



Komite Nasional Keselamatan Transportasi
National Transportation Safety Committee
Republic of Indonesia



KNKT

MAJOR ACCIDENT INVESTIGATION GUIDELINES

SEKRETARIAT KNKT



**KOMITE NASIONAL KESELAMATAN TRANSPORTASI
MAJOR ACCIDENT INVESTIGATION GUIDELINES**



MAJOR ACCIDENT INVESTIGATION GUIDELINES

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KOMITE NASIONAL KESELAMATAN TRANSPORTASI



KOMITE NASIONAL KESELAMATAN TRANSPORTASI MAJOR ACCIDENT INVESTIGATION GUIDELINES



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MAJOR ACCIDENT INVESTIGATION GUIDELINES**



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KOMITE NASIONAL KESELAMATAN TRANSPORTASI MAJOR ACCIDENT INVESTIGATION GUIDELINES



FOREWORD

Komite Nasional Keselamatan Transportasi (KNKT / National Transportation Safety Committee - NTSC) is a no blame, independent, multimodal safety investigation body within the Republic of Indonesia responsible directly to the President of the Republic of Indonesia.

KNKT has the main duty to conduct objective and independent transport safety investigation (investigation) of four modes of transportation which are; aviation, railway, road and marine transportation. KNKT investigation is intended to prevent similar occurrence in the future without implying blame or liability.

KNKT investigation of aviation events is to conduct objective and independent investigation of civil aircraft accident and serious incident under the provision of International Civil Aviation Organization (ICAO) Annex 13.

The KNKT Major Accident Investigation Guidelines contains material that will assist KNKT employees in carrying out their responsibilities when responding to a major accident. It is not the intention of this manual to dictate a process for every eventuality. Rather, the manual provides guidance to investigators to permit them to make decisions and conduct themselves in a manner that achieves the KNKT overall policy aims. Since accident investigations vary in complexity, this manual cannot cover all eventualities. The more common techniques and processes, however, have been included

Throughout this manual, the use of the male gender should be understood to include male and female persons.

Readers are invited to submit material for possible inclusion in subsequent editions of this manual. This material should be addressed to: Komite Nasional Keselamatan Transportasi; Gedung Kementerian Perhubungan lantai 3, Jalan Medan Merdeka Timur Nomor 5, Jakarta – Indonesia 10110 or email to knkt@dephub.go.id.

Jakarta, 9 September 2014

TATANG KURNIADI, PSC., SH., MM.

Chairman



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GLOSSARY

When the following terms are used in this manual, they have the following meanings:

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 as 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,

except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; 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,

except for engine failure or damage, when the damage is limited to a single engine, (including its cowlings or accessories), to 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 for minor damages to main rotor blades, tail rotor blades, landing gear, and those resulting from hail or bird strike (including holes in the radome); or

- c) the aircraft is missing or is completely inaccessible.

Note 1 — *an injury resulting in death within thirty days of the date of the accident is classified, as a fatal injury.*

Note 2.— *An aircraft is considered to be missing when the official search has been terminated and the wreckage has not been located.*

Note 3.— *The type of unmanned aircraft system to be investigated is addressed in ICAO Annex 13, paragraph 5.1.*

Note 4.— *Guidance for the determination of aircraft damage can be found in ICAO Annex 13, Attachment G.*

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.

Adviser: A person appointed by a State, on the basis of his or her qualifications, for the purpose of assisting its accredited representative in an investigation.



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

Audit: A systematic and objective review of a State's aviation framework to verify compliance with the provisions of the Chicago Convention or national regulation, conformance with or adherence to Standards and Recommended Practices (SARPs), procedures and good aviation safety practices.

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.

Directorate General of Civil Aviation: The Indonesia governmental entity that are directly responsible for the regulation of all aspects of civil air transport, technical (i.e. air navigation and aviation safety) and economic (i.e. the commercial aspects of air transport).

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

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

Note.— *The types of incidents which are of main interest to the International Civil Aviation Organization for accident prevention studies are listed in ICAO Annex 13, Attachment C and was copied in the (Appendix B of Policies and Procedures Manual).*

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: KNKT investigator unless otherwise specified

Investigator-in-charge: A person charged, on the basis of his or her qualifications, with the responsibility for the organization, conduct and control of an investigation.

Major Accident. An accident with potentially increases the complexity of investigation with regards to media interest or political issue, number institution involves, or status of occupants involves as crew or passengers.

Maximum mass: Maximum certificated take-off mass.

Operator: A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

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

Safety action: any actions taken or planned to be taken at the time of completion of the final report following an accident to improve the condition by organization involve in an accident.

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



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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 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 as it comes to rest at the end of the flight and the primary propulsion system is shut down.

Note 1 — *The difference between an accident and a serious incident lies only in the result.*

Note 2 — *Examples of serious incidents can be found in ICAO Annex 13, Attachment C and was copied in the appendix B of this manual.*

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 hemorrhage, 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 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.

Note.—In the case of the registration of aircraft of an international operating agency on other than a national basis, the States constituting the agency are jointly and severally bound to assume the obligations which, under the Chicago Convention, attach to a State of Registry. See, in this regard, the Council Resolution of 14 December 1967 on Nationality and Registration of Aircraft Operated by International Operating Agencies which can be found in Policy and Guidance Material on the Economic Regulation of International Air Transport (Doc 9587).

State safety programme: An integrated set of regulations and activities aimed at improving safety.



LIST OF ACRONYMS

The following abbreviations are used throughout this manual:

AD	:	Airworthiness directive
AIP	:	Aeronautical information publication
AOC	:	Air Operator Certificate
APU	:	Auxiliary Power Unit
ARFF	:	Aircraft rescue and fire fighting
ATA	:	Air Transport Association
ATC	:	Air traffic controller
ATS	:	Air traffic services
BASARNAS	:	<i>Badan SAR Nasional</i> (National Search and Rescue Agency)
BITE	:	Built-in Test Equipment
BMKG	:	<i>Badan Meteorologi Klimatologi dan Geofisika</i> (Meteorological Climatology and Geophysical Agency)
C	:	Degrees Celsius (Centigrade)
CC	:	Command Centre
CDL	:	Configuration deviation list
CEO	:	Chief Executive Officer
CFR	:	Fire and rescue
CRM	:	Cockpit resource management
CVR	:	Cockpit voice recorder
DGCA	:	Directorate General of Civil Aviation
EA	:	Engineering advise
EO	:	Engineering order
EPR	:	Engine pressure ratio
F	:	Fahrenheit
FAA	:	Federal Aviation Administration
FCF	:	Functional Check Flight
FDC	:	Flight data center
FDR	:	Flight data recorder
FOD	:	Foreign object damage (also the object)
GPS	:	Global positioning system
IATA	:	International Air Transport Association
ICAO	:	International Civil Aviation Organization



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ID	:	Identity
IIC	:	Investigator-in-charge
KNKT	:	<i>Komite Nasional Keselamatan Transportasi</i> (National Transportation Safety Committee)
LLWAS	:	Low level windshear alert system
MEL	:	Minimum equipment list
NOTAM	:	Notice to airmen (a notice distributed by means of telecommunication containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations)
NOK	:	Next of Kin
OSCP	:	On-Site Command Post
PPE	:	Personal protective equipment
PIREPS	:	Pilot reports
QAR	:	Quick Access Recorders (QAR)
RESA	:	Runway End Safety Area
RVR	:	Runway Visual Range
SAR	:	Search and Rescue Agency
SDR	:	Service difficulty reports
SMM	:	Safety Management Manual
STC	:	Supplemental type certificates



1 MAJOR ACCIDENT INVESTIGATION

1.1 General

A major accident is one that is larger than is normally encountered. KNKT definition for major accident is an accident with potentially increases the complexity of investigation with regards to the number or complexity of investigation activities, to media interest, political issue, number of parties involves, and status of occupants involves as crew or passengers.

A major accident normally involves high capacity transport aircraft with several number of fatality or serious damage to the aircraft.

During the major accident investigation varieties of issues and range that may extend beyond the common investigation, are require to be considered. The issues may include:

- a. Number and complexity of investigation activities;
- b. The public and media interest;
- c. Political;
- d. Participation of domestic and overseas parties;
- e. Next of kin assistance.

The Major Accident Response involves activities and considerations well beyond those required for the more common place occurrences.

Those activities and considerations encompass the following broad areas:

- a. The conduct of the investigation itself;
- b. The provision and coordination of investigation support;
- c. Liaison between KNKT and other parties directly or indirectly involved in the investigation and associated activities;
- d. The provision of factual information to the Minister and other government agencies;
- e. The release of factual information about the circumstances of the occurrence, and the progress of the investigation, to the public and other interested parties;
- f. Assistance to the victims and their families.

To cope with such number of consideration and activities, two functional posts shall be established. A Command Centre located in KNKT Head Office Jakarta lead by the Chairman and On-Site Command Post on the accident site lead by the IIC.

The KNKT Investigation Management System is one of the tools that investigator should be called upon to use especially during the Major Accident investigation. The effectiveness of the Investigation Management System is directly related to the adherence to the flow chart and the checklists.

The Investigator in Charge (IIC) for a Major Accident Investigation requires skill for activity and personnel management, communication, leadership and budget management. The IIC shall be one of KNKT senior investigator who has been qualified as level 4 investigator. The group leader may be elected from KNKT



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senior investigator qualified minimum of as level 3 investigator. The IIC and group chairperson in a major accident investigation should be familiar with KNKT Policies and Procedures and investigation management system.

1.2 Additional Fund

Financial support for a Major Accident Investigation may require significant amount and may have not been included on the KNKT financial plan. Based on the Disaster Management Act number 24 of 2007.

Pasal 1 Ketentuan Umum

1. Bencana adalah peristiwa atau rangkaian peristiwa yang mengancam dan mengganggu kehidupan dan penghidupan masyarakat yang disebabkan, baik oleh faktor alam dan/atau faktor nonalam maupun faktor manusia sehingga mengakibatkan timbulnya korban jiwa manusia, kerusakan lingkungan, kerugian harta benda, dan dampak psikologis.
2. Bencana alam adalah bencana yang diakibatkan oleh peristiwa atau serangkaian peristiwa yang disebabkan oleh alam antara lain berupa gempa bumi, tsunami, gunung meletus, banjir, kekeringan, angin topan, dan tanah longsor.
3. Bencana nonalam adalah bencana yang diakibatkan oleh peristiwa atau rangkaian peristiwa nonalam yang antara lain berupa gagal teknologi, gagal modernisasi, epidemi, dan wabah penyakit.

Article 1 General terms

1. Disaster is an occurrence or series of occurrence that threatening and disturbing live and livelihood that caused by natural and or non-natural or human and resulting to human casualty, damage to environment, damage to property and psychological effect.
2. Natural disaster is disaster that caused by an occurrence or series of occurrence of the nature that include earth quake, tsunami, volcanic eruption, flood, drought, hurricane and land slide.
3. Non-natural disaster is disaster that caused by an occurrence or series of occurrence of non-nature that include failure of technology, failure of modernization, epidemic and plague.

The elucidation of this article stated:

Bencana nonalam antara lain kebakaran hutan/lahan yang disebabkan oleh manusia, kecelakaan transportasi, kegagalan konstruksi/teknologi, dampak industri, ledakan nuklir, pencemaran lingkungan dan kegiatan keantariksaan.

Non-natural disaster include forest/bush fire that caused by human, transportation accident, failure of construction / technology, industrial impact, nuclear explosion, environment contamination, and aerospace accident,

Based on this government regulation the government may provide additional funding for a Major Accident including its investigation. KNKT Secretary will assist the chairman to process additional funding from the government.



1.3 Command Centre (CC)

1.3.1 General

Command Centre (CC) is the primary focal point for the public dissemination of information and briefing of key stakeholders and oversight of the investigation process.

Command Centre (CC) is lead by the Chairman. The permanent members of the CC are The Head of The Secretariat, The Head of Investigation Division. The Chairman may appoint Secretary of the Command Centre.

1.3.2 Duty and Responsibility

All information from the KNKT to the media and governmental bodies will come from the CC, with the exception of on-site briefings by the IIC.

The CC requires regular information updates. This information is obtained by maintain good communication with the On-Site Command Post (OSCP). All information obtained shall be recorded on the CC Event Log by the secretary of CC as well as all CC activities.

The primary tasks of the CC are to:

- a. Brief the President, Minister of Transportation or other government agencies;
- b. Handle all media releases and briefings, excluding IIC on-site briefings;
- c. Provide the personnel for media conferences;
- d. Provide oversight of the conduct of the investigation and OSCP;

The Head of the Secretariat are to:

1. Record all information and decision activities
2. Provide a single point of contact
3. Provide information to The Chairman to enable complete briefing of VIPs (President, Minister, or Government Agencies, etc)
4. Provide information for the Chairman to coordinate briefs for public, families, media (Media Releases). Include assisting in draft media releases for the Minister.
5. Prepare venues and spokespersons for media conferences
6. Disseminate media releases include the information on KNKT website.
7. Organise and oversee media monitoring activities (defining and adjusting key terms, etc) and provide media analysis to the Chairman at designated times
8. maintain a record of fact: who said what, to which journalists, etc
9. Assist the Chairman to enquire additional fund from the government.

The Head of Investigation Section as member of Command Centre are to:

- a. To facilitate standard major accident investigation tasks;
- b. Arranging travel, accommodation, liaison with local authority, police, cars, food, etc. for the go-team;
- c. Fulfilling tasks required by the IIC;
- d. Provide equipment, tools and arrangement with third party require during the investigation such as heavy equipment,.



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The staffing and organisation of the CC is intended to be flexible and proportional to the level of response required. It is likely that the CC would operate to full capacity but also may only operate to 50% capacity or less depend on the judgment of the Chairman.

