is argued that modern aircraft accidents occur, for the most part, as the result of complex interactions between many causal factors – for example:

a. Active failures committed by those at the 'sharp end' (cockpit, flight line), having immediate impact upon the integrity of the aircraft.

b. Local triggering factors

c. Latent failures, originating in the managerial and Organizational spheres, whose consequences may lie dormant for long periods.

These factors would eventually lead to committing of unsafe acts.

17.2 Unsafe Acts

Unsafe acts, as described by Professor Reason 1991, can be categorized into two distinct groups:

a. Errors

b. Violations

All involve deviations from rules and standards, but they differ with regard to the nature of the deviation. Here we discuss the psychological varieties of unsafe acts.

17.2.1 Errors

Errors may be of two kinds:

a. Slips in attention and memory lapses, involving the unintended deviation of actions from what may be a perfectly good plan.

b. Mistakes, where the actions follow the plan but the plan deviates from some adequate path to the desired goal.

Mistakes
Mistakes fall into two groups:

1. Rule-based mistake, in which the individual encounters some relatively familiar problem, but applies the wrong pre-packed solution.

2. Knowledge-based mistakes, in which the individual encounters a novel situation for which his/her training has not provided some rule-based solution and he/she has to use on-line reasoning based upon some (usually) incomplete or incorrect mental model of the problem situation.

17.2.2 Violations

Violations involve deliberate deviations standards and procedures. There are generally three types of violations.

1. Routine violations, involving short cuts between task-related points
2. Optimizing violations, in which the individual seeks to optimize some goal other than safety.
3. Exceptional violations, one-off breaches of regulations seemingly dictated by unusual circumstances.

Not all violations are necessarily bad or cause accidents. On some occasions they save lives, on others they go badly wrong and cause accidents.

17.3 Conditions that Promote Unsafe Acts

Error-producing conditions are ranked in the order of their known effects as shown below. The numbers in parentheses indicate the risk factor:

Unfamiliarity with the task	(x17)
Time shortage	(x11)
Poor signal: noise ratio	(x10)
Poor human-system interface	(x8)
Designer-user mismatch	(x8)
Irreversibility of errors	(x8)
Information overload	(x6)
Negative transfer between tasks	(x5)
Misperception of risk	(x4)
Poor feedback from system	(x4)
Inexperience (not lack of training)	(x3)
Poor instructions or procedures	(x3)
Inadequate checking	(x3)
Educational mismatch of person with task	(x2)
Disturbed sleep patterns	(x1.6)
Hostile environment	(x 1.2)
Monotony and boredom	(x 1.1)

The error-producing factors at the top of the list are those that lie squarely within the organizational sphere of influence.

17.4 Conditions that produce Violation

Violation producing conditions include:

1. Manifest lack of organizational safety culture
2. Conflict between management and staff
3. Poor morale
4. Poor supervision and checking

5. Group norms condoning violations
6. Misperception of hazards
7. Perceived lack of management care and concern
8. Little élan or pride in work
9. A macho culture that encourages risk-taking
10. Beliefs that bad outcomes won't happen
11. Low self-esteem
12. Learned helplessness ('Who gives a damn anyway' attitude)
13. Perceived Licence to bend rules
14. Ambiguous or apparently meaningless rules
15. Age and sex

17.5 General Failure Types (GFT)

There are 12 General Failure Types that are likely to apply to any aviation system. These are:

1. Inadequate regulation/procedure
2. Incompatible goals
3. Organizational deficiencies
4. Inadequate communications
5. Poor Planning
6. Inadequate control and monitoring
7. Design failures
8. Inadequate defenses
9. Unsuitable materials
10. Poor procedures (both operations and maintenance)
11. Poor Training
12. Inadequate maintenance

Together, these GFTs constitute the 'vital signs' of an organization, providing an indication of its current 'safety health'.

17.6 Post Accident Application

The principles of accident causation form the basis of a powerful accident investigation tool that allows the underlying latent failures to be identified in a step-by-step fashion. In particular, it permits the basic facts of an accident to be assembled into a coherent and remedially useful analysis. This would begin with the failed defenses and end with the fallible top-level decisions that set the accident sequence in motion.

Defences - What aspect(s) of the aircraft's defensive system was absent, Failed or circumvented (that is, detection, recovery, containment, protection or escape)?

Unsafe Acts - What types of actions were involved in breaching or bypassing the defenses (that is, slips, lapses, rules-based mistakes, knowledge based mistakes, routine violations, optimizing violations or Exceptional violations)? Were these individual or group failures?

Preconditions - What was the task, situational or environmental factors that promoted the occurrence of these unsafe acts (that is, error-producing conditions and violation-producing conditions)?

General Failure Types - Which of the 12 GFTs were implicated in creating these preconditions? Were there any other failure types involved?

Fallible decisions: Which departments were primarily responsible for these accident-implicated GFTs? What were the factors that shaped their underlying decisions? What shortcomings, if any, does this accident reveal in the organization's safety culture (that is, top-level commitment to safety goals, competence to achieve these goals and cognizance of the variety of hazards threatening the system)?

The steps listed above merely indicate the main stages of accident analysis. At each level, it is possible to make detailed connections between the identified 'facts' and their likely precursors at the preceding level, though this process becomes more problematic at the higher levels of the organization where there is likely to be a 'many-to-many' mapping between top-level decisions and GFTs.

CHAPTER – 18

REPORTING AND RECORD HANDLING

18. Reporting and Record Handling

18.1 General

This chapter describes the various reports and forms used during an investigation, and the documentation procedures that need to be followed during an investigation.

All Investigators must maintain strict confidentiality in handling information. Investigators shall not release occurrence related data or information to those not authorized to receive them. See also paragraph 6.1.

18.2 Reports

18.2.1 Recording of an incoming Notification

Record details, of an incoming notification of an Aircraft Accident/Incident, using the guidelines provided in Chapter 3 of this document. Appropriate forms for recording developed by the AIU;

Form No. CAA/AU/001 - Notification of Accident/Incident Recording Form. (Used by the Authority)

Form no: CAA/AU/002 -Notification of an accident/serious incident (as laid down in Chapter 3.4.1)

Form No. CAA/AU/003 - Aircraft Accident/ Serious Incident Report Form (to report an aircraft accident or incident to the Authority)

These forms are shown in Appendix 3, 4 and 5 respectively.

18.2.2 Recording of Data and Progress Reporting

The AIU developed guidelines/forms/check lists that may be necessary to be used by Investigators for recording of data collected, evidences and reporting of progress to the Chief Investigator during the course of an investigation. Meanwhile Investigators are requested to contact the AIU in the event a need arises.

18.3 Types of reports

An accident investigation report shall be submitted initially as a Preliminary Report until a Final Report can be produced, which usually take a period of time.

18.3.1 Preliminary Reports

When a field investigation is conducted into an occurrence, the report will be prepared to cover preliminary information. This information needs to be treated with caution in that it is only preliminary, and further investigation and full analysis may indicate different circumstances than those first reported.
Chief Investigator should submit the preliminary report within 7-10 days after the notification of the accident. In addition to giving preliminary information regarding the, nationality, registration, and type of aircraft, the circumstances of the accident, crew

names and licenses, type of operation, number of persons on board, number of injuries and brief history of flight. It should give some detail of the direction in which detailed investigation is required to be conducted. It should also make recommendations to be complied with immediately, if prima facie evidence of certain unsafe conditions of procedures is seen to exist, which may jeopardize safety of other operations.

18.3.2 Final Reports

At the conclusion of an investigation, the final report will be prepared detailing the relevant factual information; analysis of the information collected; conclusions and significant factors which flow directly from the analysis; and recommendations, if appropriate, which derive from the conclusions.

A draft of the final report usually excluding any recommendations will be forwarded to accident investigation committee for review and comment. The comments from all relevant areas of the committee may incorporate into the final report.

The Authority will send a copy of the draft Final Report of an investigation it initiated by the most suitable and quickest means, to the following States inviting their significant and substantiated comments on the report as soon as possible.

a. the State that instituted the investigation;
b. the State of Registry;
c. the State of the Operator;
d. the State of Design;
e. the State of Manufacture.; and
f. any State that participated in the investigation

The draft Final Report may include intended Safety Recommendations.

The Authority shall send, through the State of the Operator, a copy of the draft Final Report to the operator and through the State of the Design and the State of Manufacture, a copy of the draft Final Report to the organizations responsible for the type design and the final assembly of the aircraft to enable them to submit comments on the draft Final Report. Such comments received on both of those occasions shall be forwarded to the Board for consideration.

If the Authority receives comments within sixty days of the date of the transmittal letter, it will request the Board to either amend the draft Final Report to include the substance of the comments received or, if desired by the State that provided comments, append the comments to the Final Report. Such comments appended will be on technical aspects of the Final Report upon which no agreement could be reached. If the Authority receives no comments within sixty days of the date of the first transmittal letter, it shall issue the Final Report in accordance with 15.2.4 unless an extension of that period has been agreed by the Authority and any other State concerned.
Significant investigation reports will be produced as separate documents using the format specified in the Appendix to *Chapter 6 of Annex 13 to the Chicago Convention* and the completed final reports for all aircraft accident and serious

incidents will be released as soon as possible following the completion of the investigation. Additionally the Authority shall ensure that the Chief Investigator monitors the distribution of the final report within the specified time meeting the target date of distribution.

Specifically, final reports will be modeled on the following format as appropriate:

A. Title
B. Synopsis
C. Body
D. Appendixes

Title - The Final Report begins with a title comprising, name of the operator; manufacturer, model, nationality and registration marks of the aircraft; place and date of the accident or incident.

Synopsis - Following the title is a synopsis describing briefly all relevant information regarding: notification of accident to national and foreign authorities; identification of the accident investigation authority and accredited representation; organization of the investigation; authority releasing the report and date of publication; and concluding with a brief résumé of the circumstances leading to the accident.

Body - The body of the Final Report comprises the following main headings;

1. Factual Information
2. Analysis
3. Conclusion
4. Safety Recommendation

Each heading consisting of a number of sub-headings as outlined in the following.

Appendices - Include as appropriate.

Factual Information - including:

1. History of the flight.
2. Injuries to persons.
3. Damage to aircraft.
4. Other damage.
5. Personnel information.
6. Aircraft information.
7. Meteorological information.
8. Aids to navigation.
9. Communications.
10. Aerodrome information.
11. Flight recorders.
12. Wreckage and impact information.
13. Medical and pathological information.
14. Fire.

15. Survival aspects.
16. Tests and research.
17. Organizational and Management information
18. Additional information.
19. Useful or effective investigation techniques.

Analysis - Analysis as appropriate, of factual information presented above.

Under the topic survival aspects, analysis should be done, if applicable, of the procedures followed by the cabin crew and flight crew in commanding and executing the evacuation of the aircraft, deployment of slide chutes or rafts, time taken in evacuation, time taken in the arrival of fire fighting or search and rescue personnel etc. Such an analysis will help in determining whether these tasks were performed as required or whether any recommendation for streamlining the relevant procedures and their documentation are warranted.

Conclusions - Statement of conclusions drawn from factual information and analysis, and the various causal factors identified from the circumstances surrounding the occurrence. It should be ensured that the conclusions flow out of finding and the findings flow out of analysis of the facts. The conclusions should not include any factors or lapses/procedures of personnel observed during investigation which do not have direct bearing on the accident. Such lapses/practices can be separately intimated to the concerned divisions of CAA for taking appropriate action

Safety recommendations - Recommendations made for the purpose of future accident prevention, and resultant corrective action.

Appendices - Any other pertinent information considered necessary for the understanding of the report.

Safety Recommendations

Interim Recommendations - Recommendations made before the investigation is finalized will be identified as 'interim recommendations'. Interim recommendations may, of necessity, be based on incomplete factual information and analysis, and will usually only identify areas for closer consideration.

Final Recommendations - Final recommendation(s) will be made after comments have been received on the draft version of the final report of an investigation. (The draft report will not usually include recommendations). However, a safety recommendation shall in no case create a presumption of liability for an accident or incident.

The Authority will recommend in a dated transmittal correspondence, to Director General, relevant persons and appropriate authorities, including those in other States, any preventive action which it considered necessary to be taken promptly to enhance aviation safety at any stage of an accident or incident investigation.

The Authority will also address, when appropriate, any safety recommendations arising from its investigations at any stage of the investigation in a dated transmittal correspondence, to the accident investigation authorities in other States concerned and, when ICAO documents are involved, to ICAO.

The safety recommendations made to relevant authorities and persons in other States shall be addressed to the accident investigation authorities of the respective States.

The safety recommendations made to ICAO, including where ICAO documents are involved, shall be addressed to ICAO. The Final Reports shall be accompanied by a letter outlining the specific action proposed.

Action on Safety Recommendation

The Authority, when receiving safety recommendations from other States, will informs the proposing State, within ninety days of the date of the transmittal correspondence of the preventive action taken or under consideration or the reasons why no action will be taken.

However, the Authority does not have the power to enforce the safety recommendations. Nevertheless, in respect of safety recommendations made to a person or authority, the Authority has the power to require such persons or authorities into:

- take those recommendation into consideration and, where appropriate, act upon them;
- provide the Authority with the full details of the measures, if any, that they have taken or propose to take to implement the recommendations (including the schedule of implementation); or
- Provide a full explanation as to why no measures will be taken to implement the recommendations.

In respect of safety recommendations made to a person or authority outside Sri Lanka, the Authority does not have the power to require such persons or authorities to furnish information on action taken or to be taken or to furnish an explanation as to why no action will be taken. However, the Authority will endeavour to obtain such information through the accident investigation authorities of the Contracting States concerned.

The Authority shall record the responses to the safety recommendation issued and monitor the progress of the action taken in respect to those safety recommendations. Decision on the closure status of the recommendations based on the actions taken by the respective entities.

18.4 Distribution of Reports

The Authority will send the final report of the investigation of an accident with a minimum of delay to:

a. the State that instituted the investigation;

b. the State of Registry;

c. the State of the Operator;

d. the State of Design;

e. the State of Manufacture;

f. any State that participated in the investigation

g. any State having suffered fatalities or serious injuries to its citizens; and

h. any State that provided relevant information, significant facilities or experts.

the International Civil Aviation Organization, when an accident or an incident involving an aircraft of a maximum mass of over 5 700 kg.

The Authority shall not circulate, publish or give unauthorized access to a draft report or any part thereof, or any documents obtained during an investigation without the express consent of the State which conducted the investigation, unless such reports or documents have already been published or released by that State.

The completed Final Reports can be downloaded from the Authority website (www.caa.lk).