1.3.3 Location and Facility

The CC convenes immediately there is notification of a major transport accident and will be based in the Operational Room on level 3 of the KNK head office in Jakarta

The Command Centre activities will stay for 24 hours when required to accommodate progress of the OCSP and correspondence with overseas agencies which may have different time zone,

The Command Centre shall be sterile from media and public. Security personnel may stand by the entrance door to ensure free disturbance.

The Command Centre facilities may not be available on the Operation Room during the normal daily operation. However, the facilities shall be able to be quick set up when required.

The facilities include:

- a. Guidance material for setting up and operating the CC;
- b. Video-conferencing;
- c. Telephones with teleconference capability and facsimile ;
- d. Scanner, photocopier (may be sourced from another area of KNKT);
- e. Network computer;
- f. Multiple network connections and internet connection;
- g. Large whiteboards;
- h. Large projection screen; all TV, video, and computer outputs can be displayed on the large projection screen;
- i. Television receivers;
- j. Time displays showing local time, UTC, and time at the accident location;
- k. Seating and desk space for approximately 20 personnel;
- l. Stationery, general office supplies.

1.4 On-Site Command Post

1.4.1 General

A major accident investigation involves a substantial number of personnel, particularly during the initial on-site stage. At the same time, there will be considerable demand for secure working and meeting areas, dedicated communications systems and support services. A command post, which embodies these facilities, will therefore be required.

OSCP is established for investigation team meetings/briefings and the provision of support infrastructure to facilitate the effective conduct of a major accident investigation. The OSCP also provides a facility for daily media conferences (only the IIC or KNKT Personnel authorized by the Chairman can talk to the media) and NOK briefings.



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The IIC shall be one of KNKT senior investigator who has been qualified as level 4 investigator. The Investigator in Charge (IIC) is authorised by, and accountable to, the Chairman for the organisation, conduct, and control of the investigation. The IIC is responsible for controlling and coordinating the activities of all personnel associated with the investigation.

Primary responsibility for the coordination of activities OSCP rests with the Investigator in Charge (IIC) and may assist by a Site Safety and Security Officer and a secretary or a assistance.

The role of the OSCP secretary/assistant is therefore to establish a functioning 'office' facility on the OSCP to support the site activities. This will include administration, logistics support and equipment.

The role of the Site Safety and Security Officer is to ensure that all activities at the accident site(s) are properly conducted and coordinated with respect to the requirements of the [KNKT Hazard at Accident Site Guidelines](#) and the security of access to the accident site(s). This officer is immediately responsible to the IIC.

The Investigation team may also assign a Family Liaison Officer. During the on-site investigation phase, the Family Liaison officer is the focal point for interaction between:

- a. The KNKT;
- b. The air operator;
- c. Survivors;
- d. Victims' families.

The Family Liaison Officer's primary responsibility is to provide the air operator, survivors and victims' families with accurate and timely information regarding the progress of the KNKT investigation prior to that information being released to the public. The Family Liaison Officer is also responsible for the following tasks:

1. Consulting with the IIC as to what information can be released to the operator, survivors and victims' families
2. Attending any briefings coordinated by the operator to provide information to survivors and victims' families concerning the conduct and progress of the KNKT investigation
3. Conducting daily meetings with the operator's family support coordinator to review daily activities, provide information regarding the investigation, resolve problem areas and coordinate family support activities
4. Attending the IIC's daily progress meetings and providing information about any issues concerning survivors and victims' families
5. Liaising with the IIC regarding the content and timing of KNKT media releases
6. Coordinating with the IIC regarding possible visits to the accident site by survivors and victims' families.

The detail of the handling of accident victims and families are described in the Assistance to the Accident Victims and Families Guidelines.



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1.4.2 Location and facility

The OSCP will, preferably, be located close to the accident site, but consideration of proximity to the site should not be at the expense of functionality. Ideally the OSCP facility should free of media or public disturbance be co-located with serviced accommodation and dining facilities sufficient to enable the entire investigation team to reside at the one address.

As a general rule, the facilities require in OSCP are dedicated communications, including telephone, facsimile, internet network and computer.

The logistics required at the CC could include the following:

- a. Fixed line telephones;
- b. Computer/laptop with Microsoft suite of software;
- c. Printers/modems (fax card);
- d. Facsimile machines ;
- e. Photocopiers;
- f. Television;
- g. Digital camera or digital video camera (each group);
- h. Digital projector and screen ;
- i. Stationery ;
- j. Status boards (whiteboards).

Important considerations include the following needs:

- a. Food/drink (tea/coffee, cold bottled water, cups);
- b. Proximity to accident site;
- c. Transportation to and from accident site;
- d. Security guard for OSCP entrance;
- e. Dedicated 'liaison person' from the venue (particularly during the early setting up period) to assist/arrange local support aspects;
- f. Quiet areas for group meetings, briefings (hotel/motel rooms are normally adequate for this purpose if no suitable room in OSCP).

The conference room should be able to be secured and not adjoining a public conference room unless sound proofed. If not, arrangements will be necessary, such as hiring adjacent rooms, to make a sound barrier. Conference facilities including seats and tables depend on the nature of the occurrence.

The support of OSCP to on-site activities will vary greatly depending on the type of aircraft involved, the local terrain, and factors including weather.

On-site requirements could include:

1. Transport to/from site for investigation personnel;
2. Food, water, toilet facilities and shelter for team members and possibly for others;
3. Secure space;
4. Site safety;



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5. Decontamination facilities for personnel and for components;
6. Communications;
7. Site security/guarding.

1.4.3 Access control

Access control is very important for the OSCP, and the access site, as many people are involved and only some of them should be given access to specific locations.

Access is controlled using photo identification with information appended, and effective perimeter control to ensure access is only provided with appropriate identification. In this way, the right people can get access, but only through a controlled procedure.

Ready and clear identification of KNKT personnel and investigation team members is an important aspect of investigation management. KNKT personnel should wear the high visibility vest on issue and upon which is displayed the KNKT name.

For participants from other parties, form of badge system (security ID cards) may be applied. The badge shall include photo identification with information appended are name, organisation, group (if applicable). The information shall be in Bahasa Indonesia and English. The company or organisation identification cards may also be wearing together with the security ID cards.

Security ID cards will be produced on site, specific to the investigation and access permission, for issue to team members. The OSCP is responsible for issuing security ID cards for all personnel involve that provide sufficient detail to enable management and control of:

1. Access to OSCP, media conference, and NOK briefing areas;
2. Site access.

Participants who have been provided with Security ID card shall briefed with relevant part of the KNKT Policies and Procedure and sign the affidavit.

Security ID cards are to be worn by every person working on the site. Any person without an identification card will not be permitted access to the OSCP. Escorted access may also be provided with prior arrangement for accredited media and for families and friends of those associated with the accident.



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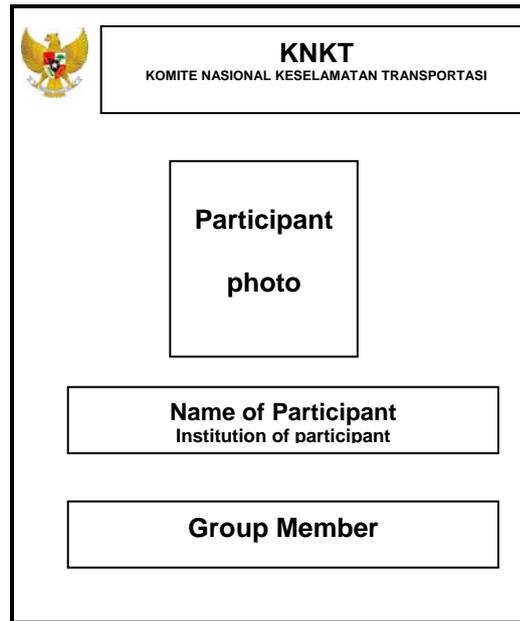


Figure 1: Sample of security ID



2 GROUP SYSTEM

2.1 General

The KNKT adopts the principles of the Group System for the investigation process for a significant and complex investigation requiring the involvement of a large number of personnel from both the KNKT and other organisations. The Group System is in accordance with international agreements and instruments.

The Group System enables the appointment of specialists to specific areas of the investigation.

The Group System enables the appointment of specialists to specific areas of the investigation. This facilitates the orderly and prompt flow of information.

This well-proven system is adaptable to the circumstances of any occurrence. In addition to the role of Investigator in Charge, KNKT personnel fill key roles as group leaders.

The success of the Group System depends on coordination, cooperation and communication between the IIC and the groups, through the Group Leaders.

All members of the investigation team should keep their respective Group Leaders informed of their activities. Group Leaders should, in turn, keep the IIC informed of developments within their group.

Depending on the type of occurrence, groups will be formed from the list below:

- a. Operations and Aircraft Performance;
- b. Air Traffic Services and Airports;
- c. Weather;
- d. Witnesses;
- e. Structures;
- f. Site Survey;
- g. Powerplants;
- h. Systems;
- i. Maintenance Records;
- j. Flight Recorders;
- k. Human Performance;
- l. Survival Factors and Cabin Safety;
- m. Evidence Tracking and File Administration;
- n. Management and Organisation.

Not all groups are required to be separately established for all occurrences; some may be combined under one leader, for example, the IIC may determine that it is more appropriate for combining one group with another group such as:

1. System and power plant Group;
2. Air Traffic Services, Airports and Weather Group.



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Should the IIC decide to combine one or more groups, or to add sub-groups to existing Groups, consideration should be given to the additional workload that this may place on individuals and Group Leaders, and the possible effect this may have on the timely flow of information.

The general job descriptions of the groups are described in this chapter, while the details are described in the appendix of this guideline.

2.1.1 Group Leaders

Group Leaders are individuals nominated by the IIC to organise, conduct and control the activities in the Group Leader's assigned area of responsibility during the investigation. Group leader shall be KNKT senior investigator qualified as level III investigator.

The Group Leader will be required to:

- a. Allocate tasks to group members in accordance with the group role and the individual's skills to ensure the efficient completion of the group's task;
- b. Keep the IIC fully informed of new information as it is revealed ;
- c. Ensure that persons assigned to the group understand, and agree to comply with, the KNKT investigation objectives.

Each Group Leader is also responsible for:

- a. The conduct of the particular aspect of the investigation assigned to the group;
- b. Management, conduct and safety of their groups under the direction of the IIC;
- c. The production of group progress reports regarding an investigation in an acceptable form for submission to the IIC in a timely manner;
- d. The production of the group report at the completion of the on-site phase;
- e. Supervision of any on-going area of Investigation;
- f. The production of the group's final report as much as possible in ICAO Annex 13 format.



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2.1.2 Group Structure

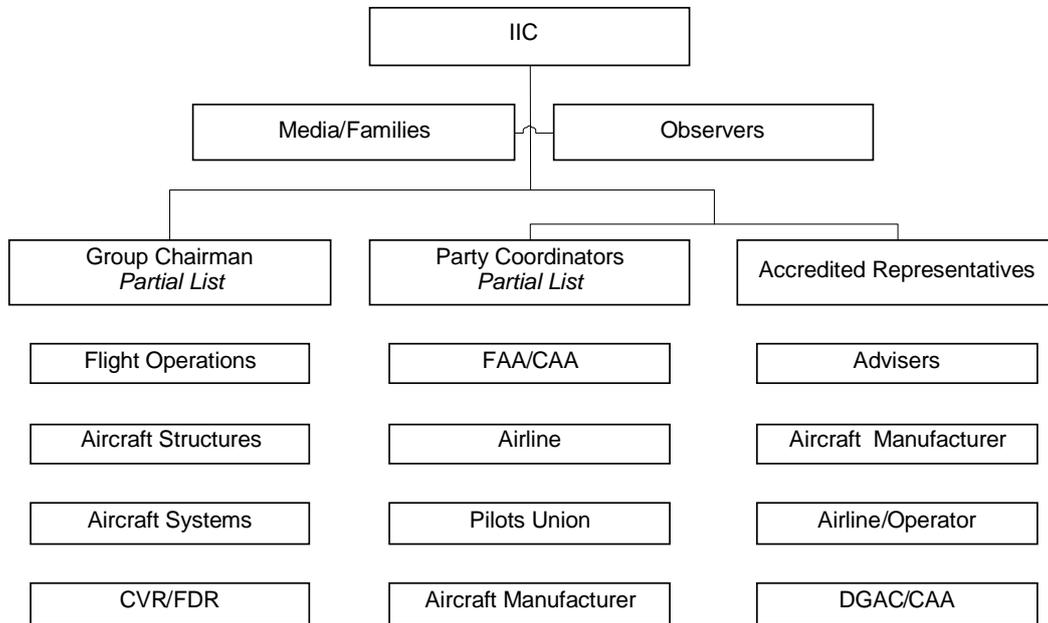


Figure 2: Example of how the investigation team may be organised, depending on the nature of the accident