18.5 Record Management

18.5.1 Procedure

Following advice of an occurrence, it is important to initiate appropriate record-keeping procedures. CAA Record Management Procedure must be followed. Control of all documents relating to all aspects of the investigation must be maintained.

18.5.2 Files

The Chief Investigator/Investigator shall ensure that a file is raised for each major accident or serious incident investigated. The file cover page should reflect the following key words:

- Name of the aircraft certificate of registration holder or operator as appropriate
- Aircraft manufacturer and type
- Aircraft registration
- Nature of the event (accident or incident)
- Location of the event
- Date of the event.

18.6 Adrep Reporting System

The provisions of ADREP Reporting may require two separate reports for any one accident or incident. They are:

- Preliminary Report
- Accident/Incident Data Report

Guidance for preparing the Preliminary Report and the Accident/Incident Data Report can be found in the Accident/Incident Reporting Manual (ICAO Doc 9156).

18.6.1 Preliminary Report

When the aircraft involved in an accident is of a maximum mass of over 2250kg, the Authority, will send the Preliminary Report to:

a. the State of Registry

b. the State of Occurrence, when investigation is delegated to the Authority;

c. the State of the Operator;

d. the State of Design;

e. the State of Manufacture;

f. any State that provided relevant information, significant facilities or experts; and

g. the International Civil Aviation Organization.

When an aircraft, not covered by above paragraph, is involved in an accident and when airworthiness or matters considered to be of interest to other States are involved, the Authority will forward the Preliminary Report to:

a. the State of Registry

b. the State of Occurrence, when investigation is delegated to the Authority;

c. the State of the Operator;

d. the State of Design;

e. the State of Manufacture; and

f. any State that provided relevant information, significant facilities or experts.

The Preliminary Report will be sent to appropriate States and to the International Civil Aviation Organization in English language by facsimile, e-mail, or airmail within thirty days of the date of the accident unless the Accident/Incident Data Report has been sent by that time. When matters directly affecting safety are involved, it will be sent as soon as the information is available and by the most suitable and quickest means available.

18.6.2 Accident/Incident Data Report

When the aircraft involved in an accident is of a maximum mass of over 2250 kg, the Authority will send, as soon as practicable after the investigation, the Accident Data Report to the International Civil Aviation Organization.

The Authority may, upon request, provide other States with pertinent information additional to that made available in the Accident/Incident Data Report.

If the Authority conducts an investigation into an incident to an aircraft of a maximum mass of over 5 700 kg, the Authority will send, as soon as is practicable after the investigation, the Incident Data Report to the International Civil Aviation Organization.

The types of incidents which are of main interest to the International Civil Aviation Organization for accident prevention studies are listed in Appendix 8 to this Manual.

With the establishment of ECCAIRS database the Authority will make use the system for ADREP reporting. Thereby the ADREP system will be done by online for exchanging of information between ICAO and the States and between all stakeholders. The establishment and implementation of ECCAIR system is shown in the Chapter 20 of this Manual.

CHAPTER 19 –

ACCIDENT PREVENTION MEASURES

19. Accident Prevention Measures

The objective of the following specifications is to promote accident prevention by analysis of accident and incident data and by a prompt exchange of information.

19.1 Incident reporting systems

The Authority will establish a mandatory incident reporting system to facilitate collection of information on actual or potential safety deficiencies and a voluntary incident reporting system to facilitate the collection of information that may not be captured by a mandatory incident reporting system. A voluntary incident reporting system shall be non-punitive and afford protection to the sources of the information.To this effect the Implementing Standards are published for mandatory occurrence reportings and voluntary occurence reportings.

19.2 Database systems

The Authority shall establish an accident and incident database to facilitate the effective analysis of information obtained, including that from its incident reporting systems. The Authority shall use standardized formats to facilitate data exchange in its database systems. For this purpose the Authority has implemented ECCAIRS reporting system as described in Chapter 20 in this Manual.

19.3 Analysis of data — Preventive actions

The Authority having established an accident and incident database and an incident reporting system will analyse the information contained in its accident/incident reports and the database to determine any preventive actions required. Additional information on which to base preventive actions may be contained in the Final Reports on investigated accidents and incidents.

If the analysis of the information contained in the database, identifies safety matters considered to be of interest to other States, the Authority will forward such safety information to them as soon as possible.

In addition to safety recommendations arising from accident and incident investigations, safety recommendations may result from diverse sources, including safety studies. If safety recommendations are addressed to an organization in another State, the Authority will transmit such recommendations to that State's investigation authority.

19.4 Exchange of safety information

The Authority may promote the establishment of safety information sharing networks among all users of the aviation system and will facilitate the free exchange of information on actual and potential safety deficiencies.

CHAPTER 20 -

EUROPEAN CO-ORDINATION CENTRE FOR AVIATION INCIDENT REPORTING SYSTEMS

20. European Co-ordination Centre for Aviation Incident Reporting Systems (ECCAIRS)

20.1 General

ECCAIRS is acronym for “European Co-ordination Centre for Aviation Incident Reporting Systems”. It is a software developed by the European Commission and used by the ICAO ADREP system for the exchange of data between States and ICAO. The ECCAIRS system was developed in close cooperation with ICAO with the aim of implementing common taxonomies developed in ICAO for the exchange of occurrence data between States and ICAO.

The ICAO recommends that the every State shall establish and maintain an aircraft accident and incident database for the effective analysis of information on actual or potential safety deficiencies and to determine any preventive actions required. ECCAIRS is the ICAO strategy to implement a well-established and common aviation occurrence data exchange platform with all stake holders.

The ICAO encourages the use of ECCAIRS Reporting System by the states to improve the promotion and implementation of State Safety Programme and Safety Management Systems (SMS) at the States level. ECCAIRS will assist the States in complying with ICAO Annex 13 ADREP reporting requirement. It also served as a part of Safety Data Collection and Processing System within the State.

20.2 ADREP Reporting Requirements of Accidents/Serious Incidents

Chapter 4.1 (e) of Annex 13 requires the State of Occurrence to forward a notification to ICAO of an accident or serious incident involving an aircraft with a maximum mass of over 2 250 kg.

A preliminary ADREP report should be forwarded to ICAO in terms of Chapter 7.1 of Annex 13, if the aircraft involved in an accident or serious incident is of a maximum mass over 2 250 kg. Finally, Chapter 7.5 of Annex 13, requires an ADREP Accident Data Report be sent to ICAO as soon as practicable after the investigation of an accident or serious incident involving an aircraft of a maximum mass over 2250 kg.

In addition Annex 13 also requires the State conducting the investigation to report to the State of Registry and the State of Occurrence on accidents to aircraft of 2 250 kg or less where airworthiness or matters considered to be of interest to other States involved.

If a State conducts an investigation into an incident to an aircraft of a maximum mass of over 5700 kg, Annex 13 requires that State to send Incident Data Report to the ICAO, as soon as is practicable after the investigation.

20.3 ADREP System and ECCAIRS System

The ICAO’s ADREP system was established in 1976.It has evolved with the changes in information technology and the aviation industry from a batch processing system, to an on-line database. AIG provides ADREP information for accident prevention

purposes to authorized officials in ICAO Contracting States, as well as to relevant Sections in ICAO Headquarters with respect to safety-related initiatives.

The ICAO Accident/Incident Reporting Manual (ICAO Doc 9176) gives full details on how reports are complied and transmitted to ICAO. The basic means of reporting is a manual system using forms and formats described in Doc 9176. However, with technological advances electronic means of reporting to ICAO are now available.

The Accident/Incident Data Reporting (ADREP) system is operated and maintained by ICAO. This ADREP reporting system is based on the use of a common reporting taxonomy, which is periodically updated in cooperation with Contracting States. The current version of the taxonomy is available from the ICAO Web site, http://eccairsportal.jrc.ec.europa.eu/.

The ADREP system receives, stores and provides States with occurrence data that will assist them in validating safety. In this context, the term ‘occurrence’ includes both accidents and incidents.

ICAO encourages the States to use this taxonomy in their national reporting to achieve international harmonization and thereby enable the exchange and aggregation of occurrence information. Cooperation between ICAO and EUROCONTROL has ensured taxonomy harmonized with ADREP Taxonomy that could be used by member States to replace the manual reporting system in place. With the technological advances, the ADREP system now provides for online reporting and exchanging of information between ICAO and the States and between all stakeholders.

20.4 Benefits of ECCAIRS

The ECCAIRS software & training is available free-of-charge to States. The system can be adapted to the size and needs of States, running on a laptop computer for those with few occurrences or running on servers with numerous users distributed throughout a State. The system is relatively easy to install and maintain. Updates are distributed via the Internet.

ECCAIRS assist in standardizing occurrence reporting worldwide and facilitating the exchange of aviation safety data through the common use of analysis tools. States have benefited as they are no longer forced to manually complete the ICAO ADREP reporting forms and increase the safety data available to ICAO and its Contracting States and facilitate as a tool used to code/enter and extract/exchange and analyze safety data.

20.5 Minimal System Requirements

20.5.1 Client side

- Intel or AMD, 2 GHz or higher, dual core recommended
- 2 GB RAM or more
- 250 MB disk space
- Suitable Microsoft windows version
- Microsoft NET Framework 4

20.5.2 Server side

- 4 GB RAM or more
- In multi-user systems with large amount of data, multi-processor systems are recommended to increase response times from database and from server
- Web Services and/or DCOM (no protocol needed for standalone install)
- 350 ~ 500 MB disk space for database components
- Up to 300 KB database space per occurrence

20.6 Implementation of ECCAIRS in CAASL

As per the ICAO recommendation the Authority established and maintained the ECCAIRS, to facilitate the effective analysis of all information on actual or potential safety deficiencies obtained, including accident/incident reporting systems, and to determine any preventive actions required. Thereby the Authority implement a well-established and common aviation occurrence data exchange platform with all stake holders.

Implementation stages;

- Amendment of CAASL internal procedures on use of ECCAIR system
- Setting up of facilities & Equipment
- Awareness and Installation of ECCAIRS in CAASL
- Industry awareness
- Installation in selected Operators

20.7 Responsibility of identified staff

The installation done by giving access to the following identified officers;

- Director General - full access
- Additional Director General/ Flight Safety Regulations– view access
- Directors of technical sections (Airworthiness, Operations, Personnel Licensing, Aerodrome & Air Navigation Services, and Aviation Security) and inspector of these sections – view access
- Manager and Assistant Manager / Aircraft Accident Investigation – data entry & full access (except delete mode)

Full access allow the client to enter data, use of views, add, edit and delete occurrence data, find and show data graphically and exchange data within States and ICAO. View access allow the client to use of views to find and show data graphically for further analysis.

Director General has the full access and be able to obtain the above facilities of this system. Senior Director, Director/ Flight Safety, Deputy Directors and the inspectors of above technical sections be able to use views and extract the data from accident/incident data base for their own analysis to present data graphically and to determine any preventive actions required, if any. Assistant Manager/ Aircraft Accident Investigation enter the data; upload the data received from operators through occurrence reports and possess the full access except delete data. Therefore the respective officers have the advantage of using this system after the implementation.

As per the ICAO Annex 13 ADREP requirements the Authority will send preliminary and full ADREP reports to the ICAO and other States using ECCAIRS system. The Authority also benefited as there are no longer to manually complete the ICAO ADREP reporting forms. ECCAIRS system will facilitate data analysis.

20.8 Introduction and Implementation in Operators

The Authority initially introduced and implemented this system into selected operators. Once after the industry awareness the Authority insisted and recommended to operators to the use of ECCAIRS system. This software installed into selected operators. The Authority recommends Foreign Air Operators to comply with this requirement. Thereby the operators shall send their all occurrence reports using the given this system to give effect to the ECCAIRS. If the operators conduct their internal investigations they shall send final report as PDF file or hard copy after forwarding initial, preliminary, data report (Full Report). All instructions are explained in the Implementing Standard 006.

20.9 Views of ECCAIRS reporting system

The View Definition menu allows selecting the appropriate view over the occurrence data-structure, among those available in ECCAIRS 5, to be used for display and browsing in the Taxonomy Tree Pane. The ECCAIRS Suite comes with five pre-defined Views optimized for typical flight operations and ATM users:

1. Operational Full view - organizes and display the occurrence data according to the complete ICAO ADREP 2000 taxonomy.
2. Operational Preliminary view - is a reduced and simple view, where all the information is condensed to be used for a quick focus on flight operations occurrences
3. ATM Full view - focuses on the Air Traffic Management issues of the occurrence
4. ATM Preliminary view - is a reduced and simple view focused on ATM specific type of occurrences.
5. Bird strike notification – focuses on Bird strike occurrence

20.10 ECCAIRS as a tool;

20.10.1 Graphic Tool and usage

Graphs are based on Queries. This is an analysis tool founded on graphical representation of data. The purpose of using this is to produce graphs of aggregated data. This connects via Repository Manager and totally configured and secured by Repository Profiles. There are large varieties of graphs in 2D or 3D with combination of any of the available data fields. It automatically manages data type and extended export functions such as export data to file, export to Office applications and snapshots. The aggregation functions (Sums, Averages, etc.) also can be done.

20.10.2 Aggregation Work Bench Tool and usage

This can be used as Data Extraction tool. The function of Aggregation work Bench is to create projects that extract data in an organised manner from a database attached to an ECCAIRS Repository. These projects can be used as a support tool for data analyses purposes using Microsoft Excel utility.

CHAPTER 21 –

ACCIDENT INVESTIGATION EQUIPMENT

21. Accident Investigation Equipment

21.1 General

The Authority provides investigators with appropriate equipment & facilities to enable the conduct of investigations; such as tools, survey equipment, marking equipment, etc. and guidance material/procedures.

The Authority will make arrangements to ensure that investigators to have their investigation field kits and essential personal items packed and ready to proceed without delay to the accident site as the instructions given in the letter shown in Appendix 7. It is expected that the investigators would be available on call as per the details given to Accident Investigation Unit and they must notify the contact details to the Unit if there is any change.

The Authority will also provide communication means availing the facility provided as per procedure laid down under “Office equipment and other facilities provided to CAASL Staff” in 1.14.2 of Doc. SLCAP 5250. Investigators appointed from the Board will provide the mobile as appropriately by the Authority.

The Authority will avail in the transportation to be provided by CAASL as and when required by the investigators as per office procedure ref. FN/OP/008.

Depending on the situation investigators may use their own vehicle or hire a vehicle to proceed to the meeting point on re-embers basis. The Authority will provide vehicles to proceed from the meeting point to the accident site. The necessary coordination will provide by of AI unit. Generally meeting points will be the CAASL headquarter at Katunayeke, which is near to the Bandaranaike International Airport.

There are five kits available for Inspectors for use on various sites and circumstances. Inspectors proceeding on field should determine which of these are required for the particular investigation and obtain the kits before they leave for the site. The Kits are:

1. Personal Issue Kit
2. Investigation field kit
3. Tool kit – tools & equipment
4. Personnel Protective Equipment
5. First Aid Kit

The list of the collective and individual equipment available within the Authority shall be maintained up-to-date by monthly basis. The record will be maintained in a specific form as shown in Appendix 6. The Assistant Manager of Accident Investigation Unit will maintain the above mentioned document and will be the custodian of the equipment. In case of requirement he/she will make necessary arrangement to provide the equipment to the investigators

21.2 Personal Issue Kit

One for each assigned Inspector. There are 7 number of personal issue kits.

Item	Description	Qty
01	Tabards- with CAASL logo (free size)	07
02	Tabards- without CAASL logo (free size)	07
03	Rain Coats – size - medium	05
	- size - Large	02
04	Hats	07
05	Boots – size - 6	01
	- size - 7	03
	- size - 8	02
	- size - 10	01
06	Safety Gloves - Heavy	07
07	Safety Gloves - Light	07
08	Inspector's Bags	07
09	Whistles	06
10	Pen Knives (blade length – 3 inch)	07
11	Flash Lights	07
12	Batteries (For flash Light)	07 *2
13	Pair of scissors	07
14	Field Note books	07
15	Ruler	07
16	Inspectors Files	07
17	Dusting Brush	07
18	Mobile Pouches	07
19	Corrective Pens	07

21.2.1 Recording of Personal Issue Kit

It is a requirement that all inspectors sign for their kits as a record of issued to them. The records must be kept in the Accident Investigation Unit.

21.2.2 Replacement of clothing and Equipment

Clothing and equipment will be replaced when the relevant items become unserviceable through normal wear and tear having regard to the inspector's duties.

Protective equipment shall be replaced at regular intervals in order to maintain the protective value of the equipment where such replacement is recommended by the equipment manufacturer or is contained in the relevant standard.

21.3 Investigation field Kit

No	Item	Qty
Survey Equipment		
01	Map of Sri Lanka	01
02	Map of Provincial	07
03	Map of World	01
04	Measuring Tape – 30 m	01
05	Measuring Tape -10ft	01
06	Nylon Rope	01
07	Twin/Cord	03
08	Barrier Tapes	03
09	Cordoning Tape	01
10	GPS	01
11	Compass with Inclinometer	01
Marking Equipment		
12	Sealing Tapes	04
13	Sticker Identification	01
14	Marking Pen	02
15	Rubber Bands	02
16	Graph Papers	03
Miscellaneous Items		
17	Tape Recorder (Portable)	01
18	Voice Recorder	01
19	Stop Watch	01
20	Cloth, Dusting	01
21	Mega Phone	01
22	Batteries for Mega Phone	04
23	Digital Camera	01
24	Binocular with a Tripod	01
25	Tent	01
26	CDMA Phone	01

21.4 Tool Kit – Tools & Equipment

No	Item	Qty
01	Tool Kit	01
02	Mechanic’s Mirror	01

03	Magnifying Glasses	02
04	Containers - volume - 7.2 m^3	01
	- volume - 5.4 m^3	01
	- volume - 2.3 m^3	01
05	Plastic Bags (disposable)	10
06	Sample Bottles – volume – 1 L	04
07	Sample Bottles – volume – 250 ml	01
08	Air Tight Baskets	03

21.5 Personal Protective Equipment

No	Item	Qty
01	Dark blue overalls (Reusable)	07
02	Goggles (Reusable)	04
03	Full face mask with two canisters	03
04	Half face mask with two canisters	03
05	Safety helmet	07
06	Safety Gloves –Surgical (100 numbers)	01 box
07	Safety Gloves - Latex	07
08	Disposable Mask (100 numbers)	02 boxes

21.5.1 Personal protective equipment against biological hazards

This provides general guidelines on the personal protective equipment (PPE) to be used by accident investigators at the accident site. PPE may also be needed when performing off-site examinations and tests on wreckage parts.

The Authority will make arrangement to train Investigators in the use of PPE, and closely monitor to ensure their safety during the use and disposal of this PPE.

All investigators shall use the provided PPE during the accident site as appropriate.

21.5.2 Personal protective equipment (PPE) for investigators

PPE consist typically of the following items (the quantity of the items may vary according to the accident site condition, tasks at hand, and required duration of work.

- Face masks
- Half-face and full-face respirators
- Disposable coveralls

- Latex gloves
- Disposable work gloves (leather, nitrile)
- Disposable heavy duty work gloves
- Kevlar cut-resistant gloves with lined palm and fingers
- Protective boots with sole and toe protection
- Disposable shoe covers
- Hard hat
- Eye protection: either safety glasses or safety goggles
- Hearing protection: either ear muffs or ear plugs
- Hand and equipment wipes
- High visibility vest
- Chemical or duct tape

Other equipment:

- Cleaning/disinfectant chemicals and supplies
- Biological hazard disposal bags
- Drinking water
- First aid kit
- Foul weather clothing
- Insect protective solutions and medication, if recommended
- Extra batteries and power supply adaptors for electronic equipment

Additional equipment for marine environments (this equipment may be specified and supplied by vessel operators):

- Life vest
- Suitable footwear for deck operations
- Hard hat or, if permitted, peaked water proof hat
- Pair of neoprene gloves
- Sun protective screen
- Motion sickness medication, if recommended

21.5.3 Some precautions on the use of PPE

Disposable latex gloves - Latex gloves should be durable even though they are to be worn under work gloves. All latex gloves should be properly disposed of prior to leaving the accident site.

Work gloves - Work gloves should be as durable as practical and provide the hand, wrist and forearm with puncture and abrasion protection. Leather, nitrile and Kevlar gloves are commonly used. All three types should be disinfected or properly disposed of prior to leaving the accident site.

Face masks - Face masks should cover the nose and mouth. Masks come in disposable and reusable configurations and should be disinfected or properly disposed of prior to leaving the accident site.

Protective goggles - Protective goggles should enclose the eyes by sealing around the top, bottom and sides. Common safety glasses are not acceptable. Goggles should be fitted with one-way check valves or vents to prevent fogging and should be disinfected or properly disposed of prior to leaving the accident site.

Disposable protective suits - Protective suits should be durable and liquid-resistant and should fit properly. If possible, they should have elastic-type hoods and elastic pant cuffs. Duct tape can be used to alter the suits and to patch tears. Protective suits should be properly disposed of prior to leaving the accident site.

Disposable shoe covers and protective boots - Disposable shoe covers made of polyvinyl chloride (PVC) or butyl rubber is recommended. Leather, rubber or Gortex work boots are also acceptable. Disposable shoe covers and protective boots should be disinfected or properly disposed of prior to leaving the accident site.

Disinfection chemicals - Two chemical types are commonly used to disinfect personal protective equipment. Rubbing alcohol of 70% strength is effective and is available in towelettes, as well as in large hand towels. The most effective disinfectant solution is a mixture of common household bleach and water, with one part bleach to ten parts of water. Never mix alcohol and bleach.

Biological hazard disposal bags - Biological hazard disposal bags must be used for disposal of contaminated personal protective equipment. The bags are red or orange and are labeled “biological hazard”. For transport, the disposed material should be double bagged.

21.5.4 Removal of PPE

PPE should be removed carefully. Investigators should carefully pull off the outer work gloves first, then peel off the latex gloves and drop both pairs into a biological hazard disposal bag. Contaminated personal protective equipment should never be reused. Exposed skin should be wiped immediately with moist towelettes, and then washed with soap and water or a solution of one part chlorine bleach to 10 parts of water. A new bottle of bleach solution should be mixed every day. Contaminated eyes should be flushed with fresh water. Special attention should be given to thorough hand washing after removing latex gloves and before eating, drinking, smoking, or handling contact lenses.

21.6 First Aid Kit

No	Item	Qty
01	Antiseptic soothing cream	01
02	Cotton wool roll	01
03	Detol bottle	01
04	Detol soap	01
05	Gauze packet	01
06	Mosquito Repellant bottle	01
07	Plaster Roll	01
08	Siddhalepa packet	01
09	Pair of scissor	01
10	Soframycin skin cream	01
11	Surgical spirit bottle	01

CHAPTER 22 –

EXPENSES AND LIABILITY

22. Expenses and Liability

22.1 General

Any expenses incurred by reason of anything done by the Chief investigator or the persons designated to assist him in exercise of any access rights or powers for the purposes of the investigation shall be recoverable as detailed by the Aircraft Accident and Incident Investigation Regulations of Sri Lanka.

22.2 Expenses for removal of aircraft and disposal of aircraft and wreckage

Any expenses incurred by reason of anything done by the Chief investigator or the persons designated to assist him in exercise of any access rights or powers for the purposes of the investigation shall be recoverable as detailed by the Aircraft Accident and Incident Investigation Regulations of Sri Lanka.

22.3 Liability

For an accident/incident in the territory of Sri Lanka, the Authority and the Chief Investigator will not be liable for any damage done to the accident/incident aircraft during its removal by the Authority or the Chief Investigator either because of the absence of the owner, operator or hirer of the aircraft, or because of failure by the owner, operator or hirer to comply with the order by the Authority or the Chief Investigator to remove the aircraft.

Similarly, the Authority, the Chief Investigator, the Investigators assisting the Chief Investigator, the accredited representatives and any of advisors will also not be liable for any damage done to the accident/incident aircraft (for accident/incident in the territory of Sri Lanka) in the course of the investigation, or to any other aircraft or object or evidence required by them in the course of the investigation, where there has been no negligence on their part Nevertheless, investigators are reminded to exercise due care and to minimize damage to any aircraft or object or evidence in the course of the investigation.

22.4 Guidance for the determination of aircraft damage

1. If an engine separates from an aircraft, the event is categorized as an accident even if damage is confined to the engine.

2. A loss of engine cowls (fan or core), or reverser components, which does not result in further damage to the aircraft is not considered an accident.

3. Occurrences where compressor or turbine blades, or other engine internal components are ejected through the engine tail pipe are not considered an accident.

4. A collapsed, or missing radome, is not considered an accident, unless there is related substantial damage in other structures or systems.

5. Missing flap, slat and other lift augmenting devices, winglets, etc, that are permitted for dispatch under the Configuration Deviation List (CDL) are not considered to be an accident.

6. Retraction of a landing gear leg, or wheels up landing, resulting in skin abrasion only. If the aircraft can be safely dispatched after minor repairs, or patching, and subsequently undergoes more extensive work to effect a permanent repair, then the occurrence would not be classified as an accident.

7. If the structural damage is such that the aircraft depressurizes, or cannot be pressurized, the occurrence is categorized as an accident.

8. The removal of components for inspection following an occurrence, such as the precautionary removal of an undercarriage leg following a low speed runway excursion, while involving considerable work, is not considered an accident unless significant damage is found.

9. Occurrences that involve an emergency evacuation are not counted as an accident unless someone receives serious injuries, or the aircraft has otherwise sustained significant damage.

10. Note 1 - Regarding aircraft damage which adversely affects the structural strength, performance or flight characteristics, the aircraft may have landed safely, but cannot be safely dispatched on a further sector without repair.

Note 2- If the aircraft can be safely dispatched after minor repairs and subsequently undergoes more extensive work to effect a permanent repair, then the occurrence would not be classified as an accident. Likewise, if the aircraft can be dispatched under the CDL with the affected component removed, missing or inoperative, the repair would not be considered as a major repair and consequently the occurrence would not be considered an accident.

Note 3 - The cost of repairs, or estimated loss, such as provided by insurance companies may provide an indication of the damage sustained, but should not be used as the sole guide as to whether the damage is sufficient to count the occurrence as an accident. Likewise, an aircraft may be considered a ‘hull loss’ because it is uneconomic to repair, without it having incurred sufficient damage to be classified as an accident.

CHAPTER 23-

ANALYSIS OF DATA DERIVED FROM THE ESTABLISHED AVIATION OCCURRENCE REPORTING SYSTEM

23. Analysis of Data derived from the established Aviation Occurrence Reporting System

1. The CAASL Accident Investigation Unit (AIU) shall;
   1.1. Provide the CAASL's co-ordination center for the Occurrence Reporting System
   1.2. Form the central point for receipt of Mandatory Occurrence Reports and as well as E5f files (ECCAIRS system)
   1.3. Storage of occurrence report information and data derived
   1.4. Identify the nature of those occurrences and direct the reported occurrences to the appropriate specialist Sections within the CAASL for action as stated in this Chapter.
   1.5. Submit monthly/quarterly analysis / statistics to DGCA.
   1.6. Maintain the ECCAIRS data base.

2. Technical Sections

The respective technical Sections of CAASL shall take action as necessary to study and where necessary, investigate into reported occurrences. The Sections shall also make trend analysis of such occurrences. Based on the results of the reports of the investigations and trend analysis of occurrences, decide and recommend the nature of follow up action required by the CAASL. The respective Technical Sections shall finally compile safety data based on the occurrence reports, investigations conducted, findings, safety recommendations and follow up actions. Safety data shall be stored in the AIU of the CAASL.

The reports which do not require follow up action by CAASL are classified as "closed" and those reports which require follow up actions are classified as "Open" until such time they could be considered as "closed" after resolution of all safety concerns. The Occurrence Report data base shall contain all appropriate data from the moment of the finding of an occurrence report to the closure of the reported occurrence.

2.1. Action by the Technical Sections

2.1.1. Upon the receipt of Occurrence report study the occurrence report and analyze information received

2.1.2. Decide whether the occurrence reported require

- Only acknowledgement and storage; or;
- Direct follow up action on information provided; or
- Investigation and follow up actions

2.1.3. If only acknowledgement is necessary, inform AIU indicating 'Closed on Receipt" and channel documents in hard copy and / or electronic format to the AIU for storage. Retain data derived out of the occurrence report for future use and trend analysis. Provide derived data to the AIU for storage.

2.1.4. If follow up action to the reported occurrence could be recommended without requiring an investigation, do so with a copy to the AIU. Ensure receipt of the response of implementation of the recommended follow up action by the reporter of the occurrence report. Channel documents in hard copy and / or electronic format to the AIU for storage. Derive data out of the Occurrence report and retain for future use and trend analysis. Provide data for storage at the AIU.

2.1.5. If investigation and follow up action is necessary on the reported occurrence, the investigation could either be assigned to the Organization who reported the occurrence or could be undertaken by the relevant Section of the CAASL. Both these processes would ultimately end up with safety recommendations, follow up actions and completion of follow up actions. At the end of the entire process, channel documents in hard copy and/or electronic format to the AIU for storage. Derive data out of the occurrence report and retain the AIU for storage.