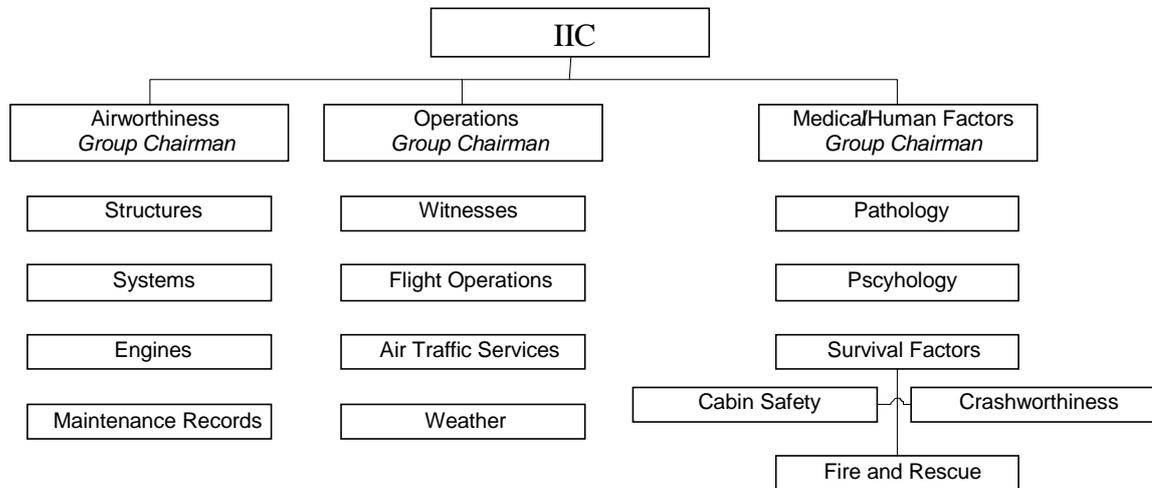


Figure 3: Investigation team organisation – Example A



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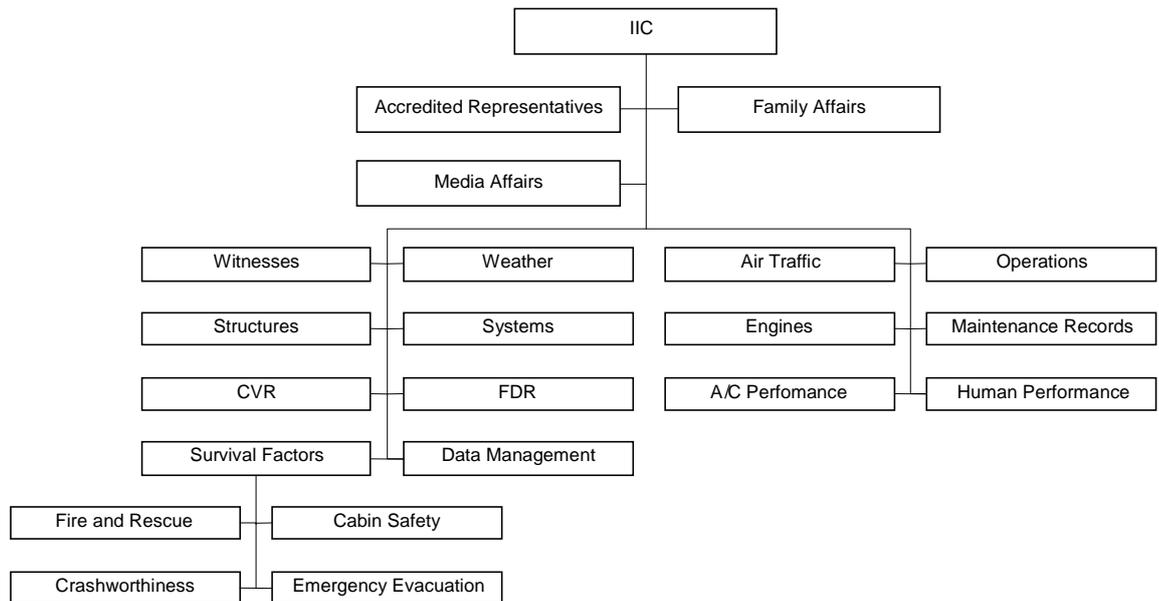


Figure 4: Investigation team organization – Example B

2.2 Group Report

In consultation with the group members, the group leader is responsible for scrutinizing the evidence gathered in relation to the tasks assigned to the group and for drafting a group report, which presents all the facts relevant to the activities of the group. Also, the group chairperson should draft an analysis of the facts that the group has established, draft the findings of the group's investigation and make proposals for safety recommendations.

2.2.1 Field Notes

Each group completes Field notes during the field phase of the investigation and for all component examinations and test work. Field notes will be completed in the same format as factual reports. At the completion of the field notes, each member of the group will sign them signifying their agreement with the content, accuracy, and completeness.

2.2.2 Factual Group Reports

Factual reports are derived from the field notes and enhanced with the follow up investigation work.

In discussion with the group members, the group chairperson is responsible for scrutinizing the evidence gathered in relation to the tasks assigned to the group, and for drafting a group report, which presents all the facts relevant to the activities of the group. Referred to as the group factual report, the draft should be shared with other specialists in the investigation, as well as accredited representatives and their advisers participating in the investigation, for the purpose of ensuring completeness and accuracy, hereafter referred to as a technical review.

After consultation and revision of the group factual report, copies should be provided to all organizations and specialists, who participated in the investigation, and then the reports should be made public, ideally by means of an Internet web site.



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A group factual report should be presented in the following format:

(name of) Group Factual Report (or field notes)

(Date)

A. Accident: XXXX (identifying code number assigned by KNKT)

Location: XXXX

Date/Time: XXXX

Aircraft: XXXX

B. Group Members

XXXX Group Chairperson

XXXX Airline Specialist

XXXX DGCA Specialist

XXXX Manufacturer Specialist

C. Summary

This section should give a synopsis of the occurrence, such as flight number, takeoff time, accident time (if known), number of persons on board, injuries, etc. This section also should contain a brief synopsis of the scope of the group's work. The terms of reference for the group and sub-groups and brief details of the time and location of investigation activities should also be recorded in this section. For example, "the Flight Operations Group interviewed the pilots, reviewed records, and conducted simulator work." And "the Aircraft Systems Group documented the aircraft components on scene, removed some parts, and conducted component examinations at the facilities of the manufacturer."

D. Details of Investigation

The facts, conditions and circumstances established by the group and investigation findings (factual) should be presented under appropriate headings describing the areas investigated. For example, in the case of the Flight Operations Group, headings would include crew histories, flight planning, dispatch and aircraft mass and balance. All the relevant facts, whether or not considered significant to the findings of the group, must be included. Relevant documentation should be appended to the group report.

2.3 Operations and Aircraft Performance Group

The Operations and Aircraft Performance Group is responsible for:

1. Sourcing all relevant operational documentation.
2. Determining all the facts concerning the:
 - a) History of the flight;
 - b) Performance characteristics of the aircraft;
 - c) Relevant technical flight crew actions.



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The group may also assist the Site Survey Group in establishing the lateral and vertical flight path of the aircraft, leading to the occurrence.

The circumstances of the occurrence may require that a specific sub-group be established to conduct a detailed examination of data relating to aircraft performance characteristics or to examine management and organizational issues.

This group is different from the other groups. It deals with operating the aircraft. The group is interested in the people who receive information from many sources, and then use that information to make decisions as they fly the aircraft.

The sources of information that interest this group are often a lot more diverse than the interests of other groups, and their tasks are less procedural and prescriptive. This group will do more liaising and gathering information from different sources as they eliminate or confirm possibilities, and this work often provides early direction and focus to the IIC and to the investigation as a whole.

The circumstances of the occurrence may require that a specific sub-group be established to conduct a detailed examination of data relating to Aircraft Performance characteristics.

Aspects to be examined, in conjunction with other groups as appropriate, may include:

• flight planning	• communications
• flight dispatch	• air traffic services
• weight and balance	• navigation and approach aids
• performance	• en-route stops
• weather	• re-fuelling
• crew medical history	• flight profile
• crew experience (flight time, time on type, checks etc.)	

The Performance Group should observe the following when going about their tasks:

- a. Ensure that an appropriate level of liaison is maintained with other groups to minimise duplication of effort.
- b. During the initial organisation meeting, request the initial on site team to gather any papers, documents, or manuals from the accident site. All items must be itemised and forwarded to the Operations/Performance Group, who will review the material for its relevance to the occurrence.

Note: Papers, documents, or manuals that are present in the cockpit should remain undisturbed until the Systems Group has inspected the cockpit. However, if conditions at the occurrence site are such that, if not collected, the material in the cockpit would perish or be irretrievably damaged, then it is essential that the initial on site team photograph the material in situ prior to its removal. Any material removed from the cockpit must be protected until it can be handed to the Operations Group.

- c. When documenting the cockpit, the responsible group must:



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- d. Take notes of the observations and have the participants sign these notes to signify their agreement with the observations
- e. Take photographs – use ‘scale’ references if required
- f. Gather and document all aircraft manuals/documents/checklists
- g. Gather and document the contents of the crew's navigation bags and personal luggage (if carried in the cockpit).

Group Coordination

The Performance Group should coordinate with the following groups.

- a. Appropriate group (usually Systems Group) in documenting the cockpit environment. Ensure that the cockpit area is not moved or disturbed until it has been fully documented. When documenting the cockpit area, try to enlist the assistance of representatives from the operator, the aircraft manufacturer, and or the regulatory authority who are qualified and proficient in the design and operation of the aircraft.
- b. Appropriate group (usually, Structures) to document the identification, location, and weight of the cargo and passenger baggage, including in cabin baggage, on board the aircraft.

Caution: Pay particular attention to any dangerous goods carried on board.

- c. Recorders Group to ensure that all relevant data obtained from the aircraft Flight Data and Quick Access Recorders (FDR/DFDR and QAR) shall be provided to the Operations and Aircraft Performance Group and that CVR is made available for transcript.
- d. Recorders Group and the manufacturer's representative to determine whether kinematic modelling of the FDR/DFDR information will be available to assist in analysis of all relevant aspects of the aircraft's performance.
- e. Systems Group to ensure that the Operations and Aircraft Performance Group shall be provided with a copy of the Previous Flight Report (PFR) from the Central Maintenance Computer (CMC), if fitted to the aircraft. Ensure that copies of the results of all system tests obtained from Built-in Test Equipment (BITE) are provided to the Operations and Aircraft Performance Group.

2.4 Air Traffic Services, Airports and Weather Group

The Air Traffic Services, Airports and Weather Group are responsible for getting and analysing the:

- a. Original records of the air traffic units
- b. Weather data and airport information
- c. Records involved with the flight.

This group should, where appropriate, provide a reconstruction of the history of the flight based on the original data and their analysis.



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Responsibility

The Air Traffic Services, Airports and Weather Group are responsible for reviewing the performance of all Air Traffic Service Units associated with the progress of the accident flight. This includes, but not be limited to an examination of:

1. Recorded voice communications;
2. Recorded radar data;
3. Other ATS recorded data;
4. Hard-copy information;
5. Interviews of ATS personnel.

The group is also responsible for:

- a. Determining the availability and effectiveness of both ground based and space based navigation aids pertinent to the occurrence;
- b. Determining the availability and effectiveness of aeronautical mobile and fixed service communications;
- c. Obtaining and assessing all relevant information on the meteorological conditions pertinent to the occurrence. This shall include both forecast and actual conditions, and the availability of meteorological information to the crew(s);
- d. (If relevant) obtaining pertinent information associated with the aerodrome, its availability, operation, facilities and condition;
- e. Determining the operational status of the airport, relevant navigation aids, communications equipment, radar equipment;
- f. Providing technical information on such equipment when required;
- g. Collecting, compiling, and analysing all factual meteorological data relating to the occurrence.

Activity

The Air Traffic Services, Airports and Weather Group will assess:

1. Recorded radar data;
2. Original automatic voice recordings of communications;

The group will also verify:

1. Written transcripts of voice recordings;
2. Air/ground capabilities;
3. Landline and satellite facilities;
4. Navigation aids;
5. Runway, taxiway and other movement area.

Of necessity, there must also be close liaison on a continuing basis particularly with Operations, Performance, Witnesses, and Systems Groups.



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2.5 Witness Group

The Witness Group is responsible for contacting and interviewing all persons who may have information pertinent to the accident but does not normally include involved parties who would be interviewed by other Groups—for example, the crew will normally be interviewed by the Operations and Aircraft Performance Group.

Witnesses will be interviewed in accordance with [KNKT Interview Guidelines](#).

The group is also responsible for:

- a. Producing a map plotting the location (at the time of the accident) of all witnesses relevant to the accident;
- b. Communicating information gained from witnesses to other groups in a timely manner to assist those groups;
- c. Producing a report, at the completion of its investigation, analysing all interview information.

Close coordination must be maintained with all groups, particularly the Operations, Human Performance and Survival Factors Groups.

2.5.1 Identification of Witnesses

Many witnesses will not have been involved in the circumstances that led to the occurrence, but they may have seen or heard:

- a. The occurrence;
- b. Things that may be relevant to the occurrence;
- c. Some event that contributed to the occurrence.

Further, many witnesses will not be transport specialists and may not realize the significance of their observations. Some witnesses may be reluctant to come forward as they consider that someone else may have given the information, or they may prefer not to become involved.

Consider the example of an accident that occurs at or near a major airport during the late afternoon or early evening peak hours. There may be a significant number of witnesses, many of whom could be travellers who have schedules to meet and cannot remain at the airport just in case someone wants to interview them. Even if a witness is willing to assist investigators immediately, KNKT staff may not be present and the witness may not know whom to approach. By the time the Witness Group members arrive at the site, these witnesses may have departed the area.

Every effort must be made to identify witnesses for later interview. There are a number of means available to do this, KNKT could:

1. Supply questionnaires to local authorities who can be with the witnesses quickly and can ask them to fill in their contact details and a brief description of their connection with the occurrence. Local authorities could include transport security staff (located in state capital cities), police, transport management staff, and KNKT regional office staff). Local media will be on scene quickly and can be expected to locate people who can tell a story;
2. Ask the media to broadcast an appeal to anyone who saw or heard anything that might have been connected to the occurrence to contact either KNKT or other nominated contacts;
3. Ask all local authorities for contact details of people who they have interviewed.



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2.5.2 Briefing of Witnesses

The attitudes of witnesses towards being interviewed can be expected to vary from keen, through co-operative to reluctant. Before interviews begin, all witnesses must be briefed about KNKT investigation, interview and information handling procedure, in accordance with normal KNKT interview practice.

Witnesses must be assured that:

1. KNKT investigates solely for the purpose of improving transport safety and is not concerned with issues of blame or liability.
2. Witnesses may have an Interviewee's 'Friend', who can be present or interpreter.
3. All information provide to KNKT will be protected under Indonesia Aviation Act no 1 of 2009 article 359.

Even if they have sustained no physical injury or suffered any bereavement in the occurrence, witnesses could be severely emotionally traumatised by their experiences. Witness Group members will need to carefully balance the need for information from fresh memories with the risk that emotional trauma may render a witness unreliable.