2.1.6. An investigation conducted by the CAASL shall involve, field inspections, document and evidence inspections and evaluations, interviews etc and analysis.

2.1.7. Any instruction or directive arising out of occurrence reports and subsequent investigations shall be compiled in draft form and submitted to the Director General with the observations/recommendations of the respective Director concerned. Channel documents in hard copy and / or electronic format to the AIU for storage. Derive further data out of the final report of the investigation and retain for future use and trend analysis. Provide data for storage at the AIU.

2.1.8. Implementation of safety measures arising out of the reported occurrences shall be done with the approval of the Director General of Civil Aviation.

2.1.9. Safety interventions required, based on inspections conducted by the CAASL inspectors shall also be channeled to AIU for storage.

2.2. Present the final advise / circular at Tech Review meeting

2.2.1. If an occurrence reported to the CAASL, which meet the criteria for a reportable occurrence, has already been adequately dealt with by the reporting organization, there would be no justification for further investigation by the CAASL. As such CAASL will take action only to store and disseminate the details of those occurrences.

2.2.2. Reports which come under the above category are considered as "closed on receipt". The principal justification for closure is that evidence

from the report proves that existing requirements, procedures, documentation etc., coupled with the reporter's actions, have adequately identified the deficiency or the hazard and the deficiency has been rectified or the risks have been mitigated. Such instance would be recommended as "closed on receipt" by the AIU to the DGCA for approval.

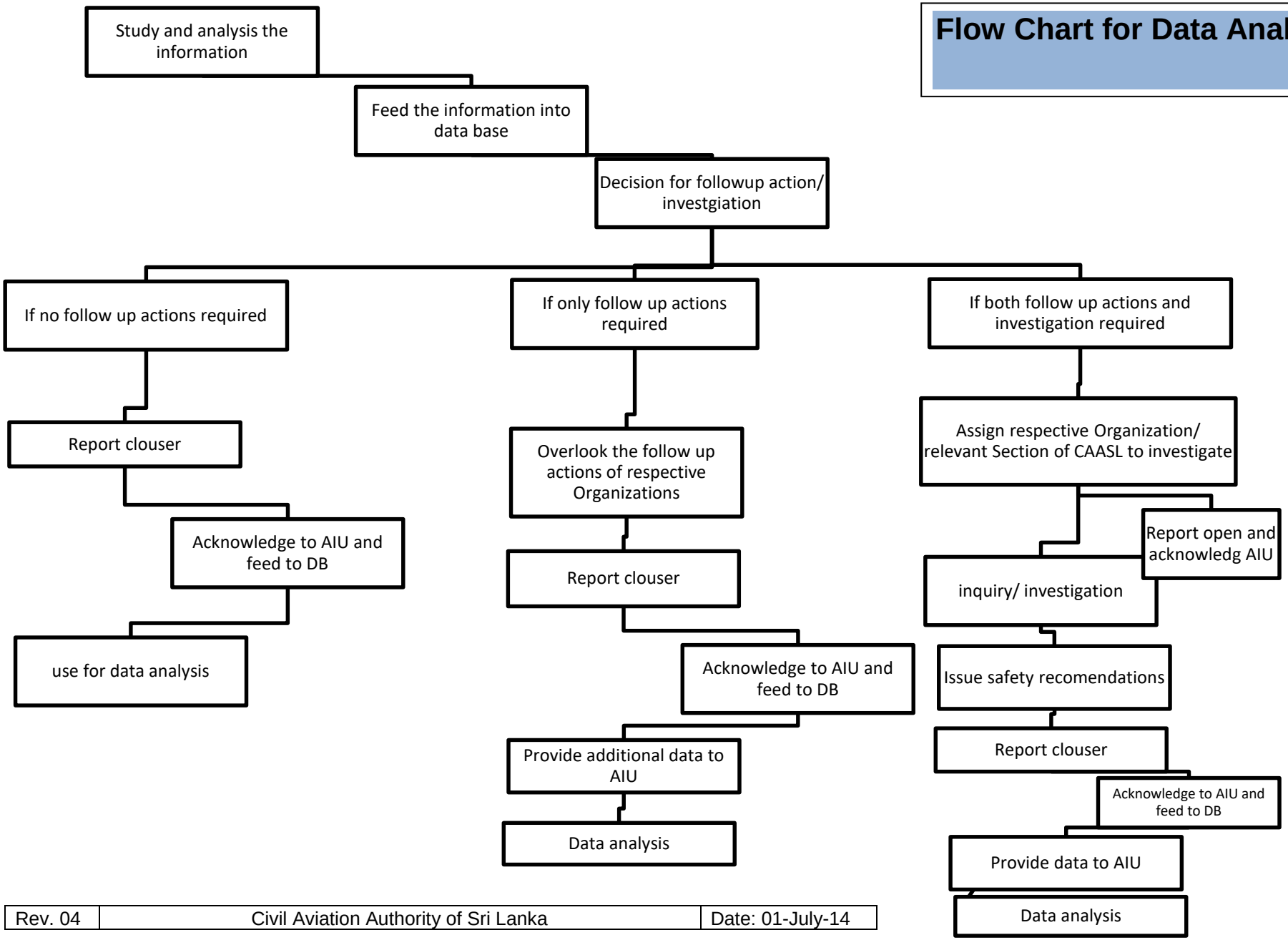
2.2.3. The ability of the DGCA to close an occurrence on receipt and thus avoid the need for further CAASL investigation is very much dependent upon the quality of the information provided in the report and specifically information on the action taken by the reporting organization to control the situation.

2.2.4. The above circumstance too, the reported information will be submitted to the relevant technical Sections in the CAASL for analysis to derive Data for trend analysis, storage and future use. Copy of the final derived data shall be forwarded to the AIU for storage.

2.2.5. When required the data will be shared with other relevant foreign authorities, specially the occurrence had been occurred in foreign aerodrome or another FIR.

The outcome and the recommendation of the inquiry received by the other State of organization will be notify to the operator.

Flow Chart for Data Analysis



Appendix -1- Guidelines for Flight Recorder Read-out and Analysis

1. Initial response

The Authority has identified that its demanding time is the aftermath of a major accident. One of the immediate decision has to be taken by the Authority after the accident or serious incident as to where to find the flight recorder and subsequently read out and analyse. It is essential that the flight recorders be read out as early as possible after an accident. In this effect the Authority has understood that the early identification of problem areas can affect the investigation at the accident site where evidence is sometimes transient. Early identification of problem areas may also result in urgent safety recommendations which may be necessary to prevent a similar occurrence.

Since Sri Lanka does not have its own facilities for the playback and analysis of flight recorder information (both voice and data) and the Authority will request assistance from other States having the facility.

2. Choice of facility

The Authority will request assistance from any State that, in its opinion, the said States can best serve the investigation. The Authority feels that manufacturer's standard replay equipment and playback software, which is typically used by airlines and maintenance facilities, is not considered adequate for investigation purposes. Special recovery and analysis techniques are usually required if the recorders have been damaged.

According to the requirement of the Authority, facilities for the read-out of flight recorders should have the following capabilities:

a) the ability to disassemble and read out recorders that have sustained substantial damage;

b) the ability to play back the original recording/memory module without the need for the use of a manufacturer's copy device or the recorder housing that was involved in the accident or incident;

c) the ability to manually analyse the raw binary waveform from digital tape flight data recorders;

d) the ability to enhance and filter voice recordings digitally by means of suitable software; and

e) the capability to graphically analyse data, to derive additional parameters not explicitly recorded, to validate the data by cross-checking and other analytical methods to determine data accuracy and limitations.

3. Participation by the State of Manufacture (or Design) and the State of the Operator

The State of Manufacture (or Design) has airworthiness responsibilities and the expertise normally required to read out and analyse flight recorder information. Since flight recorder information can often reveal airworthiness problems, the Authority will ensure that the State of Manufacture (or Design) will have a representative present when the flight recorder read-out and analysis are being conducted in a State other than the State of Manufacture (or Design).

Since the State of the Operator has regulatory responsibilities regarding the flight operation and can provide insights into operational issues which may be specific to the operator and that the flight recorder information can reveal operational problems,the Authority will ensure that the State of the Operator will also have a representative present when the flight recorder read-out and analysis are being conducted.

4. Recommended procedures by the Authority

The flight data recorder and the cockpit voice recorder should be read out by the same facility, because they contain complementary data which can help validate each recording and aid in determining timing and synchronization.

Flight recorders should not be opened or powered up and original recordings should not be copied (particularly not by high-speed copy devices) prior to the read-out because of the risk of damage to the recordings.

The facility at which the flight recorders are read out for another State should be given an opportunity to comment on the Final Report in order to ensure that the characteristics of the flight recorder analysis have been taken into account.

The facility at which the flight recorders are read out may require the expertise of the aircraft manufacturer and the operator in order to verify the calibration data and validate the recorded information.

The Authority will ensure to leave the original recordings, or a copy of them, with the read-out facility until the investigation is completed, in order to facilitate the timely resolution of additional requests or clarifications, providing that the facility has adequate security procedures to safeguard the recordings.

Appendix -2- Sample letters to be issued to Investigators

Appointment Letter

APPOINTMENT TO ACT AS THE CHIEF INVESTIGATOR/ AN INVESTIGATOR

Letter Ref. AU/…/…. Date:

Name of the Investigator,

This is to inform you that the Civil Aviation Authority has appointed an Aircraft Accident Investigation Board in terms of Section 56 of Civil Aviation Act No 14 of 2010 to carry out an investigation with regard to the accident/serious incident/incident took place at the (place) as described below.

Aircraft Type :
Registration :
Operator :
Flight Number :
Place of accident/serious incident/incident :
Date of accident/serious incident/incident :

You are hereby appointed to act as the Chief Investigator/ Investigator of the above Aircraft Accident Investigation Board which comprises of the following members.

Name of the Investigator - Chief Investigator
Name of the Investigator - Member
Name of the Investigator - Member
Name of the Investigator - Member
Name of the Investigator - Member

The validity of this appointment will remain in force until the accident/serious incident/incident investigation is completed, unless withdrawn sooner.

You are required to carry out the accident investigation in terms of the provisions in the Civil Aviation Act no. 14 of 2010 and Regulations made thereunder. You are kindly informed to submit the attached declaration prior to entering upon your duties.

……
Chairman
Civil Aviation Authority of Sri Lanka

Civil Aviation Authority of Sri Lanka
No. 152/1, Minuwangoda Road
Katunayake

Sample Letter to be issued by the Chief Executive Officer, CAA when releasing the CAA staff Members to serve as members of the Accident / Incident Board, appointed by the Civil Aviation Authority

Name :

Designation :

Reference : Letter of empowerment No…….. dated …… issued by the Chairman, Civil Aviation Authority in appointing you as a member of the Accident /Incident Investigation Board for the purpose of investigating aircraft accident / incident on …….. at ……

In view of the appointment letter issued to you by the Chairman, Civil Aviation Authority of Sri Lanka which is referred to above, I wish to hereby confirm that you are relieved from the regular duties and functions assigned to the post that you hold in the Civil Aviation Authority completely with immediate effect in order to facilitate you to engage in the assigned task.

Furthermore you are also relieved during the period of this investigation from all encumbrances and obligations cast upon you under the letter of appointment and you have the complete freedom to act as an independent person for the purpose of conducting the investigation. You are assured that your legitimate activities or actions as an Investigator which is performed for or on behalf of the Investigation Board will not be held against you or your future career with the Civil Aviation Authority of Sri Lanka. Also you will not be requested to disclose or divulge any of the matters or information connected with or incidental to, the conduct of the investigation.

Please hand over all of your current duties and functions to Mr/Ms. ……

Please note that you should not get involved any of the CAA activities during the period of release, without approval from me in writing.

……..
Director General of Civil Aviation and
Chief Executive Officer.

Date :

TERMS & CONDITIONS - AAIB

You have been appointed to investigate the accident/incident into …….. flight …….. occurred in dd/mm/yy at (place)……..

The following terms & condition shall be complied by you in conducting the investigation.

1. The investigation shall be conducted in camera
2. The investigation shall in no way be considered as being in derogation of any power which under any other law may attach to any police, judicial or other investigation, provided that the Board shall have priority in the examination of the relevant evidence.
3. You shall not make the following records available to any person for any purpose;
   a. All Statements recorded by you in the course investigation;
   b. All communications between persons involved in accident or incident;
   c. Medical or personal information regarding persons involved in the accident or incident;
   d. Cockpit voice recordings, flight data recordings, recordings from the air traffic control units and transcripts from such recordings;
   e. Opinions expressed on the analysis of information, including flight recorder information; and
   f. Any records not directly related to the analysis of the accident or incident investigated
4. You are deemed to be a public servant within the meaning of Penal Code as long as you are acting as a member of this Aircraft Accident Investigation Board.
5. The Aircraft Accident Investigation Board that you serve has the power to;

   I. Summon under its Chief Investigators' hand and call before it and examine all such persons whom it considers necessary;

   II. Require any person summoned to answer any question or furnish any information or produce any books, papers, documents or articles which the Board may consider relevant and retain any such books, papers, documents and articles, until the completion of the investigation;

   III. Take statements from all such persons as it considers necessary and to require any such person to make and sign a declaration relating to the truth of the statement made by him;

   IV. Have unhampered and unrestricted access to the aircraft wreckage, flight recorders, air traffic records, the place where the accident occurred and to any other relevant material and for that purpose to require the aircraft concerned or part of the equipment thereof to be preserved unaltered, to enable a detailed investigation to be made without delay;

   V. Examine, remove, test, take measures for the preservation of and otherwise deal with the aircraft or any part thereof or anything contained therein;

   VI. Enter and inspect any place or building where it appears to be requisite for the purposes of the investigation; and

VII. Take all measures necessary for the preservation of evidence.

6. You may also aware that no person summon as a witness to this investigation shall;
    a. Disobey a summoned issued by the Board;
    b. Refuse to be sworn in or to make an affirmation as a witness;
    c. Fail to answer any question which he or she is lawfully required to answer; or
    d. Refuse or fail to produce ant documents or part or component of an aircraft which he or she or lawfully required to produce.
7. Your function as a member of Aircraft Accident Investigation Board shall cease with the submission of the final report to the Authority.

Appendix -3 - Notification of Accident / Incident Recording Form

CAA/AU/001

Civil Aviation Authority of Sri Lanka

Notification of Accident / Incident Recording Form

Date :		Time :	

Mode of Information :Tele ☐ Fax ☐ AFTN ☐ E mail ☐ NOTAM ☐

Notifying Person

Name:

Position:

Company:

Contact Details:

Date of Occurrence:

Time of Occurrence -: UTC:	Local:
Location:	Country:

Name of Owner:

Operator:

Hirer:

Details of Aircraft

Manufacturer (Type):

Model:

Nationality:

Registration Mark:

Serial Number:

Pax / Cargo / Both:

Time of Departure:
Last point of Departure:
Point of Intended Landing:
Name/ Qualification of Pilot-in-Command:
Total Number Onboard:
Total Number of Crew:
Total Number of Passengers:
Total Number of Fatalities:
Total Number of Injured:
Nature of Accident:
Extend of Damage:
Geographical / Topographical Characteristics of Accident Area:
Presence and Description of Dangerous Goods:
Completed by : Name & Designation:…… Signature: …… Data ……
Chairman's/DGCA's instructions:

Appendix - 4 - Notification of an accident/ serious incident

CAA/AU/002

Civil Aviation Authority of Sri Lanka

Notification of an accident/serious incident

FAX : +94-11- 2257154 TEL : +94–11–2358817/2358819 E-MAIL : sldgca@caa.lk ; mgraaii@caa.lk

C.C ☐ State of Registry ☐ State of the Operator ☐ ICAO

☐ State of Manufacture ☐ State of Design

a)	Identification (ACCID / INCID)	ACCID (Accident) ☐	INCID (Serious Incident) ☐	Incident (Optional) ☐
b)	Aircraft Data			
	1. Manufacturer			
	2. Model			
	3. Nationality			
	4. Registration			
	5. Serial Number			
c)	Name and Address of ;			
	1. Owner			
	2. Operator			
	3. Hirer			
d)	Qualification of the Pilot-in-Command and nationality of crew and passengers			
e)	Date of Accident or Serious incident			
	Time of Accident or Serious incident (Local / UTC)	(LT) ☐	(UTC) ☐	
f)	Last point of Departure			
	Point of intended Landing			
g)	Location of the accident or serious incident			
h)	Number of crew and passengers; aboard, killed and seriously injured. Others : killed and seriously injured	Persons on board ____crew ____pax Fatal ____crew ____pax ____others Serious Injury ____crew ____pax ____others Minor ____crew ____pax ____others		
i)	Description of the accident / serious incident			

j)	Level of damage to aircraft (If information is available)	Destroyed ☐ Substantial ☐ Minor ☐ None ☐
k)	Extent of Investigation	
l)	Physical characteristics of the accident/ serious incident area	
m)	Presence and Description of Dangerous goods	
n)	Identification of originating authority, contact details of the investigator-in-charge and accident investigation authority	

Name, Organization and contact information of person/organization submitting notification:	Name: Title: Organization: Address: Telephone: Email:

Appendix -5 - Aircraft Accident /Serious Incident Report Form

CAA/AU/003

Civil Aviation Authority of Sri Lanka

Aircraft Accident/ Serious Incident Report Form

Provide as much details as possible immediately. The purpose of this form is to collect immediately the mandatory information pertaining to the accident/incident for CAA to act immediately for the investigation and review the causes.

Completed form should be submitted at the earliest possible to: Civil Aviation Authority, No 152/1, Minuwangoda Road, Katunayake.

Fax:+94-11-2257154; Tel:+94-11-2358817,+94-11-2358819;E-mail:sldgca@caa.lk;mgraaii@caa.lk

Role of reporter in relation to the aircraft:

☐ Crew ☐ Operator ☐ Rescue/Fire Service ☐ Owner ☐ Aerodrome Operator ☐ Other (Pl. specify) .....

Personal particulars of reporter

Your name

Designation

Contact Address

Telephone

Fax

E mail

Crew & Operators Details

Qualification of PIC

Nationality

Type of Licence

Licence No. & Date

Qualification of First Officer

Nationality

Type of Licence

Licence No. & Date

Name of additional crew

Nationality

Crew position

Aircraft registration

Flight Number

Aircraft make & model

Aircraft Owner

Aircraft Operator

if hire name of renter/hirer

Operator's Telephone

Fax & E mail

Accident /incident details

Date of Accident / Incident

Time – UTC & Local

Location

Last departure pt.

Intended destination

Actual point of landing (if different)

ATS route

Heading

IAS(Kt)

Mach number

Flight Level/Attitude

Number of Person on board

Total Crew on board

No Injuries

Minor Injuries

Serious Injuries

Fatalities

Total pax on board

No Injuries

Minor injuries

Serious Injuries

Fatalities

No of persons injured on ground

Minor injuries

Serious injuries

Fatalities

Other Company employees onboard (Specify duties)

Aircraft damage

Destroyed ☐ Substantial ☐ Minor ☐ Nil ☐ Damage description

Effect on flight

None ☐ Rejected T/O ☐ Precautionary landing ☐ Engines shut down ☐ other ☐

Weather condition

Wind speed

Visibility

Precipitation

Cloud(type, amount & base)

Temperature (C)

Cloud Top

Cloud Base

QNH

QFE

Rain (Drizzle/Light/Moderate/Heavy)

Icing (Nil/Light/Moderate/Sever)

Other information relevant to the event

Flight rules **VFR** ☐ **IFR** ☐

Flight condition **VMC** ☐ **IMC** ☐

Light condition **Day** ☐ **Night** ☐ **Twilight** ☐

ELT information: (as Applicable)ELT manufacturer and model

Fixed ☐ Portable ☐

Manual activation ☐ Automatic ☐ Did not activate (Why?) ☐ _____

ELT location

Cockpit ☐ Cabin ☐ Rea/tail ☐ Other ☐ _____

Phase of Flight

☐ Parked ☐ Pushback ☐ Taxing out ☐ Lined up ☐ Take off roll ☐ Holding(specify)

☐ Lift off ☐ Climb ☐ Cruise ☐ Descent ☐ Approach ☐ Circuit

☐ Touchdown ☐ Taxi in ☐ L/ Roll

Airspace designation _____ Runway state Dry /Wet/ Ice/ Snow/ Slush Category I/II/III

Type of Operation

ETOPS ☐ Passenger ☐ Freight ☐ Ferry ☐ Test ☐ Training ☐

Business ☐ Other(Specify) ☐

Description of Dangerous goods on board

Wildlife strike

Was bird or animal involved: ☐ No of Bird ☐ Small/Medium/Large Species _____

Description of Accident/Incident (All relevant documentation should be forwarded to CAASL. Attach additional paper if required.)

Include your suggestions as to how this type of occurrence could be prevented. (Attach additional paper if required.)

Signature _____ Date _____

Appendix- 6- Accident Investigation Tools and Equipment Check List

Personal Items
20 __ (Yr) -_____ (Month)

Item	Description	Type	Unit	Quantity	Checked
	Luminous Vests		Ea	14	
	Rain Coats		Ea	07	
	Hats		Ea	07	
	Boots		pair	07	
	Safety Gloves -	Heavy	Pair	07	
		Light	Pair	07	
		Surgical	Box	01	
	Whistles			06	
	Pen Knives			07	
	Flash Lights			07	
	Cells(For flash Light)		Set	07	
	Scissors	Small		07	
	Field Note books			07	
	Ruler			07	
	Inspectors Files			07	
	Dusting Brush		Ea	07	
	Mobile Pouches			07	
	Corrective Pens			07	
	Inspector’s Bags			07	

Checked by;

Name & designation: ……...

Signature : ……

Date :……..

Investigation Field Kit

20___ (Yr) - ____ (Month)

Item	Description	Type	Unit	Quantity	Checked
Survey Equipment					
	Map of Sri Lanka		Ea	01	
	Map of Provincial		Set	07	
	Map of World			01	
	Measuring Tape	100ft		01	
	Measuring Tape	10ft		01	
	Nylon Rope		Roll	01	
	Barrier Tapes		Roll	03	
	Twin/Cord		Roll	03	
	Cordoning Tape	Yellow	Roll	01	
	GPS			01	
	Compass with Inclinometer		Ea	01	
02. Marking Equipment					
	Sealing Tapes		Roll	04	
	Sticker Identification	Paper	Packet	01	
	Marking Pen		Packet	02	
	Rubber Bands		Packet	02	
03. Tools and Sampling Materials					
	Tool Kit		Kit	01	
	Mechanics' Mirror		Ea	01	
	Magnifying Glasses		Ea	02	
	Containers		Ea	05	
	Plastic Bag		Packet	01	
	Sample Bottles		Plastic	05	
	Air Tight Baskets		Plastic	03	
04. Miscellaneous Items					
	Tape Recorder (Portable)	Micro	Ea	01	
	Recording Tapes	Micro	Packet	03	
	Stop Watch			01	
	First Aid Kit		Kit	01	
	Cloth, Dusting		Ea	01	
	Mega Phone		Ea	01	
	Cell for Mega Phone		Set	04	
	Binocular with a Tripod			01	
	Digital Camera			01	
05. Personal Protective Equipment					
1.	Overalls (Reusable)	Dark		07	

		blue			
2.	Goggles (Reusable)			04	
3.	Full face mask			03	
4.	Half face mask			03	
5.	Twin filter cartridge		pairs	06	
6.	Safety helmet			07	

Checked by;

Name & Designation: …….

Signature:……

Date: ……..

Appendix – 7 – Go Team Letter

All Investigators,

I wish to inform you that you have been included in the board of aircraft accident investigation, which I have constituted for the purpose of conducting investigation into aircraft accidents, under the Civil Aviation Act. You will continue to serve in the Panel unless removed in writing.

The date, time & venue where your services would be specifically required, would be notified to you, separately, depending on the necessity.

It is expected that you would be available on call as per the details given to me already. Therefore in the likely event that you would not be contactable as the numbers given to this office already, you are kindly requested to notify the CAA Accident Investigation Unit along with the details of the contactability. You are requested to keep ready a “go-bag” containing the essential items and to be present on call, as early as possible.

Also please be informed that you shall continue to provide your services in the conduct of accident investigation once summoned until you are officially released. Voluntary retirement from accident investigation whilst the process is on-going, is not expected.

In the unlikely event of non contactability, you would be sent a SMS containing the message “MAYDAY - X” originated by CAA – AIU. On receipt of such a SMS, you are expected to call immediately the CAA – AIU for further details, regarding the services expected from you.
(X – Field Major, Field, Limited, Incident, Delegated, Special depending on the nature of the accident as per the accident classification procedures.)

Yours faithfully,

Chairman
Civil Aviation Authority of Sri Lanka

Appendix – 8 - List of examples of serious incidents

Serious incident - An incident involving circumstances indicating that there was a high probability of an accident and is associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time it comes to rest at the end of the flight and the primary propulsion system is shut down.

The incidents listed are typical examples of incidents that are likely to be serious incidents.

The list is not exhaustive and only serves as guidance to the definition of serious incident.

1. Near collisions requiring an avoidance manoeuvre to avoid a collision or an unsafe situation or when an avoidance action would have been appropriate.
2. Collisions not classified as accidents
3. Controlled flight into terrain only marginally avoided.
4. Aborted take-offs on a closed or engaged runway, on a taxiway* or unassigned runway.
5. Take-offs from a closed or engaged runway, from a taxiway* or unassigned runway.
6. Landings or attempted landings on a closed or engaged runway, on a taxiway* or unassigned runway.
7. Gross failures to achieve predicted performance during take-off or initial climb.
8. Fires and/ or smoke in the cockpit, in the passenger compartment, in cargo compartments or engine fires, even though such fires were extinguished by the use of extinguishing agents.
9. Events requiring the emergency use of oxygen by the flight crew.
10. Aircraft structural failures or engine disintegrations, including uncontained turbine engine failures, not classified as an accident.
11. Multiple malfunctions of one or more aircraft systems seriously affecting the operation of the aircraft.
12. Flight crew incapacitation in flight.
13. Fuel quantity level or distribution situation requiring the declaration of an emergency by the pilot, such as insufficient fuel, fuel exhaustion, fuel starvation, or inability to use all usable fuel on board.
14. Incidents related to runway incursions including
15. Take-off or landing incidents. Incidents such as undershooting, overrunning or running off the side of runways.

16. System failures, weather phenomena, operations outside the approved flight envelope or other occurrences which caused or could have caused difficulties controlling the aircraft.
17. Failures of more than one system in a redundancy system mandatory for flight guidance and navigation.
18. The unintentional or as an emergency measure, the intentional release of a slung load or any other load carried external to the aircraft.
19. Air traffic services related incidents; such as ATM-specific occurrences, ATC Navigation and Communications significant malfunction or deterioration of service, ATC overload, failure or unplanned shutdown of a major operational ATC computer system
20. Decompression
21. Bomd onboard aircraft on ground or inflight
22. Biological / Chemical threats onground or inflight
23. Highjacking inflight or onground
24. Any other incident on ground or in air or in and around operational airport which requires further investigations by CAASL as per the evaluation of Accountable Manager of the Responsible Organization.

(note *: excluding authorized operations by helicopters)

All occurrences related to different areas are described in Implementing Standard 006 on Aviation Occurrence Reporting System.

Appendix - 9 - Speciemen of the MOU

MEMORANDUM OF UNDERSTANDING

Between

Civil Aviation Authority of Sri Lanka (CAA-SL)

and

…… (“Party”)
on

Aircraft Accident and Incident Investigation

Whereas, CAA-SL and the …… (the “Parties”) recognize that, in the event of an accident to a civil aircraft occurring in Sri Lanka and involving death or serious injury, or indicating a serious technical defect in the aircraft or air navigation facilities, an inquiry shall be initiated by the CAA-SL into the circumstances of the accident, pursuant to Civil Aviation Act of 2010 and Regulations made thereunder on Aircraft Accident and Incident Investigation;

Whereas, such inquiry shall be carried out by an independent body of experts appointed by the Civil Aviation Authority of CAA-SL or delegated as a whole or in parts thereof to another State should the circumstances of the accident so warrant;

Whereas, the investigation shall be conducted in accordance with the provisions of Article 26 of the *Convention on International Civil Aviation* (Chicago 1944), Annex 13 - *Aircraft Accident and Incident Investigation* and the guidance contained in the International Civil Aviation Organization (ICAO) *Manual of Aircraft Accident and Incident Investigation* (Doc 9756), as well as other relevant ICAO documents,

Acknowledging the importance of establishing a standardized basis for the investigation of civil aircraft accidents and incidents which occur in Sri Lanka,

Recognizing that the purpose of the investigation shall be to determine the probable cause or causes to the accident and to prevent the repetition of similar accident, while confirming that the investigation shall not seek to attribute blame or liability and shall not prejudice any other investigation that may be undertaken by any other organ,

Recognizing the need for co-ordination between the Chief Investigator of the Accident Investigating Body and the…….. (“Party”),

For the purpose of ensuring, in the event of an occurrence, that the necessary co-operation exists in order to ensure …… ("the coordination expected from the party") during investigations.