Interviewers must be alert to the possibility that something could be remembered or said that could upset a witness, and may result in the witness being unable to continue the interview.

Ideally, the Witness Group should include a person with expertise in human factors to be available to advise other group members who do not have that expertise.

Interviewers should visit the site to get a clearer picture of what has happened. This may assist in directing questions. If this is not possible then be briefed by the IIC or group leader engineering or operations as to known facts or hypotheses at the time, or any specific line of questioning required.

An occurrence that takes place at or adjacent to a major airport, or in a heavily populated area, will probably be seen or heard by a large number of people. Although information given by these people will include a considerable amount of repetition, ideally they should all be interviewed.

The result will be a large number of people (possibly several hundred) wanting to tell their stories plus a large volume of interview information to be processed, virtually all at once. This will require careful management to ensure that witnesses are not demotivated by delays in interviews, and that their information is collated accurately. Clearly, these tasks require a level of resourcing well above that which is available within the KNKT.

Keep in mind that it would not be expected to do more than eight proper interviews a day. Interviews are time consuming and tiring, and the administration, pre-briefing and post-briefing all take time. This process should not be rushed.

Interviews are digitally recorded unless there is a strong resistance from the interviewee. To that end, interviewers shall take notes of the interviewee statement. The interviewee shall be offered a copy of the digital recording at the end of the interview, and arrangements made for sending it to them.

An interviewer may also take written notes if that helps them.



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The Witness Group, consisting of at least two investigators on site equipped with a minimum of one recorder, one laptop computer plus an ample supply of stationery. Number of investigator in Witness Group depend on the number of interviewee, Additional resourcing is required if long delays and fatigue are to be avoided.

The additional resources would be required for interviewing and for collating/transcribing records of interview. The minimum additional resourcing required will be one person who can type quickly and accurately, to enter the notes of interview into the database.

Additional interviewers may also be required and as KNKT investigator, or may require interviewers from outside the KNKT. Steps should be taken to ensure that appropriately experienced people are used for this important task.

2.6 Structures Group

The Structures Group is responsible for examining the airframe and flight control surfaces of the aircraft. This includes accounting for the total aircraft structure, documenting the wreckage distribution and damage and conducting an examination to establish the aircraft pre-accident integrity and configuration.

The examination is compared with design and technical drawings and records, and wreckage information has to be recorded or maintained in a way to allow a valid comparison.

The group works closely with the Site Survey Group in the production of a wreckage plot, and is responsible for the reconstruction of all or part of the wreckage when such action is considered necessary.

The group may participate in determining the final flight path, speed, impact attitude and sequence of events.

The group may assist in:

- a. Locating, identifying and cataloguing of the wreckage;
- b. Assessing the magnitude of the forces experienced during the accident;
- c. Assessing the nature of any failures to items critical to passenger safety.

The responsibility of the group may overlap with those of other groups such as Site Survey, Systems, Performance and Survival Factors and as such requires coordination.

General points of note to the group are:

1. If at any point during the investigation the evidence indicates that the accident or related damage may have been caused by a deliberate act that might be criminal in nature, the IIC must be informed without delay.
2. Preservation of the evidence is paramount. All team personnel must be aware of the requirements and must conduct all activities in a way that minimises the risks of evidence loss.
3. Fire or explosions can either be the cause of an occurrence or result from it. The extent of the fire/explosion damage to individual components and of the burned areas on ground should be carefully documented.



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2.7 Site Survey Group

The Site Survey Group is responsible for producing, in pictorial and graphical format, a description of the occurrence site showing the location and distribution of wreckage, human remains, and other associated items.

The group also establishes the probable path, impact angle and speed, and impact forces.

One of the main tasks for the Site Survey Group is to record the accident site before it is disturbed, and to record the locations of all relevant areas of the accident site before they are disturbed.

A range of tools are available. The Site Survey Group may use:

1. A traditional tape;
2. A compass;
3. A clinometer;
4. A camera;
5. A 3D theodolite (useful for gathering spatial data that cannot be gathered by the 3D camera, such as the location of photographs, or twig-breaks in a tree canopy);
6. A 3D camera (useful for making a visual 3D record of an accident site).

The activities of the Site Survey Group are closely linked with those of other groups, particularly the Structures Group.

2.8 Powerplants Group

The Powerplants Group is responsible for the investigation of all aspects concerning the aircraft powerplants, including the fuel and oil systems, propellers, and associated control systems.

The examination is compared with design and technical drawings and records, and wreckage information has to be recorded or maintained in a way to allow a valid comparison.

In the early stages of the investigation in particular, the group works closely with the Structures and Site Survey Groups in the production of the wreckage plot.

The Powerplants Group is responsible for investigation of the engine(s), Auxiliary Power Unit (APU), including fuel and oil systems to the firewall, propeller(s) and power plant controls.

The group:

- a. Checks if the engines have memory storage capability (such as, FADEC), and if so, liaise with the Flight Recorders Group for component and data recovery;
- b. Investigates the source of, time of onset, and extent of any powerplant fire and the effectiveness of extinguisher systems;
- c. Examines the type of fuel used and the condition of that fuel;
- d. Investigates the pre-impact integrity of the power plant.



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The Powerplants Group must liaise closely with the Site Survey, Structures, Systems, and Operations Groups.

2.9 Systems Group

The Systems Group is responsible for the examination of all the aircraft systems and their components other than power plant. The group's job may be diverse, depending on the type of systems on the accident aircraft, or systems that may be discounted at an early stage, such as pressurisation in a low-level flight.

The Systems group is responsible for the detailed examination of all the aircraft systems and components including:

- a. Vehicle controls;
- b. Hydraulics;
- c. Fire suppression;
- d. Pneumatics;
- e. Electrical/electronics;
- f. Instruments;
- g. Communications;
- h. Navigation;
- i. Air conditioning;
- j. Pressurisation;
- k. Ice and rain protection;
- l. Fuel;
- m. Fire protection;
- n. Oxygen.

The examination includes determination of the condition and/or operational capabilities of the systems and components as well as the positions of associated controls and switches.

This group may also be required to assist the Site Survey Group with the wreckage plot.

2.10 Maintenance Records Group

The Maintenance Records Group is responsible for reviewing all the aircraft maintenance records to ascertain the maintenance history of the aircraft with respect to the adequacy of inspections, malfunctions that could be related to the occurrence, and time-in-service of relevant components. This group may lead the direction of the investigation, or confirm other's findings. The nature of their task is variable, and can have very different inputs into the story behind an investigation report.

The investigation may extend into legislation, design, certification, manufacturing and maintenance. The areas may include standards and procedures, quality control, equipment and facilities, and maintenance personnel.



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To conduct the duty, Maintenance Record Group may not come to the accident site, and more on the operator maintenance based. Therefore, close coordination with Powerplant Group, System Group, Structure Group or Operation Group shall be maintained.

Maintenance records and appropriate transport vehicle documents are reviewed with regard to:

- a. Adequacy and appropriateness of maintenance, servicing and inspections, repairs and modifications, supplemental type certificates;
- b. Airworthiness Directives and Service Bulletins that might be relevant to the occurrence;
- c. Malfunctions that might be related to the occurrence;
- d. Operational hours and cycles for the airframe, engines, and applicable components;
- e. Time and cycles since inspection/overhaul/ repair/modification of the airframe, engines and critical system components.

The Group is also responsible for determining the background data relative to:

1. Design, manufacture and certification;
2. Possible design deficiencies;
3. Maintenance standards and procedures;
4. Servicing and inspection schedules.

2.11 Flight Recorders Group

The Flight Recorders Group may be called upon to assist locating, identifying of damage or burnt recorder and securing the flight data and cockpit voice recorders carried on the aircraft. However, the group will not normally attend on-site and therefore, this task would be performed on their behalf under authority/direction of the IIC.

The information stored in these recorders will normally be retrieved and collated as part of the investigation process.

The Flight Recorders Group is responsible for the extraction, calibration, and technical analysis of data contained in the aircraft's flight recorders.

The Group, in conjunction with the on-site team, is also responsible for the location, retrieval and transport of the flight recorders to the KNKT recorder facility.

The group will also determine what, if any, other data sources are available for recovery that may provide an insight into the circumstances leading to the occurrence.

Detailed aviation recorder recovery information and notes are available in [Recorders Handling Guidelines](#).

The Flight Recorders Group will normally work at the KNKT Recorder Facility in Jakarta to download and analyse the recorded data. The group assists most of other groups by providing recorder data.



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2.12 Human Performance Group

Human performance investigators assist the investigation team to identify the significant human factors issues involved in the accident (unsafe acts, local factors and inadequate defences).

The Human Performance Group is responsible for the determination of significant physiological, psychological and behavioural aspects (events) involved in the occurrence, and the factors that may have influenced those events. Their task tends to develop later on in an investigation, so they may assist other groups at the outset, particularly in taking interviews.

The group obtains medical information on the crew, including post-mortem examinations when applicable.

During a major accident investigation, human performance investigators are primarily involved in collecting and analysing the following types of information:

1. Sequence of events involved in the occurrence;
2. Behavioural, cognitive, emotional, physiological and medical conditions of the relevant operational personnel;
3. Recent (72 hours to 14 days) history of the relevant operational personnel;
4. Task and environmental conditions which may have influenced the performance of the relevant operational personnel.

During the on-site data collection phase, human performance investigators will primarily be collecting information on items two and three, and assisting with other data collection tasks.

The group may be required to assist other groups such as Operations, ATS, Witness and Survival Factors, by conducting interviews and physical and psychological assessments.

For many major accident investigations it will be more appropriate to have the human performance investigators in several other groups rather than have a separate group. In such circumstances, as agreed with the IIC, a Human Performance Group Leader is still required. This person will coordinate with the other human performance investigators to ensure that all the relevant information is being collected.

The general points below serve as a guide to the Human Performance Group Leader and other human performance investigators:

- a. The 'relevant operational personnel' may include crew, traffic services personnel, maintenance personnel, and so on;
- b. The group may also be responsible for collecting and analyzing information on management and organisational issues associated with the occurrence. However, this phase of the investigation will typically occur several weeks after the accident and can be coordinated at that time;
- c. The activities of the Human Performance Group must be closely coordinated with other groups, particularly the Operations, Witness, Traffic Services, Survival Factors, Flight Recorders, and Management and Organisational Factors groups;



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- d. Human performance investigators will generally be present at most of the significant interviews with relevant operational personnel, and these interviews will usually need to be conducted as soon as is practicable. These activities need to be coordinated with the other relevant group leaders;
- e. To help obtain and analyse medical and physiological information, the Human Performance Group will normally use a medical specialist(s). This specialist(s) may also be a key member of the Survival Factors Group, and his/her activities will need to be coordinated with that group;
- f. At present there is no legal or established protocol for the KNKT to obtain biological screening tests on surviving personnel (for levels of alcohol, glucose, carbon monoxide, etc.). However, such personnel could be advised (through their company or representatives) that to undertake such an examination might be to their advantage. These examinations could be arranged through a government medical officer in some locations;
- g. A wide range of checklists exist of issues/potential factors to consider in a human performance analysis (for example, Chapter 4 of the ICAO Human Factors Training Manual). These checklists are not listed in the present manual, as their useability varies depending on the circumstances. Human performance investigators should carry a set of such checklists for reference purposes during data collection activities such as interviews;
- h. Although the on-site phase involves mainly collecting data on the relevant operational personnel, the analysis phase will require the human performance investigators to consider a wide range of information in order to identify and analyse the significant human factors issues;
- i. To be a member of the Human Performance Group, a person must have appropriate expertise in human behavioural and/or medical sciences.

2.13 Survival Factors Group

The Survival Factors Group is responsible for investigating the occurrence with regard to the survivability of passengers and crew. These aspects include, but are not limited to:

1. Any relevant crew briefings;
2. The performance of the crew;
3. The effectiveness of:
 - a) crash and evacuation procedures
 - b) search and rescue
 - c) fire suppression
4. The crashworthiness.

The group is also responsible for interviewing passengers and obtaining relevant medical data on non-surviving passengers.

Investigating the impact survivability issues for all vehicle occupants includes developing and documenting information on the following:



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- a. Impact and occupant dynamics;
- b. Vehicle interior configuration;
- c. Crash injury and survivability;
- d. Evacuation and post evacuation;
- e. Search and rescue.

To avoid duplication, it is important for the Survival Factors Group to work closely with the Witness and Human Performance Groups in arranging and conducting interviews.

The activities of this group will overlap, to varying degrees, with those of the Human Performance, Structures, Operations, Site Survey, Airports, Maintenance Records, and Witness groups. CASA is also one of the prime sources of expertise on crashworthiness.

2.14 Management and Organisational Issues Group

The task of the Management and Organisational Issues Group is to assess the influence on the occurrence of management and organisational factors. Management and Organisational Issues include influence of management and organisational factors on the occurrence. Those factors can include, but not be limited to:

- a. Organisational structures and functions;
- b. Resources;
- c. Economic status;
- d. Management policies;
- e. Regulatory frameworks.

A group dedicated to investigation of these issues may not be established, but resources to enable this function to be addressed will be allocated to other groups to assist as appropriate. The Management and Organisational Issues Group is required to work closely with other groups and will normally work within, or as a sub-group of other groups such as Operational Group, Air Traffic Services Airport and Weather Group, or Maintenance Record Group.

2.15 Data Tracking and File Administration

The data tracking and file administration is conducted by the secretary or assistant of the IIC and responsible for the control and safekeeping of the various forms of evidence collected during the course of the investigation.

Data tracking and file administration main duty is for the oversight of tagging, recording and tracking of all documents, records, components, hardware and software during the investigation. data tracking and file administration is also responsible for the creation and ongoing administration of files during the investigation.

For the purposes of this section, items and records refer to all of the above.

The OSCG secretary/assistant liaises with the all group leader in collecting all



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evidence. The collected evidence shall be tagged and logged. The tagging format, which is the ID of the each evidence, shall include the source and the date and time of the collected, for example, ID 'Air Operator' dd mm yy.