The Parties agree as follows:

The list duties expect from the "Party" by the Civil Aviation Authority of Sri Lanka.

1. ……

2. ……..

3. ……

4. …… .

5. This Memorandum of Understanding may be modified or amended by written agreement among parties hereto.
6. This Memorandum of Understanding is effective upon signature of the Parties and will remain in effect unless and until amended or modified under Article 5.

For CAA-SL

_____

CAA-SL
Date

for the "Party"

_____

"Party"
Date

Appendix 10- Autopsies and Toxicological Testing

The Chief Investigator has the responsibility to assure that an autopsy and toxicological exams are performed and to obtain copies of those reports. Autopsy and toxicological exams, including breathalyzer, blood test, urine test and any other tests should be accomplished through coordination with the Police, Health and any other relevant Departments as required.

In case of fatal accident the Chief Investigator or a delegated member of a Board conducting an investigation shall arrange, where necessary in consultation with the Authority and Judicial Authorities for a complete autopsy examination to be carried out by a pathologist, preferably experienced in accident investigation, of all crew members and subject to the particular circumstances of the case, of any passengers and cabin attendants who were killed due to the accident. These examinations shall be carried out as expeditiously as possible.

The Chief Investigator or a delegated member(s) of a Board conducting an investigation shall, where appropriate in consultation with the Authority, arrange for a medical examination to be carried out of all the crew members, passengers and any aviation personnel involved in any accident or incident, by a physician preferably experienced in accident investigation. Such examinations may also include an examination for purpose of determining whether the level of physical and psychological fitness of the crew members and other personnel directly involved in the accident or incident are of such nature as to enable them to contribute and participate at the investigation being conducted. These examinations shall be carried out as expeditiously as possible.

Toxicological tests shall be performed on all fatally injured crew members and passengers with access to the flight controls. Consideration should be given to toxicological testing of passengers when death was associated with an in-flight or post-crash fire. It is the Chief Investigator's responsibility to assure that toxicological samples are obtained and handled properly.

The Chief Investigator or a delegated member(s) of a Board conducting an investigation shall arrange the toxicological test including breathalyzer and any other tests of flight attendants, ATC personnel, airport personnel, mechanics, dispatchers, and other persons depending on the nature of the accident/incident. Toxicological samples shall be collected from all ATC personnel who were communicating with, controlling, or supervising the control of an aircraft which was involved in an accident/incident where performance or judgment of the controller may be a factor. Samples from ATC personnel must be obtained in writing to the appropriate supervisor(s).

Timeliness of the collection of samples is essential in determining performance impairment. Arrangement should be made to collect samples within 24 hours of the accident/incident. Arrangement should be made to collect samples, include both blood and urine. Urine samples may be used to determine the presence of alcohol and drugs, but cannot be used to determine the extent to which performance may have been impaired at the time of the accident/incident. Denial of toxicological sample requests will be documented in the Chief Investigators factual report.

Shipping instructions for toxicological samples shall be followed and the toxicological sample boxes should be used for such purposes.

Instructions for handling of toxicological samples are given in the below. Once samples are collected, the Chief Investigator shall arrange for the storage and shipment of the samples.

Arrangements for analysis of the toxicological samples

The Chief Investigator will locate a medical facility which will take the toxicological samples. These arrangements will be made prior to sending the individual to the facility. The arrangements should include payment, handling and storage of the samples, and initiation of a chain of custody for the samples.

These samples are typically drawn by hospital personnel (for living subjects) or pathologist (for deceased subjects) before the investigator arrives on-site. It is the responsibility of the Chief Investigator to oversee that samples are collected and tested properly. When first notified of the accident, and before leaving for the accident site, the Chief investigator should ensure that timely requests are made through the proper authorities for toxicological.

Most toxicology specimens, including urine and blood should be drawn as soon as practical after the accident to provide suitable samples for toxicological testing. Always keep a second sample in cold storage so that it can be tested later if the first tests are not conclusive. Alcohol swabs should not be used during the drawing of blood. The blood samples must be sealed as "legal" evidence, preserved with Sodium Fluoride (NaF) and refrigerated.

The individual will be directed to the appropriate facility.

The Chief Investigator must arrange for the shipment of samples to a testing facility. Tests may be performed at the medical facility if they have the capability to do so. If not, the samples should be shipped to suitable facility in consultation with the appropriate authorities.

If a determination is made not to test the sample(s), the individual who gave the samples should be contacted. The samples should either be returned to the individual or destroyed. This should be documented both on the chain of custody letter and in the factual report.

The Chief Investigator may delegate the task to Medical Assessor or Medical Examiner to interacts with the proper medical and Laboratory authorities to track and assist with proper protection and testing of the samples. Activities include locating and documenting the available samples, assisting as needed in arranging for laboratory testing, assisting as need in preserving a proper chain-of-custody, giving input to the laboratories on desired tests, and obtaining and Interpreting the toxicology results. It is the responsibility of the Chief Investigator or Human Performance/ Human Factors Investigator to oversee the toxicology testing effort to insure that this very perishable information is collected in timely fashion and without error.

General Circular

General circular letter No.

02-59/2007

My No: MA/MS/ J/17/2007
Ministry of Healthcare & Nutrition,
"Suwasiripaya",
385, Rev Baddegama Wimalawansa Mw.
Colombo10

29 .05.2007

All Provincial Director of Health Services,
Deputy provincial Director of Health Services,
Divisional Director of Health Services,
Heads of Specialized campaigns,
Director of Teaching Hospital,
Heads of Institutions.

Assistance on medical examinations in case of an aircraft accident.

Civil aviation authority of Sri Lanka has requested the assistance of the Ministry of Health in conducting autopsy examinations and Medical Examinations of the crew, passengers and other aviation personnel in air craft accidents.

Civil Aviation Authority seeks the assistance of government MBBS medical Officers to perform tests/examinations mentioned above in any part of the country at the request of CAA as and when appropriate.

Therefore you are here by advised to extend your fullest assistance to civil aviation authority in case of a request to perform above mentioned examinations.

CEO's Secretariat
MCR Ref No
37541

Dr.U.A.Mendis
Actg. Director General of Health Services
CIVIL AVIATION AUTHORITY OF SRI LANKA

Appendix – 11- Interviewing Techniques

Purpose of interviews

Information collected from interviews is used to confirm, clarify, or supplement information learnt from other sources. In the absence of other data, interviews can become the singular source of information.

The role of an investigator, as an interviewer, is to obtain from witnesses evidence that is accurate, complete and as detailed as possible. To accomplish this, the investigator must:

- Be prepared
- Have a clear objective
- Have a good knowledge of the occurrence and related background information
- Be able to adapt to the witness' style
- Be willing to go beyond the actual facts

Witnesses for an occurrence investigation can include surviving flight crew and cabin crew, passengers, next-of-kin, eyewitnesses, air traffic controllers, maintenance personnel, training personnel, rescue and firefighting personnel, and management. Interviews should be conducted as soon as practicable to avoid:

- Loss of perishable information from fading memory
- Interpretation and rationalization of events
- Contamination caused by exchange of information (e.g. news media, other witnesses)

If it is not practicable to immediately interview individuals whose information is perishable, the investigators should request that they prepare a written statement. The investigators shall bear in mind that an interview is not an interrogation.

Preparing for the interview

The investigators should take time to thoroughly prepare for the interview and consider doing the following:

- Follow appropriate company or agency protocol when arranging for the interview
- Assess the audience and dress accordingly
- Prepare a brief on the status of the investigation
- Study the background information (e.g. relevant manuals, regulations)
- Prepare for technical descriptions and explanations
- Review the following:
    - The facts relating to the crash sequence

- The ATC or CVR/FDR tapes, if applicable
- Technical information (e.g. aircraft systems)
- Any operational peculiarities in procedures
- The crew's personal records
- Human performance references to identify relevant questions
- ATS and airport references, if relevant
- Any legal aspects

- Ensure all relevant documents and equipment (e.g. models, maps, pictures, diagrams of aircraft seat rows/exits/lavatories/galleys) are available
- Define the general objectives of the interview
- Prepare a set of appropriate questions to address all areas of concern during the interview
- Request the assistance of experts for interviews of a highly technical nature

The interview process

An interview is normally structured in three parts:

1. an opening
2. a main body and
3. a closing

An interview session should not last for more than two hours.

The number of people attending the interview should be as few as possible, e.g. two interviewers and the interviewee (plus maybe an expert). The interviewee may be allowed to be accompanied by a third person during the interview, provided that this person is not his superior. This person is not allowed to answer questions or to suggest answers to questions. Permission for his presence may be withdrawn if he is not cooperative.

If possible, the investigators should conduct interviews in a neutral location and select a location that is quiet and comfortable, free from interruptions and familiar to the interviewee (if appropriate).

The investigators should determine the language of choice of the interviewee. If the language is not one spoken by the interviewing investigators, arrangement should be made for another qualified investigator suitably fluent in that language to conduct the interview. If such an investigator is not available or if the interviewee cannot communicate effectively in a language spoken by the investigator, arrangement will have to be made for an interpreter.

The interview process - Opening

When opening an interview, the investigators should reassure the interviewee about:

- The purpose of the investigation (not for blame)
- Their roles as investigators in the accident
- The goals of the interview
- The importance of the information the interviewee may provide
- The interviewee's rights
- Protection of the statement made by the interviewee
- Use of tape recorder,
- The interview procedure to be followed

The investigators should establish a rapport with the interviewee at the outset by:

- Being polite
- Introducing themselves
- Having mobile phones turned off before the interview
- Behaving in a natural manner and not making the interview seem artificial
- Keeping interruptions to a minimum
- Striving for an atmosphere of friendly conversation
- Intervening only enough to steer the conversation in the desired direction
- Displaying a sincere interest

The interview process - Main body

The investigators should begin the main body of the interview with a "free recall" question to let the interviewee talk about what he knows of the occurrence or subject matter. Such a free recall question allows the interviewee:

- To ease into the interview in a more relaxed manner.
- To feel that what he has to say is significant.
- To provide information which is uncontaminated by the investigators.

As the interview progresses, the investigators may use a mixture of other types of questions:

- Open-ended questions would evoke rapid and accurate descriptions of the events and lead to more participation from the interviewee.
- Specific questions are necessary to obtain detailed information and may also prompt the interviewee to recollect further details.
- Closed questions produce "yes" or "no" answers.
- Indirect questions might be useful in delicate situations.

Investigators should avoid questions with the definite article unless the object in question has already been mentioned by the interviewee. For example, they should ask “Did you see a broken strut?” rather than “Did you see the broken strut?” They should also use neutral sentences without adjectives or figurative verbs and avoid leading questions. For example, they should ask “Which way was the aircraft travelling?” rather than “Was the aircraft travelling west?’

Other interview tips for the investigators:

- To design the questions so that they do not mention objects before the interviewee mentions them. A question which mentions some objects (whether the object existed or not) tends to cause the interviewee to assert that he saw the object.
- To try to get the interviewee to cooperate in a general way before asking them to cooperate in a specific way.
- To use indirect questioning for questions of a very personal nature.
- To let the interviewee fill in the information gaps himself.
- To remain objective and avoid making evaluations early in the interview.
- To remember that the interviewee approaches the occurrence from a different perspective than the investigators’.
- To adapt to the situation and to the interviewee, as the interview is a dynamic process.
- To be aware of possible biases when assessing what was said during the interview.
- Not to allow the interviewee’s personality to influence our interpretation of the interview.
- Not to accept any information gained in an interview at face value, but to use the information to confirm, clarify or supplement information from other sources.

The interview process - Closing

In closing an interview, the investigators should consider the following:

- To summarise the important points.
- To give the interviewee an opportunity to expand on any points previously covered, add further points which he feels are significant, or ask questions.
- To reassure and thank the interviewee.
- To determine the interviewee’s availability for further interviews.
- To let the interviewee know how to contact the Authority in the future.

Eyewitnesses

The investigators should obtain the following information from all eyewitnesses of an accident or incident:

- Personal data to complete the interview record.
- Time of observation of the occurrence, if noted by the eyewitness. Otherwise, time as determined in relation to other events.
- Location of the eyewitness at the time of the observation, to be pinpointed on a map or aircraft diagram, if necessary.
- Weather, light and visibility conditions
- Any obstructions to visibility or sound.
- What drew the attention of the eyewitness to the aircraft.
- Anything heard or seen concerning the aircraft, and the actions of other nearby aircraft.
- Actions taken by the eyewitness relating to the occurrence.
- Actions taken by others such as rescue and firefighting personnel.
- Anything taken from the wreckage scene and by whom.
- Any photographs or video taken and by whom.
- Any other eyewitnesses, their names and addresses.
- Any other agency who previously interviewed the witness about the occurrence, such as Police or media.

Tips for the interviewing of eyewitnesses:

- If possible, to interview eyewitnesses at the location where they observed the occurrence.
- To conduct the interview one-on-one, away from other people.
- To get eyewitnesses to tell us everything they saw, by starting with a question like “Tell me what first directed your attention to the aircraft.”
- To let the eyewitnesses demonstrate a manoeuvre with an aero plane model rather than describe it verbally.

Eyewitnesses may be re-interviewed for specific information, but it has to be borne in mind that their initial account would likely be the most accurate.

Handling of difficult witnesses

Crew members – They might be hesitant, defensive or unable to communicate information, possibly because of the following factors:

- Guilty feelings that they survived while other died, or grief over deaths of friends.
- Struggle or torment over their role in the occurrence.
- Concern with regulatory actions, loss of their ratings or jobs.
- Pressure from their company or union representatives.
- Their pride.
- Confusion or vulnerability of the situation.

Reluctant witnesses – When witnesses refuse to be interviewed, the investigators may consider the following:

- To try to determine why and resolve the problem.
- To enlist the assistance of an external party (e.g. the pilot union may be asked to help convince the flight crew to be interviewed).
- To appeal to their concern for flight safety.
- To allow witnesses to be accompanied by their representatives at the interview.
- As a last resort, to apply legal process (to summon under their own hand the attendance of the witnesses).

Uncooperative witnesses – During interviews, if witnesses do not cooperate, refuse to answer or give deliberately evasive answers, the investigators may consider the following:

- To explain to the witnesses to make sure they understand the purpose of the interview.
- To appeal to their concern for flight safety.
- To explain that their evidence may contribute to preventing a recurrence of an accident.
- To concentrate on the positive, preventive side of the investigation.
- To determine if they would be more cooperative if they had representatives present.
- As a last resort, to apply legal process.

Emotional or grieving witnesses – When witnesses are emotionally upset or grieving, the investigators may consider the following:

- To be sympathetic and offer condolences (but an investigator should try not to say “I know how you feel” unless he really had a similar experience).
- To maintain your stature as a professional investigator with a job to do.
- To explain that our job as investigators is to try to prevent a recurrence.
- To anticipate that the witnesses will want to talk about the deceased.
- To avoid saying anything that may be interpreted as a negative reflection on the deceased.

For the more sensitive questions, to imply that we as investigators are following standard procedures when asking such questions and that we are protecting them (the witnesses) as best as we can.

Documenting the interview

The interview should be documented. This may be done in the following ways:

1. Transcript
2. Summary
3. Written statement
4. Note-to-file
5. Hand written notes
6. Tapes

Personal data of the witnesses should be kept together with the statements. Personal data include name, age or date of birth, occupation, role in the accident/ incident (e.g. pilot-in-command, cabin attendant, passenger and eyewitness), address, telephone/fax/e-mail contacts.

If there is a need to get the interviewee sign an interview statement, the following phrases may be incorporated, as applicable:

“I certify that the above statement is a true account of the facts, as far as I am concerned, pertaining to the accident/incident.” or “I declare that the above statement to be a true statement.”

Time may be saved for all concerned (including the interviewee) if the interviewee allows his statement to be shared with other parties which may also wish to interview him. In such a case, the following phrase may be incorporated in the interviewee’s statement:

“I have no objection to a copy of this statement being passed to … (e.g. the Coroner).”

Use of tape recorder

Recording the interview on tape is highly recommended because it would enable interviewers to:

- Focus their attention on what is said
- Direct the interview and adapt and formulate questions based on what is said
- Perceive non-verbal signs that might contradict or reinforce what is said
- Notice discrepancies or sudden changes in conversation
- Have a non-biased and accurate summary of what is said
- Review critical elements of the interview later, if necessary

When using tape recording for the interview, the investigators should consider the following:

- Carry extra batteries
- Find a quiet place to avoid background noise
- Test the recorder before and after the interview
- Position the recorder close enough to all participants to avoid problems of low volume
- Do not let the recorder's presence be too obvious
- Ask soft-speaking witnesses to speak louder

Witness Statements

The following should be noted for the taking of statements:

- Statements should, in normal circumstances, be taken by an Investigator. The Investigator should write down in longhand the information given by the witness. As far as possible, the witness' own words should be used. If there is any difference of opinion regarding the form of wording to be used, the wishes of the witness must prevail.

- The witness should be given ample time to read over the written statement before he signs it.

- If the witness wishes a solicitor, advisor or friend to be present when a statement is being taken, this should normally be agreed to but it should be appreciated that this is not a right. When the presence of a third person obstructs or impedes the Investigator in the exercise of his powers, the witness' request for the third person to be present should be refused or permission for him to be present withdrawn. The solicitor, adviser or friend should not be permitted to answer questions or to suggest answers to questions.

- If a third party, such as a Flight Safety Officer or other representative of the operator, wishes to be present at the interview of a witness, this should be refused unless his presence has been specifically requested as an adviser or the witness has been asked, not in the presence of the third party, whether he agrees to the person being present and he has no objection.

- Witnesses should be given copies of their statements as soon as possible. Whenever practicable, copies of the originals should be left with the witnesses. (Typed copies may be sent later if necessary.)

The record if each statement taken from every witness should include the following:

- The full name in block letters.
- Age (can be given as "over 18").

- Occupation.
- Normal and temporary addresses (if applicable).
- Date, time and place the statement was taken.
- Signature of the witness declaring the truth of the statement.
- Counter signature of the Investigator taking the statement.
- When the statement is of more than one page, items (a) to (g) will appear in each page (e.g. at the bottom).
- The witness will initial all amendments, alterations or additions to the statement.

Appendix – 12 - Provision of information to accident victims and their families

The provision of family assistance should be separate from the accident investigation. The Chief Investigator must remain focused on the investigation of the accident. However, the Chief Investigator should bear in mind that the Authority has a responsibility to provide relevant and timely information to the families of the victims and the accident survivors. The Authority should be aware of the concerns of the families and survivors and anticipate the need to provide, through the appropriate channels (e.g. public relations, airlines, Police), information to the families and survivors on issues of immediate concern, such as the release of personal effects held as part of the investigation, and progress on the investigation.

If any personal effects need to be retained by the investigators for aircraft accident investigation purposes, the investigators shall coordinate with the party concerned (the protection of personal effects is usually the responsibility of the aircraft operator concerned in conjunction with the Police). The Chief Investigator may also need to facilitate visits through the appropriate channels to the accident site by the families of the victims. However, it shall be noted that there will be occasions when visits to the accident site are impractical for accessibility reason. Visits to the site may also be restricted by the Police.

During visits to the accident site by the families of the victims, whether the investigators will be required to brief the families will have to be coordinated in advance. In the longer term, the investigators may also need to provide the families and the survivors through the appropriate channels from time to time with updates on the progress of the investigation. The investigators shall be circumspect as to the information to be given to the families.

Some families and survivors may consider that they should be entitled to listen to the cockpit voice recording and to have access to a transcript of the cockpit voice recording. Such requests shall not be acceded to as disclosure of cockpit voice recordings and transcripts is contrary to the international Standards in Annex 13.

To shield the Chief Investigator from a large number of direct inquiries, the Authority should if necessary arrange for an officer to be the liaison person for such inquiries.

The expectation of the accident victims or their families (e.g. dissemination of timely information) should be borne when communicating with them. The following actions may also have to be considered:

a) To remind accident victims and their families that an investigation results in safety recommendations based on the causes, contributing factors and conclusions of the investigation, and that these safety recommendations are aimed at preventing a repetition of such a tragedy, not at determining any blame or liability.

b) To reassure accident victims and their families that neither political bias nor cultural orientation nor economic considerations will affect the conclusions of the investigation.

Appendix - 13 - Public Relations

General

The Civil Aviation Authority of Sri Lanka, being a government agency, is responsible to the public for its actions. It is the CAA's responsibility to keep the public informed about the progress of an investigation; however, care must be exercised in discharging this responsibility to insure that the public will not be confused or misled, or innocent parties damaged by information released. Each person who is authorized to release information shall assure that the preliminary information released is factual, and any information which is released during early stages of an investigation is clarified to avoid misunderstandings.

Release of information

Examples of information that may be needed/ considered for release to the public are:

<u>Initial (field investigation) phase</u>

- Brief description of the accident
    - Aircraft's flight number, nationality and registration marks
    - History of the flight
    - Weather condition at the time of the accident, etc.
- Nature of the injuries sustained by the persons on board (especially the flight and cabin crew members)
- Damage sustained by the aircraft and other properties
- Completion of search and rescue operation
- Whether the CVR and FDR have been recovered
- Arrangement for the reading out of the CVR/FDR
- Size of the accident site
- Securing of the accident site
- Distribution of wreckage and debris pieces
- Aircraft's airworthiness
- Name of the investigator-in-charge appointed by the AIU
- Participants of the investigation team (number, nationality, agencies/ organizations/companies)
- Organization of the investigation team

- Progress of the investigation
- Updated factual information

Analysis phase

- Progress of the investigation
- Safety recommendations being contemplated
- Important milestones of investigation (e.g. follow-up meetings in particular areas of investigation)

Final phase

- Release of Final Report
- Safety recommendations made

Field Major Investigations

When the DGCA is present at the scene of an accident, he/she is the official spokesperson for the CAA unless he has specifically delegated such tasks to another. When the DGCA is not present, or leaves the scene, an officer duly authorized by him will serve as the spokesperson. If the nominated spokesman is not present, the Chief Investigator or in his absence the Lead Investigator will be the spokesperson.

During accidents attracting an abundance of media coverage, the DGCA's Public Relations Office can be useful in handling inquiries even though a representative may not be on-scene. In such cases, it is the responsibility of the Chief Investigator / Lead Investigator to keep that office appraised of factual information available on at least a daily basis.

Presses interviews at the accident site present a timely opportunity to report on the factual progress of the investigation and at the same time educate the public regarding the CAA and its mission.

The DGCA Public Relations Office will be developing a Media Information pamphlet which may be distributed to news personnel, from time to time. This pamphlet will provide general information regarding the CAA, how investigations will be conducted, and how to obtain CAA accident investigation reports.

Since the amount of media coverage on each accident varies, the DGCA's Spokesman, Chief Investigator / Lead Investigator must be flexible in dealing with the media. The majority of accidents will involve local news reporters. In cases where the amount of media interest is small, Chief Investigator / Lead Investigator they can easily brief reporters on an as needed basis while on-scene.

Field investigators may, however, become involved in accidents/incidents which attract a great deal of media attention, and along with that, a large number of reporters. In cases such as these, media briefing times may be scheduled and a group briefing may be conducted. Attempting to individually brief each reporter will become overburdening and will prevent the Chief Investigator / Lead Investigator from performing his/her investigation duties.

Visit of accident site

From time to time, there may be requests for visit of the accident site by the media. Such requests will be coordinated by the Public Relations Officer. The Chief Investigator will facilitate such requests. Where necessary, the Chief Investigator will specify a safety distance from the aircraft wreckage or debris.

Appendix – 14 - Underwater Location and Recovery of Aircraft Wreckage and Flight Recorders

1 Introduction

1.1 Sri Lanka been a state which has a coastline, internal body of water and aircrafts on its national register flying over international waters, has the responsibility of having to conduct an investigation into the loss of an aircraft in its territorial waters or on the high seas. When an aircraft comes down in water, whether at sea or in a lake or river, the first need access to the accident site, is problematic in itself. The problems become greater as the water becomes deeper.

1.2 Underwater location and recovery has extremely challenging characteristics, and requires a well-planned and timely response, coordinated amongst many parties. Inadequate preparation or poor management of the initial investigative response has the potential to degenerate into a crisis, and can threaten crucial evidence. That risk increases where the accident site is problematic.

1.3 The guidance considers the preparations needed by Authority to undertake an underwater location and recovery operation and then the on-site challenges of operations at sea: the working environment, decisions on what to recover, issues specific to location and recovery, and the management of human remains. The guidance also considers ancillary issues, including the costs of underwater operations, and sets out key points to undertake operations in this difficult environment.

2 Preparation for Underwater Location and Recovery Operations

2.1 Decision to recover the aircraft wreckage

The circumstances and location of an accident should determine whether salvage of the aircraft wreckage is practicable and necessary. In most cases, the aircraft wreckage should be recovered, if it is considered that the evidence it might provide would justify the expense and effort of a salvage operation. If the aircraft wreckage is likely to contain evidence significant to air safety, the Authority should provide the impetus needed to ensure that action is promptly taken to recover the aircraft wreckage. Such action includes obtaining the necessary funding and specialized equipment and personnel for the tasks.

There have been several instances in the region where aircraft wreckage has been successfully recovered from deep water. Such recoveries necessitated expensive salvage operations lasting several months, but the results exceeded expectations, and the evidence obtained from the aircraft wreckage established the causes and contributing factors of the accidents and led to accident prevention measures.

2.2 Partnership and Contacts

Authority may not generally be able to conduct an investigation having an underwater dimension without outside assistance. Relationships therefore need to be established in advance with potential partners and sources of assistance.
These partners should include Ministries with responsibilities for matters relating to the sea, the naval service and the diplomatic service. It is especially important to have a procedure to secure rapid access to bathymetric and bathythermograph data, at least for national waters.

Partnership relationships should also be established with other national safety investigation authorities, as well as in relevant foreign, military and diplomatic services. Although advice should be taken from organizations such as the police, the navy and the coastguard, overall control of the operation should always be retained by the Authority. Assistance may usefully be sought from other safety investigation authorities which have recent experience of mounting similar operations.
In the context of these contacts abroad, there is merit in establishing commonality in the technical specifications of equipment and software used by regional States, so that such resources may be shared and used with ease when needed.

It is also important to have information about where relevant equipment may be sourced. While it might be possible to borrow some equipment from partners, it may be necessary to enter into hire contracts for sea-going vessels, underwater craft and other specialized or expensive equipment. Contact details for suitable contractors, and an understanding of the kinds of equipment and expertise (for example, in diving) each can offer, should be part of the standing preparations for a possible underwater operation.
Check-lists for underwater operations are important for planning purposes. But no two accidents are the same and detailed planning will inevitably be event-specific. Effective equipment and personnel may be expensive but they can reduce overall costs.

2.3 Hiring Equipment and Vessels

The key factor in the selection of the vessel and its onboard equipment is the nature of the location of the accident site, sea state conditions, probable depth and the seabed environment. Other important factors will be the proximity of the nearest useful port, and the availability of suitable vessels.

In considering the suitability of the vessels available, account should be taken of their capability to perform the required task in the time available, including their fitting out with specialized equipment such as acoustic devices for detecting 37.5 kHz signals and, when necessary, with a hull-mounted multi- beam sonar for bathymetry of the seabed. Other considerations will be the vessel’s present location and availability, transit time to the accident site, and the entire charter cost, including provision of equipment, and mobilization or demobilization.

Relatively small craft, for use in operations on lakes, rivers and close inshore, are unlikely to be difficult to secure. For operations at sea, it is necessary to know where to find the appropriate kind of larger vessel.

If no suitable State vessels are available an approach to the chartering market may be necessary, and consideration given to issuing a call for tenders. Such a document should specify the size of the lost aircraft (this will dictate the lifting equipment and deck space needed), the depth of the site, any human remains issues and the expected duration of the operation. Ancillary issues may be the need for a heli-deck and any auditing or certification requirements. The deadline for responses should be indicated.

Many of the vessels suitable for aircraft salvage are employed in support of the offshore oil and gas sector, notably in the North Sea, the Arabian Gulf, and the Gulf of Mexico and off West Africa. Few are designed to support operations in more than 2,000 meters of water and in those cases it may be necessary to charter the vessel and to hire separately the additional equipment. It will be important in those circumstances to establish the compatibility of the vessel and its systems with the equipment being brought aboard, for example in storage, lifting equipment, power supplies, and deck loadings and securing.

Experience shows that the mobilization of large vessels with deep-water recovery capability can take time. There may be an advantage in taking a two-stage approach, first employing a smaller vessel able to reach the location quickly and begin the task of locating the Underwater Locator Beacons (ULBs), pending the arrival of a recovery vessel. The decision to dispatch the recovery vessel should only be made once the wreckage has been located, and the delay between its location and the departure of the vessel should be kept to a minimum. If the wreckage has not been located during the period in which the ULBs can be assumed to be transmitting, it will be necessary to proceed to another phase of location, using sonar equipment, which will normally correspond to different vessel requirements.