If the IIC or a Group Leader requires a specific item that has been tagged and recorded, the secretary or assistant will be able to immediately tell that person the location of the item and the holders of any copies. [For detail data required see Investigation Checklist.](#)



3 ACTIVATION OF MAJOR ACCIDENT RESPONSE

3.1 Notification

Once notification of a major accident has been received the Major Accident Response is activated. This activation involves appropriate personnel being contacted and a range of initial actions including the establishment of the Command Centre.

The size, characteristics and location of the accident will determine the investigation response necessary.

The Chairman and the Head of Aircraft Accident Investigation Sub-Committee shall immediately appoint Investigator in Charge and investigation team.

The Chairman, the Head of the Secretariat and the Head of Investigation Division shall immediately establish the Command Centre.

3.1.1 Notification During Normal Working Hours

In the event of notification of a major aviation accident during normal working hours:

- a. The **Secretariat Officer** who receive the notification shall immediately advise the Chairman, the Head of Secretariat, the Head of Investigation Division and the Head of Aircraft Accident Investigation Sub-Committee.
- b. The Head of Aircraft Accident Investigation Sub-Committee will advise the:
 - 1) An KNKT regional investigator (if appropriate);
 - 2) DGCA;
 - 3) Badan SAR Nasional (BASARNAS).

3.1.2 Notification Outside Normal Working Hours

In the event of notification of a major aviation accident outside normal working hours, the Notifications duty officer is to immediately notify the Head of Aircraft Accident Investigation Sub-Committee who will ensure the following are notified:

- a. The Chairman;
- b. The Head of the Secretariat;
- c. The Head of Investigation Division;
- d. The head of recorder facility;
- e. Appropriate KNKT staff.

The Chairman and the Head of Aircraft Accident Investigation Sub-Committee will assign Investigator in Charge (IIC) and investigation team nominated based on the qualification, capability and availability.

The IIC will nominate who else needs to be notified and which resources are also to be deployed to initiate the investigation. The Command Centre identifies the people/positions to be deployed to the site as the initial go team.

The Chairman will normally brief the Minister or the government executive.



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3.2 Initial Actions

3.2.1 Command Centre Initial Action

The Head of Secretariat and the Head of Investigation Division shall immediately establish Command Centre. Appropriate facilities shall immediately set up in Operation Room.

Appropriate staff shall immediately notify. The staff assigned for the Command Centre shall immediately proceed to the operation room and establish the Command centre facilities.

The Head of Investigation Division shall arrange the travel, accommodation, financial support and investigation tools for go team. KNKT should ensure that it has an advance group of personnel on site as soon as possible following the occurrence.

This serves a number of purposes including:

1. The establishment of contacts with rescue services/police, to ensure that those organisations understand the role of the KNKT, and its intentions;
2. The provision and coordination of advice to emergency services regarding hazards and dangerous goods, and the preservation of evidence;
3. Ensuring the site is appropriately secured/cordoned off ;
4. If possible, early recovery of CVR/FDR units, and site photography.

Prior to the deployment of go team, all information related to the accident shall be received and logged by Command Centre secretary. Appropriate information shall be forwarded to the IIC.

The information requires immediately include the hazard and dangerous goods that maybe on board.

3.2.2 Establishing On Site Command Post

Actions required to establish a On Site Command Post (OSCP) will vary depending on whether it is to be established in a city/town, airport or in a remote location. However, while facilities should be easier to arrange in a city/town or airport, the magnitude of the resources required in the event of a major transport accident are such that similar problems may be faced in either circumstance.

Although establishment of the OSCP is the responsibility of the IIC, it is likely that the CC will be required to perform many of the initial actions required to establish the OSCP. Where possible, the OSCP is to liaise closely with the CC to initiate the necessary action to establish OSCP.

Upon arrival on the site, the IIC should perform these initial actions to establish OSCP:

1. Liaise with the CC to establish OSCP requirements, including:
 - a) Preferred location;
 - b) Accommodation needs;
 - c) Conference/operations facilities;
 - d) Special arrangements.



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2. Consider external assistance. In most situations, and particularly in a situation where a major accident has occurred in an area remote from towns or cities it is likely that the KNKT will need to request assistance through BASARNAS or military force. The Chairman should process such a request. The request may include specific assistance such as transporting personnel to accident site (number of person), or in the case decision not to send investigator, may request for data collection and recorder removal.

3. Set up the OSCP.

Once the OSCP has been established the OSCP secretary or assistant will act as part of the investigation team to provide administrative and logistic support to the team and to maintain OSCP facility for the collection, retention, and distribution of documentation collected during the on-site phase of the investigation.

3.3 Communicating the Major Accident Response

This section provides guidelines and instructions for communicating the response to the major accident. The primary communication objectives in the event of a major accident are to:

1. Assure the public that:
 - a) An independent, thorough and professional investigation is being conducted into this major occurrence by KNKT;
 - b) Factual public information will be disseminated as soon as it is available and confirmed.
2. Provide affected individuals and media with factual information in a timely manner without compromising the work of the investigative team or the outcome of the investigation.

3.3.1 Media Liaison Activities in the Event of a Major Occurrence

The dissemination of information will be undertaken by way of a agreement/discussion between the OSPC and the CC. The discussion will include who will conduct news conference and contain of information that will be disseminated.

After an occurrence, the Chairman may conduct an initial news conference, as early as possible, to outline initial factual information and how the investigation will proceed.

The Chairman will refer all technical questions to the Investigator in Charge (IIC). The venue for news conference would be arranged by the Head of the Secretariat and will consider the number of the media representatives. The venue will be at KNKT Office in Jakarta.

The Chairman will be available to address media inquiries on more general topics—that is, overview, similar past accidents, safety records, etc.

The Head of the Secretariat will be responsible for maintaining a media desk at the Head Office to re-route and coordinate responses to all media requests, and also responsible for coordinating and disseminating all information to the media.

At the occurrence site, to maintain the integrity of the information coming from the



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KNKT, the official spokesperson on the progress of the investigation will be the IIC. The secretary of OSCP or the assistant may:

- a. Coordinates the arrangements for the media briefing;
- b. Provides specific expertise and advice to the IIC in handling the media;
- c. Ensures that media requests and community queries are followed up;
- d. Provide background information to the media, as requested/agreed by the IIC to give specific information on the occurrence.

3.3.2 Coordination

In the days after a major occurrence there is often a lot of confusion and speculation. Therefore, it is important to maintain consistency in the KNKT message. Constant coordination will be necessary between OSCP and the CC, as requests for information will be directed to both.

It will be important to maintain the principle of only the IIC (official KNKT spokesperson), to disseminate information with respect to the conduct of the investigation especially during the field-phase of the investigation.

The IIC may coordinate with on-site investigators or the group leaders related to the information that may disseminated to the media. The information will be limited to the non-disclosure factual information that has been confirmed and the progress of the investigation.

Information released by the IIC must be provided to the CC to ensure a united approach to the media including through the web site.

All information concerning the actual investigation to be released by anyone other than the IIC must be vetted through the IIC and can only be released through the CC.

1. Command Centre

In relation to the media, the Head of the Secretariat in the Command Centre will undertake the following activities:

- a. Maintain the link between the OSCP secretary/assistant and the Command Centre to ensure a consistent KNKT communications approach.
- b. After consultation with the OSCP secretary or assistant, prepare and issue a media release stating that the KNKT is sending a team of investigators to the site and giving initial information about the occurrence.
- c. Contact Public Relation of the Ministry of Transportation and other relevant Indonesia Government departments; and relevant local governments and police as well as sections of industry, to clarify respective responsibilities and establish possible cooperation regarding media relations.
- d. If a large number (more than 100) of local, national and international reporters are expected to cover the occurrence, assistance from the Public Relation of the Ministry of Transportation may be required.
- e. Obtain prior data on this type of accident, such as involvement in previous accidents etc., as the media typically requests these very early in the process.
- f. Set-up a special page on the KNKT website and post up-to-date information on



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the occurrence.

- g. Collect and analyse media clippings on a daily basis in order to evaluate the accuracy of coverage and make corrections as needed.

2. On-Site Command Post

The OSCP secretary/assistant will undertake the following activities:

- a. Facilitate a consistent approach with the dissemination of information to the media and public by maintaining close liaison with the IIC and the Command Centre.
- b. Make arrangements to set up a suitable venue to undertake regular press conferences. The timing and regularity of press conferences is at the discretion of the IIC. However, in the initial stage, it is considered best practice for press conferences to be held daily at approximately 4pm. This is to give on site investigation activities completed on the day and also provide sufficient time for electronic media to meet evening news.
- c. Organise media tours of the perimeter of the site in cooperation with the IIC. It will normally be necessary to establish measures to control media access to the accident site, including site over flights.

3.4 General liaison Responsibilities and Activities

a. The Chairman

The Chairman will be responsible for liaison with Ministry of Transportation and other government departments to coordinate public communications.

The Chief Commissioner will be responsible for liaising with the Presidential staff, Minister of Transportation and the Director General of Civil Aviation about the coordination of public communications and the progress of the investigation.

b. Family and Friends

The IIC or his/her delegate (under the supervision of the IIC), will liaise with the appropriate division of Air Operator or Airport Authority for family assistance in accordance with their code, to have available an official list of family and friends, and be the point of contact for all queries coming from next-of-kin.

The IIC or his/her delegate will also, following completion of the on-site phase, provide family and friends, when feasible, with prior notice of information regarding major announcements, communiqués, release of final report and other sensitive information.

c. Final Report Release

The Chairman may conduct an official news conference, while release the Final Report. The location might be at KNKT head office or the Ministry of Transportation building. The IIC and members of the investigation team will be present to answer technical questions.

The Head of the Secretariat is responsible to coordinate setting up this event.

A series of briefings may be held prior to the official release. These briefings might be offered separately to the Minister, Director General of Civil Aviation, the Air Operator, persons/organizations with a direct interest (Directly involved parties),



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family and friends or any other concerned group as required.

3.5 Group Meetings

3.5.1 Initial Organisational Meeting

During the initial phase of the investigation, after the On-Site Command Post has been established, organizations participate in the investigation (include observer) have been arrived at the OSCP, the initial organizational meeting should be set up.

This initial organizational meeting will discuss:

- a. Initial information acquired;
- b. Registration of investigation team and ID card process;
- c. Group set up include assignment of group leaders;
- d. [KNKT investigation code of conduct include signing the affidavit](#);
- e. Initial plan of investigation includes the site situation (identified hazard and PPE required).

For participants arrive after the organisational meeting should be briefed the discussion and process on the initial group meeting.

At the outset of the investigation, there will probably be an abundance of keenness and enthusiasm, and a willingness to work long hours. The IIC should establish a working schedule such that team members are assured of adequate rest.

3.5.2 Regular Progress Meetings

The IIC should conduct regular progress meetings as the investigation proceeds. The purpose of the meetings is to share information with team members, and to monitor and control the progress of the investigation.

Meetings may involve all members of the investigation team including accredited representatives and advises, group leader only, or specific groups, depending on the circumstances of the investigation.

The need to share information should be weighed against disruption to the conduct of the investigation. Participation in the meetings by personnel other than from the KNKT will be limited to those persons essential to ensure that the IIC can discharge their duties effectively.

Daily meetings of group leaders or all member of investigation team should be arranged by the IIC to review the progress and direction of the investigation. The daily progress meeting is normally conducted at the conclusion of the day's events so all concerned can start prepared and fresh on the next day's activities.

In a daily meeting of group leaders, the group leaders are expected to brief their respective team members on matters discussed at progress meetings.

The normal format for the meetings would be for each group leader in turn to summarise the activities of, and the information gained by, the group since the last meeting. The group leader should then outline the groups planned activities for the following day and answer questions from other groups. Other group may suggest to be amended the group plan if another group has significant finding.



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It is important for the IIC to retain tight control during team meetings. Any attempt to begin analysing evidence should be discouraged by the IIC.

After the completion of the on-site phase, the IIC should arrange follow-up meetings of group leaders as necessary until all group activities are complete and their final group reports received by the IIC.



4 APPENDICES: DETAIL JOB DESCRIPTION OF GROUPS

4.1 Witness Group

The decision to form a specific Witness Group depends on the circumstances of the accident. If there are a limited number of eyewitnesses to an accident, the Operations Group would interview those witnesses as part of its work. If there are numerous eyewitnesses to an accident, a specific Witness Group should be formed.

The Witness Group should consist of a chairperson and group members with expertise to assist in the interviews. The Witness Group members may include at least one pilot with a type rating on the accident aircraft type to provide understanding of witness observations.

[KNKT Interviewing Guidance](#) contains detailed procedures for interviewing all witnesses, including eyewitnesses.

Sources of potential eyewitnesses include local law enforcement officials, who may have already conducted some interviews as part of their work. The Witness Group should collect any statements taken by law enforcement officials to determine if additional interviews may be necessary.

In some accidents with a large number of witnesses, the Witness Group may wish to divide its resources to conduct interviews, including telephone interviews, to determine which witnesses may require more in depth, face-to-face interviews.

The Witness Group should use a good map of the accident area for the purpose of marking the locations of the witnesses relative to the flight path and accident site.

Note: *The Witness Group must coordinate its activities and findings closely and continuously with other groups, including Operations, Weather, and Survival Factors, to ensure that data collected are supporting their work. For example, the Witness Group may interview flight crews of other aircraft or other personnel on an airport that may shed light on operational issues and/or post accident rescue and fire fighting activities.*

Witness interviews should be obtained as soon as feasible, since long delays between the witnesses' observations and the interviews increase inaccuracies in their statements. What may seem like insignificant information may become important when combined with facts discovered during the investigation.

Conduct interviews of relevant individuals as soon as possible after the accident. If interviews must be delayed for any reason, ask the witnesses to write down their observations to prevent loss of accuracy when you conduct the actual interview. Obtain written statements from all persons, who provided weather information to the flight crew.

Locating witnesses may vary from an overwhelming number of people volunteering statements to having to conduct a door-to-door search for witnesses. Typically, witnesses will make themselves known to someone; however, this is not always the case. Local authorities, newspapers, news media personnel, local residents, airport personnel, and passengers and crew members of other aircraft may be valuable witnesses or may aid in locating witnesses.



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Regardless of the formality of the interview, the questioning of witnesses should not be conducted as an "interrogation." The interview should be conducted on a basis of courtesy, cooperation, and neutrality.

Witnesses should be encouraged to freely relay everything they may have seen or heard regarding the accident. The witness should be urged to relate only their own observations and not those of other witnesses. It should be made clear to the witness that the purpose of the interview is to gather information regarding the accident to prevent similar occurrences in the future.

Note: *It is unlikely that eyewitnesses would feel the need to have a representative present; however, it is NTSC policy to permit any person being interviewed (eyewitness, flight crew, air traffic controller, etc.) as part of an investigation in Indonesia to have a representative present. For example, members of the flight crew belonging to a union may wish to have a union representative present during the interview. The interviewee may only be represented by **one** person. The representative may not disrupt the interview or otherwise interfere with the work of the investigators. Pilots of multi-crew aircraft will be interviewed individually and not as a crew.*

Interviews of crew members and air traffic controllers should not be unnecessarily delayed. To expedite the preparations for the interviews, the investigator could communicate interviewees' rights through their association or employer when the interviews with the air traffic controllers, flight crew members, and flight attendants are scheduled. In the event a flight attendant or other crew member appears for an interview and is unaccompanied by a representative, the individual should be advised of his/her right to such representation.

The following guidelines will help achieve a successful interview:

1. Visit the accident site prior to interviewing witnesses. This will help develop a list of areas to be covered during the interview.
2. Establish before hand, with the witness, a time to conduct the interview, if possible.
3. Before the interview, have a general idea of information desired from the interviewee.
4. Attempt to develop a positive rapport with the witness. Always be polite and courteous to the witness.
5. Qualify the witness regarding his/her knowledge and experience related to aviation.
6. Obtain information on the location of the interviewee at the time of the accident.
7. If witnesses are interviewed by a group, the group chairperson should act as the spokesperson and take control of the interview. The spokesperson should brief the group prior to the interview on how the interview will be conducted. Only one person should ask questions at a time, with others to follow in an agreed order.
8. Limit the number of persons participating in the interview. A maximum of two interviewers is desirable.



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9. A model aircraft, compass, watch, maps and charts are valuable tools that can be used during witness interviews.
10. Encourage the witness to share his/her recollections without interruption. Periods of silence by the interviewer, while the witness collects his/her thoughts, have been found to encourage the witness to expound more fully and avoid omissions. The interviewer's ability to be a good listener is essential in this phase. Do not interrupt the interviewee.
11. Ask specific questions after the witness has completed his/her narrative. Keep questions simple and brief. Avoid aviation/technical jargon with those not familiar with such terminology.
12. Be cautious that the questions are not presented in a leading manner.
13. Note-taking during the interview is advisable; however, it should only be done with the consent of the witness and in such a manner as not to be distracting.
14. A voice recorder can be a valuable tool, but should only be used with the witness's consent noted on the recording. If the interview is recorded, a copy will be provided to the witness.
15. When interviewing a witness under a doctor's care, always obtain permission from the attending physician before the interview. In these cases, limit the number of questions and the size of the participating group.
16. After all questions have been asked, provide the interviewee with the opportunity to ask questions of the interviewers.
17. If the interview is not recorded, ask the witness to prepare or permit you to prepare a written statement including all the pertinent information given during the interview. Encourage the witness to use sketches, drawings, photographs, and maps to supplement the statement. If a witness refuses to sign a statement, do not press the issue. Indicate on the statement in whose presence it was made and that the witness did not wish to sign it.
18. Leave a telephone number and an address where you can be reached in case the witness recalls additional information.

When all information is obtained from the interviewees, review the notes of the interviews with the other group members who participated in the interview, and verify their concurrence with the factual contents. The highlights of the interviews should be noted in the Witness Group factual report.

The product of the Witness Group should include a report of the general observations of all witnesses, with no analysis of the observations. The group should also develop a map showing witness locations correlated with the observations.

Note: *In cases for which there are very few eyewitnesses, there is no need to form a Witness Group. In such cases, the Operations Group would conduct the interviews and would include the eyewitness information in its report.*

4.2 Weather Group

The Weather Group is responsible for documenting the environmental meteorological conditions pertinent to the accident and for evaluating the meteorological products and services of the various agencies and individuals



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involved in the accident. Documentation efforts include gathering all relevant weather data and conducting interviews to augment and amplify the weather data.

Note: *It is not necessary to form Weather Group for all investigations. For accidents in which weather factors are closely associated with the accident circumstances, Weather Group should be formed. For example, if the accident involves low ceilings and visibilities and an instrument approach, Weather Group would be formed. If the accident circumstances do not directly relate to weather factors, such as accidents in good weather that involve mechanical failures or similar factors, the Operations Group would typically collect relevant weather data to support the investigation.*

If possible, a chairperson, who is a meteorologist familiar with aviation operations, should lead the Weather Group. The group should be supplemented with specialists from other agencies, such as the national weather service, and the airline and the airport meteorology and dispatch office(s). Availability of a pilot who is type rated in the accident aircraft is important, if aircraft specific issues arise. If a meteorologist is not available to lead the group, such expertise should be sought to support and advise the group.

The Weather Group is responsible for determining if weather forecasts and observations passed to the flight crew were timely, adequate and accurate. Moreover, the objective of the Weather Group is to determine if meteorological conditions played a role in the circumstances of the accident, either as causal or contributory factors.

Initial investigation efforts should centre on defining and obtaining data that may be most relevant to the accident. For example, detailed surface observations should be immediately obtained for an accident that occurs at or near an airport. However, weather radar data may be immediately required for an in-flight accident when thunderstorms or turbulence are suspected to have played a role in the accident. The Weather Group chairperson should also ensure that highly perishable data, such as recorded digital data are immediately archived for later retrieval. These data include Runway Visual Range (RVR), low-level windshear advisory system (LLWAS), Doppler radar, etc.

The Weather Group activities would likely include a visit to the accident location, the local weather service office, and the weather observing facility nearest to the accident location. In addition, interviews (both in person and via telephone) with weather service personnel, such as forecasters and meteorological technicians, and eyewitnesses may be necessary.

If an accident occurs in the vicinity of an airport, weather observers may also be interviewed. Also, if the accident involves an airline that maintains a meteorological department, it may be necessary to interview the airline meteorology staff and the dispatch personnel. In certain cases, data may be requested from relevant military meteorological personnel or other local and national agencies.

Follow-on Weather Group activities often depend on the complexity of the weather associated with the accident. Activities such as calibration, teardown and testing of weather instrumentation, meetings with researchers specializing in the various weather hazards, and review of Doppler weather radar data are examples of possible group efforts.

The Weather Group must maintain close coordination throughout the investigation



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with other investigation groups, such as Operations, Aircraft Performance, Witnesses, and Air Traffic Control. This is essential since information from communications, pilot reports, and eyewitness weather observations is of interest to the Weather Group, while data it has collected may be of immediate importance to the other groups. In many cases, the groups concerned with aircraft wreckage distribution require wind information, while upper wind and temperature data may be vital to the work of the Performance Group and others. Information should also be exchanged with the Flight Data Recorder and Cockpit Voice Recorder Groups.

Note: *An updated list of internet web sites that provide meteorological information and data is helpful for many accidents that occur in remote locations.*

There are scores of sources for obtaining weather information and defining the weather environment associated with an accident or incident. Depending on the circumstances of the accident, the Weather Group has several organizational sources for such information, including:

- a. The national weather service or Badan Meteorology, Klimatology dan Geofisika (BMKG);
- b. Airline meteorological sources;
- c. Airline Dispatch Office;
- d. Air Traffic Services;
- e. Airport / local Meteorological Office / Station;
- f. TV and Radio Stations ;
- g. Universities (Research Programs);
- h. Air Quality Monitoring Networks;
- i. Internet Sites.

Other data sources for obtaining weather information and defining the weather environment include:

1. Documents provided to the flight crew;
2. Surface weather observations;
3. Forecasts and advisories (area and terminal forecasts);
4. Hourly and special reports;
5. Surface weather observations, logs and records;
6. Weather advisories;
7. SIGMETs and AIRMETS;
8. Precipitation records;
9. Barograph records;
10. Wind records;
11. Synoptic charts;
12. Upper air charts;
13. Ceilometer records;



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14. RVR records;
15. Radiosonde observations;
16. Satellite cloud photos;
17. Conditions of natural light (day/night, sun/moon angle);
18. Accurate times of sunrise and sunset;
19. Weather radar data (Acoustic Doppler, LIDAR);
20. Satellite data;
21. Lightning data;
22. Transmissometer (visibility) data;
23. Rainfall records;
24. Severe weather reports;
25. Low level windshear alert system (LLWAS) data;
26. Video cameras (personal, from outdoor security systems, etc);
27. Wind information;
28. Cloud height information;
29. Pressure information;
30. Visibility information;
31. Temperature information;
32. Type of precipitation (frozen or freezing);
33. Post accident checks of equipment;
34. Visibility reference charts.

Other **indirect sources** of weather information that likely will require interviews include:

1. Eye witnesses;
2. Air traffic services specialists;
3. Pilot reports (PIREPS);
4. Weather observers;
5. Weather briefing personnel;
6. Weather forecasters;
7. Flight crews (accident flight crew and others in the vicinity of the accident);
8. Airport personnel;
9. Law enforcement agencies;
10. Video, photograph.



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In assessing the role of the weather in the accident circumstances, the Weather Group should consider the following potential hazards and phenomena:

- a. Ceiling;
- b. Visibility;
- c. Obstructions to vision;
- d. Surface and upper winds;
- e. Temperature;
- f. Density altitude;
- g. Precipitation;
- h. Turbulence;
- i. Mountain wave effect;
- j. Revolving storms (tornadoes);
- k. Icing;
- l. Wind shear and microburst activity;
- m. Electrical storms;
- n. Whiteout and other visual illusions;
- o. Sunrise, sunset, sun angle.

The product of the Weather Group should include a factual report of the data collected, along with interview summaries and statements. Much of the data can be summarized in the factual report with attachments of relevant documents to support the report.

4.3 Air Traffic Services Group

4.3.1 General

Air traffic controllers are often eyewitnesses or indirect witnesses to accidents or incidents. Collection of data from them is important in any investigation.

If the circumstances of an accident indicate that Air Traffic Services (ATC) factors are involved in the causal sequence, an ATS Group may be formed. Otherwise, the Operations Group would document routine ATS information. If an ATS Group is formed, it would be led by an ATS specialist and would have participation from the civil aviation authorities, the air navigation services, airline specialists and air traffic controllers' union safety specialists, if appropriate. Depending on the nature of the circumstances of the accident, the ATS Group may be supplemented by navigational aid (airways facility) specialists.

4.3.2 The Investigation

Receive a briefing from the ATS facility staff/manager about the facility and its operation. The briefing should include a summary of what the facility staff/managers know about the accident. Try to control the size of the group, limiting attendees to those necessary to assist in the investigation. The briefing is for you and those you choose to assist you; feel free to account for all those present and ask that unnecessary persons leave. For example, facility managers not involved in the briefing may make others present uncomfortable, so they should be excused.

Listen to the original ATS recording (may be tape or digital off a hard disk drive).



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Facilities generally record the line to/from the control position headset jack. If there are any questions about what actually got transmitted or received from the radio system, it may be necessary to consult with the airport facilities technicians to establish whether other recording points exist and whether there were other recordings at the time of the accident or incident. You may find that comparing the two recordings shows discrepancies, although this is unusual.

Watch the time clock to ensure there are no breaks in the recording.

Read the draft transcript along with the original recording to ensure you have an accurate working copy.

If the time is off more than 1 or 2 seconds, point it out to the facility person responsible for the transcript. If the times are not corrected in the certified transcript, make a footnote in your report that this is what you found.

Previously furnished cassette working copies are useful, but you should listen to the original ATS tape to verify the accuracy of the transcript. Certified re-recordings will be stereo, with time on one channel and voice on the other, whereas working copies normally include only the voice channel.

4.3.3 Items to Request

1. Certified voice recording (in stereo) with time channel re-recorded at 5 db or less. List each position you are requesting a recording for, typically 5 minutes before initial contact to 5 minutes after the last contact with the subject aircraft. Include the Aerodrome Terminal Information Service (ATIS), as necessary. Most facilities record incoming and outgoing telephone conversations (land lines). Request these recordings to determine whether pertinent calls were made or received.
2. Certified transcripts. A partial transcript is normally sufficient for frequencies the aircraft was communicating on before the accident. A full transcript should be requested for the frequency the aircraft was on at the time of the accident.
Note: *Transcripts are often prepared using a copy recording. Always verify the final transcript by comparing with the original recording medium.*
3. A copy of ATS controller statements for any person who had responsibility for controlling or communicating with the flight or preparing or handling data related to the flight; witnessed any portion of the flight operation; was involved in emergency action as a result of the accident; or provided a weather briefing to the flight crew within 24 hours of the accident. Obtain a statement from the supervisor on duty at the time of the accident.
4. Copies of all notes, flight progress strips, pads, forms, and memoranda used by the air traffic controller(s) at the time of the accident, as well as copies of pertinent chapters of facility orders and position binders.
5. If OJT (on-the-job-training) was being conducted, a copy of the facility training order and verification that the instructor is properly certified, and a copy of the training evaluation for the session that included the accident.
6. Diagram of facility layout.
7. Applicable letters of agreement between the air traffic facility and other facilities or operators.