As “principal contractor” it is important to be aware of shared responsibilities which may have been assumed, for example for damage which might be done to sub-sea pipelines or other infrastructure during the operation. It is also important to establish that the vessel has the required certification from the Flag State and Classification Society, for example in relation to its safety equipment and maintenance, crew training and certification, pollution insurance, and health and safety management systems.

Once the vessel has been selected and contracted, it is important that a good working relationship is established and maintained between the investigation team and the captain of the vessel.

2.4 Other Special Equipment

The depth at which the aircraft wreckage and flight recorders are believed to be located will be the primary determinant of the recovery options.

Air diving is feasible at depths up to 40 meters, and saturation diving up to 500 meters. However, for deep water and sustained operations, the use of a Remotely Operated Vehicle (ROV) is generally the best option. These are connected to the parent vessel by an “umbilical” carrying power and navigational and imagery capabilities. They come in many forms and sizes, and may be equipped with one or more “manipulators” for working at the accident site. Use of an ROV permits the whole investigation team to view and exploit in real time the images transmitted from the ROV to the parent vessel. It also facilitates the mapping of the accident site.

A range of ROVs can be deployed in operations at up to 6,000 meters, and certain very specialized (and scarce) ROVs can be used below that depth. The supplier of an ROV can be expected to specify the dynamic positioning capability (eg ‘DP I’ or ‘DP II’) required of the vessel from which it will be operated. Such a capability is valuable when conducting sea searches, as knowledge of the exact position of the vessel, for example in relation to a search grid, is important and it may provide a stable working platform for operations in up to Force 7 sea state conditions.

Another type of unmanned vessel available for underwater operations is the Autonomous Underwater Vehicle (AUV), which is a ‘search’ (rather than ‘grapple-and-recover’) tool. AUVs are not tethered to a parent vessel but are battery-powered and programmed to follow a defined search programme, at the conclusion of which they surface and upload their findings to the control center. This may be aboard a vessel or in a road vehicle parked at the lake or river side. The preparation and launching of an AUV will typically take only a few hours and its control team may number only three or four. The more sophisticated AUVs have hovering and automated obstacle avoidance capabilities. A number of sensors may be carried by the AUV, including side-scan sonar and cameras.

3 Challenges and Priorities On-Site

3.1 Working at Sea

Some challenges in operations at sea derive from the length of time which the investigation team may need to be out of physical contact with the shore. For any long voyage, there is a need to give careful thought in advance (even under time pressure) to all of the types of equipment which may be required and to the specialist personnel needed aboard.

Some of the equipment carried to the accident site (such as transponders and hand-held hydrophones) will prove unserviceable, so it is wise to build redundancy into what is carried and have some onboard capability for repair. For operations in water, more robust equipment is generally needed than at first seems likely.
At the accident site, simple maneuvers (transiting across the search grid, dispatching and recovering small craft and divers) takes considerably longer

than those accustomed to working in aviation expect. The investigation team needs to be prepared for this.

Working vessels present particular health and safety issues for those not familiar with them. The investigation team should complete a risk assessment of the working environment in consultation with the vessel's health and safety officer, including the possibility of sea-sickness, with consideration of safe and appropriate medication. The planning process should include the configuration of accommodation and work spaces.
The noise and movement of the vessel, the confined and less than perfectly clean spaces probably available to the investigation team, the presence of seawater and damp, all make for a working environment which is hostile to individuals and to sensitive electronic equipment such as cameras and computers.

A particular problem in operations at sea is the moment when a large piece of debris is lifted out of the sea and Archimedes' principle is negated. This can lead to a sudden and dangerous increase in load, with potential to damage the wreckage and lose evidence. There may be a need to counter this risk by providing additional tethering to the wreckage (to take any additional loads at key points) and the use of netting is particularly useful. The use of an active 'heave-compensated' crane can help in alleviating load variations on the lift line. The condition of the wreckage should be recorded before any recovery attempt is made, and likewise any damage sustained during the lift.

3.2 Location

An Underwater Location Beacon (ULB) fitted to an aircraft flight recorder is triggered by immersion in water. It will emit an ultrasonic pulse of 10 milliseconds, at 37.5 kHz and at one-second intervals. The present ICAO requirement is for ULBs ("pingers") to transmit for at least 30 days. They have a nominal audible range of 2 to 5 km, depending on parameters such as depth, water temperature and sea conditions.

There is value in a search operation in deploying the most effective resources as early as possible, to minimize the risk of a protracted search and an even more expensive investigation. It is preferable to undertake a 'passive' acoustic sweep first (while the pingers can be expected to be still transmitting), with an 'active' side-scan sonar search next, taken under less time pressure.

There is benefit in beginning as soon as possible, using a small vessel to find the pinger(s), on the basis of a preliminary review of the 'loss' data such as radar and the Aircraft Communications Addressing and Reporting System (ACARS). The search area may be refined later, as more data become available. The sonar search will begin only after the end of the pinger's transmission period.

The 37.5 kHz frequency is outside the audible spectrum for the human ear. Acoustic hydrophones 'translate' the signal into the audible spectrum, a process which does not exactly reproduce the original emission, which can be 'polluted' by the water environment and thus misprocessed.

ULB signals can be picked up using acoustic hydrophones deployed singly, as a hand-held unit, or in an array (for example, in a flexible tube housing, towed behind and below a vessel). Digitalization of the ULB signal by onboard software enables the 'listening' for the ULB to be done by a computer, rather than a human.
Such an array may be deployed to good effect even in difficult sea conditions. However in shallow waters the amount of background noise may lead to the signal 'spike', experienced when the 'ping' is detected, not being prominent, and perhaps missed. With such faint signals, difficulties may also be experienced when sounds emitted by the biological environment (eg whales) confuse the acoustic devices. Cetacean sound emissions typically take the form of swift 'chirps' over a wide spectrum of frequencies, which could at times be perceived as a short regular pinger signal, after being sampled and processed by acoustic devices.
Towing a hydrophone array at a speed of 4 knots on a search grid of parallel tracks one nautical mile apart will enable forty square miles of sea to be searched in a period of around 10 hours. Use of the vessel's autopilot (if fitted) while following the search grid is valuable in countering the effects of strong crosswinds and crosscurrents. Strong currents may also cause wreckage and recorders to drift from their original location.

Other systems for picking up and locating ULB signals may involve the repeated 'dipping' of a detector below the 'seasonal thermocline' (which separates the noisy mixed surface layer of water from the calm, relatively quiet, deeper water below), at different locations, to generate a triangulated homing point, or the deployment of acoustic listening buoys equipped with GPS and UHF radio.
For searches in very shallow waters with poor visibility, for example in a river or lake, grapple dragging by surface vessels and the use of metal detectors mounted on inflatable craft are options.

3.3 What to Recover

The priority targets for the investigation team during the recovery phase should be flight recorders, aircraft debris or parts (including avionics components which may contain non-volatile memory), any human remains and personal effects. Wreckage observation and mapping are also important. When available, a photographic survey of the accident site enables its original state to be recorded before it is altered by diver or ROV interventions.

It is necessary to select carefully, with opinions from all investigation parties considered, the aircraft debris and parts to be recovered, and to priorities them, with a view to the overall investigation. The initial analysis of the FDR and CVR may assist in this selection process.

There is a case for recovering only those parts of the aircraft judged to be relevant to the investigation, especially if the aircraft wreckage is very large or fragmented. Divers or ROV operators might be given a 'shopping list' of those parts of the aircraft most desirable to recover, based on preliminary information gathered from recorders, sea bed images and aircraft data (such as manufacturers' drawings, parts catalogues, wiring diagrams and manuals).

It is sometimes more straightforward to recover as much as possible, avoiding the difficulty of finding again particular items which may have been disturbed by underwater currents. The full wreckage may then be examined for its key elements in a more suitable environment. Storing wreckage on land can however pose a challenge, as hangar space is often scarce and long-term storage space may not be available.

3.4 Recovery

The recovery of aircraft wreckage is generally accomplished by the parts being rigged to a hoist and lifted by crane out of the water and onto the recovery vessel. Alternatively, the lift might in some cases be achieved by the attachment to the wreckage, by divers, of small 'parachutes', then inflated with compressed air by divers; care is needed to avoid inflatable items being punctured by sharp metallic edges on the wreckage. In at least one recovery operation, sealed buoyant metal tubular fabrications, inserted beneath the aircraft's wings, were used with success.

For ROV operations it may be useful for a steel basket to be lowered to the sea bed, into which debris may be placed by the ROV. Such a basket may also be used for the recovery of human remains, in which should be a separate operation. When using an ROV, particularly where the wreckage is spread over a large area of the sea bed, it is important to identify clearly those locations which the ROV has visited. This may be achieved by dropping markers, carried down in the basket referred to in 3.4.2.

Where aircraft wreckage has rested for some time underwater, sediments may accumulate within it, increasing its weight and rendering its recovery more difficult. It may be necessary to remove at least some of this sediment before lifting, for example using suction tools. This possible complication is an argument for recovery action to be taken without unnecessary delay, and not to be paused, once begun.

The internal components of flight recorders recovered from underwater are vulnerable to corrosion, and should be kept in fresh water for transit and until they are opened. All wreckage recovered should be rinsed to remove salt water and further anti-corrosion application of specialized products can help in preserving evidence. Access to recovered wreckage should be limited.

It is important to re-stow all equipment in an orderly fashion after use, including the washing off of salt water, so that it is ready and fit for use on the next occasion.

Paragraph 6.12 of Chapter 6 of this Manual, contains procedures for the actions at the site of the accident, including dealing with wreckage in water and its preservation. Chapter 5 of the ICAO "Manual of Aircraft Accident and Incident Investigation" (Doc 9756 Part 1) contains procedures on decisions on what to recover, psychological stress and specialist examinations. Chapter 7.4 of ICAO Doc 9962, "Manual on Accident and Incident Investigation Policies and Procedures" is also useful.

3.5 Human Remains

In recovering an aircraft underwater there is frequently a need to deal with human remains. This poses special technical and psychological challenges beyond those associated with an accident site on land. This highlights the need to be prepared.

Unless autopsy is judged important for the safety investigation, there may be no perceived need for bodies to be recovered from an underwater site. Their recovery must nonetheless be considered, to meet the expectations of relatives and for safety reasons. There may be important legal reasons (such as passenger identification) for the recovery of bodies.

In fatal accidents on land, emergency service personnel will typically lead the recovery of bodies. At sea, it is likely that surface recovery of human remains will be conducted by search and rescue services, often military or Coast Guard. However, for human remains at deep water sites, deployment of a ROV may be the only means of gaining access and the ROV operator may be wholly inexperienced in encountering images of human remains. He or she will in that event need careful briefing and management.

The recovery of bodies is an operation that should not be improvised - material preparation, ample space, and good conditions are crucial. It is important to have available the necessary specialized equipment (such as refrigerated containers, and body bags) and any special expertise.

Medico-psychological support may be needed, to manage the psychological risks related to the recovery of human remains. This can be done through briefings during transit to site, 'defusing' moments on board and debriefing during the return transit. It is important to control access to data, including photographs, relating to human remains. It may be desirable to establish a system to filter photographs of human remains from the general investigation data and store them separately.

In general, personal effects should be managed onboard by police. Safety investigators should not bear the responsibility of dealing with these effects or of dealing directly with the recovery of human remains and the identification of victims.

4 Other Issues

4.1 Wreckage Location and Responsibilities

In some cases of aircraft lost at sea, there have been difficulties in establishing definitively and in a timely manner exactly where the aircraft came down. Possible indicators will include the last radar report and floating wreckage, which may be in national or international waters.
To avoid a dispute which could compromise the investigation, it is required for Authority and Safety Investigation Authorities of other countries concerned, been the State of Occurrence and State of Registry to reach prompt agreement on their respective responsibilities.

4.2 Cost

The costs of investigations increase quickly if the wreckage or flight recorders need to be recovered underwater, and they may exceed the normal budget of the Authority.
The costs of hiring specialist vessels and equipment, may be stated as ‘mobilisation costs + (daily rate x duration) + demobilisation costs, plus - as a good “rule of thumb” - an additional 20% as a budget for all consumables. It is important to obtain good information in advance about the accident site, and about the capabilities of the vessel intended to be hired, before chartering, and to understand the nature of task before selecting the other tools. The contract (“charter party”) with the vessel provider should be checked for fairness and balance and the charterer should be aware of his full financial responsibilities for the ship and its crew. Liability issues should also be considered.

The Authority should be prepared for the possibility that the operation will not be completed quickly. If the site is far out at sea, or the vessel starting from a distant port, even reaching the accident site may take considerable time. Decision-makers and politicians should be made aware of the cost and timeline realities, and Authority should have a procedure for accessing emergency funds. In other cases, the costs of search and recovery operations have been shared with other parties involved with the aircraft, such as the operator, the manufacturer or the charterer. The level of involvement of these other parties should be determined by the Authority.

4.3 Data Handling

Investigators can be faced with handling large amounts of data, in various formats and locations. Confidentiality issues should be considered, especially for data related to human remains. Strict procedures need to be developed, and a means of secure transmission implemented, between the various entities involved in the search. In most cases, a database containing as a minimum pictures, coordinates and descriptions of debris will be needed.

Oceanographic data and sonar imagery pose additional challenges for storage, and video footage of all ROV dives may need to be duplicated in different formats. Having available high-capacity external hard drives (in Terabytes) will allow for the

backup of relevant data. It is recommended that high speed VSAT5 connections be set up between vessels, using a secured File Transfer Protocol site to exchange data. To reinforce confidentiality, those involved in search and recovery operations are generally invited to sign a non-disclosure agreement.

4.4 Training

Where possible, the more experienced personnel should be used for underwater operations, given the special challenges they pose. They should have been trained to handle and monitor such operations, including familiarity with maritime agencies and national navies, participation in workshops and exercises, and involvement in underwater recovery operations. Investigators should receive training in survival procedures at sea (including helicopter underwater escape) and health and safety issues.

4.5 Ecological Aspects

The loss of an aircraft in water may be followed by the leakage into the water of fuel, oil and other noxious fluids. It may be possible to contain and recover these, in order to avoid ecological harm. In shallow waters it may be feasible to surround the wreckage with special protective curtains or booms during an operation to recover the liquids, and these curtains or booms may then be towed to land. Specialist assistance should be considered.

4.6 Closing an Investigation

An investigation involving underwater recovery should document the operations so that other investigation authorities may benefit from the lessons learned. A short report could accompany the safety investigation final report. A decision to halt an underwater recovery operation should be the prerogative of the Authority, made after careful assessment of the possible safety benefits of continuing the operation, set against the expenditure of additional resources.