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8. Pilot bulletins.
9. A copy of the authorized and on-duty staffing on the day and the shift at the time of the accident.
10. Copy of all NOTAMs pertaining to airport operational and equipment status on the day of the accident.
11. Copy of all SIGMETs, AIRMETs, CWA, meteorological impact statements, terminal forecasts, and current weather observations for the time and day of the accident.
12. Facility equipment status documentation:
 - a. Facility Maintenance Logs.
 - b. Previous flight checks of NAVAIDs, as appropriate.
 - c. Post-accident flight check reports.
13. Copy of instrument approach procedure, including the chart on file at the air traffic facility if an instrument approach procedure is involved.
14. Facility evaluations and facility replies.
15. Unsatisfactory condition reports related to procedures or equipment pertinent to the accident.
16. Any other pertinent documentation that may come to your attention as a result of your investigation.

4.3.4 Records

Review the air traffic controllers' training records for the following information:

- a. Date entered the current facility.
- b. Date became fully certified.
- c. If in training, the positions the air traffic controller is certified in.
- d. The number of hours the air traffic controller has accumulated in the position involved.
- e. Date certified in the position involved.
- f. Any applicable training briefing items and the date received.
- g. Any history of operational errors. Any in past 2½ years should be shown in training records, and the full facility investigation package can be requested if needed. Date entered on duty.
- h. Technical training discussion records – supervisory evaluations of the air traffic controller performance.

4.3.5 Observe Conditions in the Facility

- a. Determine the location and accessibility of maps, charts and approach plates, etc.
- b. Noise levels.
- c. Lighting.
- d. Indications of alarms, bells, doors, various sectors, traffic management staff, supervisory positions.



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4.3.6 Conducting Interviews

- a. Introduce yourself and the other members of the group, if any;
- b. Explain how the interview will be conducted;
- c. Interviewee has the right to one representative of his choice. The role of the representative is not to intervene. They cannot tell the interviewee what to answer or tell you what you cannot ask;
- d. You are in charge of the interview. Ensure that the questions are fair and are not phrased in a leading manner (i.e. "would you agree that...");
- e. Although the policies and procedures may permit other experts to participate in the interviews, only the investigators are essential. Interviewees may also request that one or more members of the group be excused, but you should advise the interviewee that the interview notes will still be available to all group members;
- f. If the interviewee wishes that others, such as DGCA personnel, not be present, they should be excused, although this is not recommended, just as long as the DGCA personnel are not promoting violations. Persons other than the investigators, who may disrupt or delay the interview, should be excused. Group members can be given your notes in lieu of actual attendance if you believe that having others present during the interview will reduce the interviewees' willingness to talk.

Note: *The controllers should be interviewed separately, but may have a friend present. A maximum of two interviewers is desirable.*

4.3.7 Sample Interview Questions

1. Air traffic services history. Did they attend an ATS training college or academy? Where? When? Did they graduate? Review training records.
2. Where they were first assigned for training? Did they successfully complete training? Where did they transfer? Did they complete training there?
3. Do they have military ATS experience? How long? Where? What type of facilities?
4. What ATS license and ratings do they hold e.g. procedural, radar etc?
5. Any pilot experience? What license and ratings do they have? How many hours? Do they fly in the area of the accident? Are they current?
6. What are their operating initials?
7. Date of their last medical certification (get a copy from the facility). Any waivers or restrictions? What are they? (If they must wear glasses or contact lenses, were they wearing them at the time of the accident?).
8. Describe their general health.
9. Who is their immediate supervisor? How long?
10. How much overtime in the last round of shifts?
11. What assigned shift was the air traffic controller(s) working? What did they actually work? What were the previous shifts? Which day of the work week?



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12. What were they doing before taking the position involved?
13. Did they receive a complete relief briefing? Did they use a position relief checklist? Was the briefing recorded? (Briefing should be on the position tape). What information did they receive during the briefing?
14. Ask the interviewee to provide a narrative description of his involvement in the accident sequence, starting from when he first became aware of the aircraft involved.
15. If appropriate, elicit air traffic controller assessment of workload, staffing levels, traffic complexity, supervisory performance, response to requests for help, condition of equipment, settings of equipment, effectiveness of ATS procedures used, and any distractions in the control room at the time of the accident.
16. Watch out for “agendas” — air traffic controllers often use interviews as an opportunity to complain about issues of concern to them (labor/management) although the issues’ relevance to the accident may be dubious.
17. Ask if interviewee has any questions or is aware of any areas not adequately covered in the interview.

4.3.8 Time Sources

The radar clock should be set to the GPS clock, which is very accurate. Most digital voice recorders use a GPS time source, which also is extremely accurate. Analog systems use a digital time signal that is recorded on a specific (assigned and numerically designated) recorded channel. Airport facility or ATS personnel should check the timing at least twice per day. Verify this as part of the investigation. Ensure that the timing from different sources (en route, approach, tower, etc.) is synchronized.

4.3.9 Completing the Field Phase

Coordinate with the IIC to ensure that you both understand what the ATS investigation is to accomplish. Once the field phase is complete, produce your factual notes in conjunction with the group. Validate the notes with the group members and obtain their concurrence that the contents represent the group’s work. Provide each member with a copy of the notes and ensure that the IIC accepts that your work is complete by initialing off on the note package.

4.3.10 Report

The report of the ATS Group should include a summary of the tasks accomplished, copies of relevant voice transcripts, radar plots of the aircraft movements, statements of the air traffic controllers and copies of relevant facility records. In some cases, a computer-generated animation of the ATS events is an important product to illustrate the events of the occurrence.

4.4 Operations Group

4.4.1 General

The Operations Group will cover a wide spectrum of issues related to the accident, depending on the circumstances and magnitude of the accident and the formation and the assignments of other groups. If there are a limited number of other groups formed, the Operations Group would be required to investigate several areas normally covered by other groups in a major accident investigation. For example, if



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there is no Witness Group, the Operations Group would conduct eyewitness interviews. Similarly, if there is no Weather Group, the Operations Group would collect weather data. In some cases, the Operations Group would also document Air Traffic Services issues.

The Operations Group routine activities involve all aspects of flight operations, including pre-flight planning, dispatch services, mass and balance, ground handling (de-icing, loading, etc.), flight operations, training and checking etc. If appropriate, the Operations Group would also document airport issues, such as runway and taxiway lighting, navigational aids, snow removal, runway conditions, and in the absence of a Survival Factors Group, passenger safety issues and any emergency, fire and rescue services response.

Note: *This checklist should be combined with the other appropriate checklists contained in this Appendix depending on the number of groups formed.*

4.4.2 At the Accident Site

A senior operations investigator will lead the Operations Group. Members of the group would include type-rated pilots from the airline, perhaps from the Director General of Civil Aviation (DGCA), and from the aircraft manufacturer. If there is an airline pilots union, the group would include a type-rated pilot from the union with accident investigation training and experience. Airline management pilots, such as the Chief Pilot, and Aircraft Operations Inspectors from the DGCA with some form of regulatory oversight of the airline shall not be assigned to the Operations Group, because they are likely to be interviewed as part of the investigation and would have a conflict of interest in the findings. An airline representative on the Operations Group could be a type-rated training captain with no management responsibilities. However, this person should not be the training captain who is responsible for training and checking the crew members of the accident flight.

During the initial organization meeting, inform the participants to pick up any papers, documents, or manuals from the accident site and forward them to the Operations Group. The Operations Group will review this material for its relevance to the investigation.

Coordinate with the appropriate group (usually the Structures Group) the documenting of the identification, location, and mass of the cargo (passenger carry-on baggage, checked baggage, and cargo) on board the aircraft. To the extent possible, return the material to its pre-accident condition before weighing.

Coordinate with the appropriate group (usually Systems Group) the documenting of the cockpit environment. Confirm that the cockpit area will not be moved or violated pending its full documentation. If documenting the cockpit area, enlist the assistance of representatives from the airline, the aircraft manufacturer, and the civil aviation authority, who are qualified and proficient in the design and operation of the aircraft. In documenting the cockpit, the group should:

- a. Take copious notes of the observations and have the participants sign in agreement.
- b. Take photographs, if possible.
- c. Obtain aircraft flight manual for reference.
- d. Obtain and document the contents of the flight crew's flight cases and personal overnight luggage. Have a representative of the airline, union (if applicable), and the civil aviation authority present during this activity.



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4.4.3 History of Flight

The following information should be collected in order to document the history of the flight:

1. Name(s), address, and telephone number of owner and operator of aircraft.
2. Type and model of the aircraft and serial number.
3. Nationality and registration marks.
4. Flight number(s).
5. Type of operation (i.e. regulations, such as domestic scheduled services).
6. Date, time, and location of the accident site (latitude, longitude, and elevation). Distance from the point of departure or destination.
7. Last point of departure. Obtain block in/out and takeoff time.
8. Intermediate stops. Obtain block in/out and takeoff time.
9. Point of intended landing.
10. Diversionary landing site, if applicable.
11. Dispatch release. Review original and obtain a certified copy.
12. Weather information provided to the flight crew. Review original and obtain a certified copy. Request statement of weather briefing given, if applicable.
13. Obtain a copy of the flight plan. Review original and obtain a copy.
14. ATS clearance received. Obtain certified ATS communications transcript. Listen to the original recording if no ATS Group is formed.
15. Route and altitude actually flown and normally flown/assigned. Flight crew familiarity with each route.
16. During flight, airline company radio contacts and ATS radio contacts (facility and frequency). Obtain certified ATS transcripts and recordings.
17. Flight plan log. Review original, if available, and obtain a certified copy.
18. Aircraft maintenance log. Review original and obtain certified copies, as required, of write-ups entered during previous 72-hour period, checking for conditions that could affect the performance of the aircraft or the ability of the flight crew to perform their duties. The Maintenance Records Group will view more extensively.

4.4.4 Mass and Balance

1. Weigh the cargo and passenger baggage, if applicable.
2. Mass and Balance Form. Review original document and obtain a certified copy. Perform manual mass and balance calculation and compare with automated results. Validate the authorization for actual versus standard masses.
3. Cargo manifest. Review for type, labeling, placement, and means of securing cargo, especially hazardous cargo as applicable to the situation. Review original documents and obtain certified copies.
4. Passenger manifest.



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5. Fuel and oil record. Review original documents, if available, and obtain a certified copy. Compare data with quantities verified or stated to be on board the aircraft. Check with airport authorities for any previous problems with fuel and the fuelling facility. Secure fuel samples for analysis (See section on Airport Group).
6. Method of mean aerodynamic chord (MAC) or center of gravity (CG) computation. Verify by manual calculation and automated method, if applicable.
7. Mass and balance manual used by airline. Compare with manufacturer and civil aviation authority approved data.
8. Aircraft limitations. Compare airline, manufacturer, and civil aviation authority approved data.

4.4.5 Aircraft Performance

According to evidence and company Standard Operating Procedures (SOP), determine the following:

- a. For Takeoff and Landing:
 - 1) Flap and trim settings.
 - 2) Reference V speeds (atmospheric adjustments).
 - 3) Takeoff and go-around EPR.
- b. En route:
 1. Engine power schedules for climb, cruise and descent.
 2. Airspeed (indicated) schedules for climb, cruise and descent.

Note: Part 11, Aircraft Performance Group, of this appendix contains detailed procedures for the investigation and documentation of complex aircraft performance issues.

4.4.6 Airline Information

The following information regarding the airline should be collected:

1. Size and scope of operation:
 - a) Number of personnel, aircraft and size of route structure.
 - b) Standardization of aircraft fleet.
2. Copy of Air Operator Certificate (AOC).
3. Copy of operations specifications.
4. Waivers and amendments to the operations specifications.
5. Operations Manual. Compare the operating procedures of the airline with the procedures recommended by the manufacturer and the civil aviation authority.
6. Aircraft Flight Manual. Compare the checklist in the company flight manual with the checklist actually used by the flight crew and the checklist published by the aircraft manufacturer.
7. En route, standard terminal area arrival route (STAR), standard instrument departure (SID), terminal, and approach charts used by the flight crew. Determine if each flight crew member was provided with his own.



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8. Training program. Obtain the airline training program and syllabus. Confirm civil aviation authority approval of the training program. Indicators that assist in determining the quality and effectiveness of the program include the establishment of a training directorate within the airline, programs incorporating stabilized approach criteria, and cockpit resource management (CRM). Compare the policy and procedures of the operations manual with the training manual/program for continuity. Document the background and qualifications of company training personnel.
9. Does the airline have a safety office/department? Determine its authority and ability to impact safety enhancements in the flight operations. In the absence of such an entity, what person and/or department is delegated this responsibility? Conduct interviews.
10. Company pilot bulletins or reading file. Review for data that may be relevant to the circumstances surrounding the accident.
11. Dispatch and flight following. Determine size and scope of the dispatch and flight following function. Compare the duties and responsibilities as stated in company documents with the civil aviation authority regulations. Background and qualifications of the dispatch and flight following personnel. Dispatch and flight following procedures.
 - a. Weather briefings.
 - 1) Review original data provided. Obtain certified copies.
 - 2) Determine source of data and method provided.
 - b. Flight planning forms.
 - c. Computer flight plan.
 - d. Fueling record.
 - e. Method of flight following. Advisories issued.

4.4.7 Flight Crew Information

For recently hired flight crew (less than 5 years), confirm the extent of the pre-employment checks that were made on the flight crew members.

Request and obtain licenses, certificates, and medical information and any violation data.

Review company personnel files and employment history for trends (both positive and negative) that may be relevant to the investigation. This includes violations and commendations, absenteeism, and extended period between employment. Obtain name, address and telephone number of previous employers and physician(s) used for medical certification and possibly non-flight related events. Obtain certified copies.

Obtain copies of pilot certificates and ratings held from company files.

Obtain copies of medical certificates and related information from company files. Compare to civil aviation authority data.

Training and proficiency check records. Review the training and proficiency check records initially for the previous two-year period. In the review you are checking for the quality and quantity of training given and remarks noted on the forms by the



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instructors. The forms would contain instructor and pilot signature and date attesting to the training given. On occasion, you may find it prudent to compare the signatures of the pilot and instructor and the training documents with other sources such as payroll records and driver's license. Review the following:

- a. The training records for initial, line (en route), six months proficiency, and annual/recurrent including ditching and emergency. Obtain certified copies.
- b. Initial focus should be on specific areas of training and proficiency checks that on the surface may appear to be relevant to the investigation.
- c. Information that should be available and obtained from the personal, training, and flight records of each flight crew member include:
 - 1) Date employed.
 - 2) Date upgraded to present position.
 - 3) Date upgraded to present position in particular aircraft type.
 - 4) Total pilot time.
 - 5) Total pilot time (flight and duty) last 24 hours, 72 hours, 30 days, 60 days, and 90 days.
 - 6) Total instrument time, if available.
 - 7) Total instrument time on type, if available.
 - 8) Total night time, if available.
 - 9) Regency of experience at the airport related to the accident and with the approach procedure used.
 - 10) Previous experience of the flight crew in flying with one another.

4.4.8 Airport information

See section 4.12 of this guideline for additional airport information

1. Obtain latest copy of airport master record and airport planning chart.
2. Latest report of the civil aviation authority annual inspection.
3. NOTAMS (class D, L, and FDC).
4. Construction on airport property and surrounding area.
5. Inspection results on the condition of runway surface(s).
6. Local obstructions.
7. Condition of runway lights and radio aids.
8. Aerial photos, topographic charts.
9. ATS information, if no such group formed.
10. Weather information, if no such group formed.
11. Obtain fuel samples for analysis.
12. In the absence of a Survival Factors Group, the following activities of the fire and rescue services will be addressed in addition to those items listed above:
13. Time and method notified.



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14. Response time.
15. Number and types of units responding.
16. Fire fighting time.
17. Rescue activities.
18. Pictures of the accident site and the aircraft.
19. Problems with terrain/visibility/route to the accident site.
20. Problems with access to the aircraft wreckage, the passengers and the crew.
21. Type and quantity of fire fighting compounds used.
22. Security established: how ?when ?by whom ?
23. Crowd control problems ?
24. Facility station log.
25. Last airport disaster drill.
26. Activity reports covering the response from the fire station(s) and airport security.

4.4.9 Directorate General of Civil Aviation (DGCA)

- a. Inspections performed on the airline during the previous 12 month period, such as base checks, ramp inspections, en route checks, ground and flight training program checks, crew member checks; dispatcher records (including flight and rest), trip records, dispatch center/flight following/flight/locating facility. Obtain certified copies.
- b. Latest regional inspection performed. Obtain a certified copy.
- c. Latest national inspection performed. Obtain a certified copy.
- d. Frequency of DGCA surveillance and inspections. Compare the number and types of inspections performed with regional and national inspections guidelines.
- e. If the DGCA has conducted audits of the operator in the past, the audit reports and action plans to address any findings should be examined.
- f. Background, qualifications, and workload of the Aircraft Operations Inspectors.
- g. Authorized and current staffing level of the DGCA inspection office.
- h. Most recent pre-accident flight inspection and post-flight inspection results of pertinent en-route and approach facilities/aids. Obtain certified copies.
- i. Most recent pre-accident airways facility inspection and post inspection or pertinent en-route and approach facilities/aids. Obtain certified copies.

4.4.10 Interviews

Detailed guidance on conducting interviews is contained in [Interviewing Guidelines](#). Generally, the Operations Group chairperson will conduct the interview and a human performance specialist and Operations Group members will record notes of the responses. The interview questions should be asked primarily by the chairperson or a flight operations investigator with an opportunity for other group members to ask a limited number of questions, as follow-up.



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Questions related to the flight crew:

- a. Events leading up to the flight in question;
- b. History of the flight;
- c. Operating procedures and techniques;
- d. Training.

The interview should include questions of the following information or personnel:

1. Seat belt and shoulder harness security before and after impact;
2. Difficulty in releasing restraints;
3. Seat adjustment position;
4. Seat security after impact;
5. Difficulties during egress;
6. Aid given to the cabin crew and the passengers;
7. Meals taken during the previous 24 hours;
8. Off duty activities during the previous 24 hours;
9. Description of injuries and how they were attained;
10. All of the above as applicable to the cabin crew;
11. Other crew members who have flown with the flight crew of the accident flight;
12. Other flight crews operating in the vicinity of the accident flight;
13. Families of the flight crew members;
14. Dispatchers and flight following personnel;
15. Other flight operations personnel who came in contact with the flight and the flight crew;
16. Airport ramp personnel, airport counter personnel, etc;
17. The flight crew who flew the aircraft prior to the crew involved in the accident;
18. ATS air traffic controllers, if no such group formed;
19. Training instructors and check airmen;
20. Civil aviation authority principal operations inspectors;
21. Witnesses, if no such group formed;
22. Passengers, if no such group formed.

4.4.11 Organizational Factors (Management and Safety Oversight)

In most investigations, the Operations Group will document management and safety oversight issues, including any Safety Management Systems (SMS) in place and previous audits, both internal and external.

Note: ICAO Doc 9859, *Safety Management Manual (SMM)*, should be referenced to ensure that SMS issues are properly documented.



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The Operations Group would conduct interviews of airline managers and the DGCA safety oversight inspectors to determine the roles that airline management and DGCA safety oversight may have played in the accident. These interviews should be coordinated with a human performance specialist to examine corporate safety culture issues.

If an SMS system is in place, the elements of the program and the effectiveness of implementation should be investigated. Copies of both internal and external audits, including the action plans to resolve findings from the audits, need to be obtained and examined.

4.4.12 Reports

The Operations Group report should contain a detailed description of the areas covered during the investigation along with the results of the investigation. Copies of all relevant documents reviewed should be attached.

4.5 Structures Group

4.5.1 General Information

The Structures Group chairperson will usually be the point-of-contact with the Site Safety and Security Coordinator regarding accident site safety and security activities in close coordination with the IIC. As a senior investigator at the accident site, he will oversee and coordinate the accident site activities amongst the various groups and will assure safety of personnel and security of the aircraft wreckage, in cooperation with the Site Safety and Security Coordinator, during the field phase of the investigation at the accident site.

Note: *In some cases there may not be a separate Site Safety and Security Coordinator. Rather, the Structures Group chairperson or another responsible person, such as the IIC, will assume the duties of ensuring proper site safety and security.*

The initial responsibilities of the person responsible for site safety and security should include restricting access to the aircraft wreckage and ensuring that the accident site is well secured. Depending on the location of the wreckage, this may include cordoning or marking off the area and arranging for security guards, as necessary. Arrangements should be made to restrict access to the aircraft wreckage to only those who have proper authorization. Access to the wreckage will typically be controlled by the use of "Access to Wreckage" badges, issued for the accident investigation team members, who need to have access to the accident site.

The safety of the site, including chemical and biological hazard containment and/or protection will be assured before access by investigators is permitted. Containment/protection may be in the form of protective clothing and equipment worn and used by investigators entering the site, and the decontamination facility when leaving the site.

The Structures Group may assist in locating and retrieving the cockpit voice recorder and the flight data recorder. Special care may be required to maintain the integrity of the flight recorders.

The Structures Group will be responsible for accounting for the total aircraft structure, documenting the aircraft damage and the wreckage, and determining the pre-accident structural integrity of the aircraft.



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The responsibilities of the Structures Group will often overlap with those of other groups, especially the Systems, Powerplants and Survival Factors Groups. In absence of a specific agreement with another group, the Structures Group will be responsible for documenting the overall aircraft wreckage distribution and condition, relevant impact marks, and other evidence of the path of the aircraft immediately preceding impact. Coordination with other groups will be necessary during preparation of field notes and throughout the investigation.

The Structures Group chairperson will normally be in charge of the aircraft wreckage throughout the field phase of the investigation activities. This could include coordination with medical officials involved with the recovery of human remains and personal effects. The chairperson of the Structures Group should be consulted before any aircraft wreckage is moved by other groups and he/she should ensure that minimal damage occurs if and when it is to be moved. It may also be his/her responsibility to authorize the release of the aircraft wreckage in consultation with the IIC at the end of the field phase of the investigation. Note: The wreckage custody and release form contained in Appendix K, item 1, will be completed and signed by the IIC and authorized recipient of the wreckage.

Arrangements to revisit the aircraft wreckage should always be considered in the event that additional documentation is necessary. Wreckage release will be to the owners of the aircraft or their authorized representative.

In the absence of a person designated for accident site safety, the Structures Group chairperson would normally assume responsibility to ensure that proper safety precautions are taken throughout the field phase of the investigation. This will include the use of protective gear (gloves, masks, boots); the discharge of pressurized components (tires, struts, oxygen bottles); and the elimination or minimization of ignition sources (smoking, cutting equipment). Moreover, before any investigation effort is to begin, the Structures Group chairperson (in the absence of an accident site safety person) should assist in identifying whether any hazardous materials are on board the aircraft or whether the area is unsafe for any reason. If so, the proper officials should be notified and the area decontaminated before any investigation work is initiated at the accident site.

4.5.2 Actions at the accident site

Conduct a visual survey of the accident site and surroundings:

- a. Conduct "walk-around" inspection (arrange for aerial view and photographs, if necessary).
- b. Note the general aircraft wreckage distribution.
- c. Check for and document extremities of the aircraft, condition of leading edges, and evidence of pre-impact aircraft configuration.
- d. Determine pre-accident integrity of the aircraft.
- e. Document impact attitude (heading, flight path, etc.) and crush lines.
- f. Document pre-impact strikes on surrounding obstacles.
- g. Document fire patterns and damage.
- h. Formulate a general plan of investigation.



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4.5.3 Wreckage distribution and the accident site documentation

1. Determine appropriate methods of obtaining aircraft wreckage distribution data:
 - a. Global Positioning System (GPS) unit;
 - b. Surveyor;
 - c. Laser transit;
 - d. Tape measure, compass, etc.
2. Determine appropriate plotting methods:
 - a. Airport or local map;
 - b. Centreline;
 - c. Grid;
 - d. Polar;
 - e. Establish location;
 - f. Latitude/longitude;
 - g. Elevation;
 - h. Terrain characteristics.
3. Obtain maps, charts, and aerial photographs.
4. Assign group members to help in identification of aircraft parts (manufacturers and airline maintenance personnel are best suited for this task).
5. Basic information required:
 - a. Note initial impact marks and heading;
 - b. Note major ground scars (direction, length, depth, etc.) and obstacles struck.
 - c. Location of significant pieces (control surfaces, cockpit, engines, "four corners" of the aircraft, etc.);
 - d. Limits of ground fire;
 - e. Evidence of in-flight fire;
 - f. Terrain features and elevations;
 - g. Photograph or videotape all pertinent items.
6. Numbering of pieces:
 - a. Tag/identify/number aircraft parts; include ground scars and obstacles struck.
 - b. Number all main parts in succession from a reference point or number opposite sides of the centreline in succession (i.e., 1L, 2L; 1R, 2R).
 - c. While numbering important aircraft pieces, document their orientation and evidence of fire, impact angles, etc. (sketch and photograph, as necessary).
7. Detailed examinations:
 - a. Identify aircraft piece/component and note its position and condition.
 - b. Document evidence relevant to possible in-flight failure (separate ground impact damage and in-flight failure).
 - c. Document failure mode and sequence of failure.
 - d. For structural failure, document fracture characteristics.
 - e. Determine aircraft condition at impact.



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8. Control surfaces:
 - a. Ailerons.
 - b. Trailing edge flaps.
 - c. Leading edge devices (flaps or slats).
 - d. Spoilers.
 - e. Elevator.
 - f. Rudder.
 - g. Trim tabs.
 - h. Other (canards, variable geometry, etc.).
9. Control systems (coordinate with Systems Group):
 - a. Position of control surfaces at impact (jackscrews, actuating cylinders, etc.); look for witness marks.
 - b. Examine all movable mechanisms to determine their integrity prior to impact.
 - c. Examine control systems from cockpit to control surface for integrity.
 - d. Measure travel of rudder, ailerons, and elevator.
10. Fuselage - note telescoping, crushing, breaks:
 - a. Cockpit.
 - b. Entry/exit doors, emergency exits, and cargo doors (jammed, inoperable, etc.).
 - c. Fuel tanks.
 - d. Windows (cracked/crazed, blown out, fracture patterns, etc.).
 - e. Engine pylons, in coordination with the Powerplants Group.
11. Wings:
 - a. Evidence of pre-impact marks or damage.
 - b. De-icer or anti-ice systems
 - c. Fuel system (tanks, vents, dump) for integrity or evidence of leakage.
12. Empennage:
 - a. Pre-impact strikes.
 - b. De-icer boots.
13. Landing gear:
 - a. Position (up, down, intermediate).
 - b. Direction of failure.
 - c. Condition of tires and brakes.
 - d. Wheel wells.



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14. Estimate and calculate impact attitude and velocity:
 - a. Flight path (angles and heading).
 - b. Ground scars (preserve and measure).
 - c. Obstacles struck.
 - d. Terrain at main impact area and nature of terrain.
 - e. Terrain angle.
 - f. Crush lines/angles.
15. Analyse all breaks and separations:
16. Check for evidence of preexisting cracks and corrosion.
17. Loading:
 - 1) Type
 - (a). Tension;
 - (b). Compression ;
 - (c). Bending;
 - (d). Shear ;
 - (e). Torsion.
 - 2) Direction
 - 3) Source
 - (a). Impact
 - (b). Aerodynamic
 - (c). In-service
 - (d). Explosion
 - (e). Fire fighting/rescue
18. Determine need for laboratory examination (coordinate with materials specialists).

4.5.4 Mock-ups

Two-dimensional mock-ups are generally used when a control system problem, a fire, or an in-flight structural break-up are suspected. Three-dimensional mock-ups are usually limited to a critical section of the aircraft, rather than the complete structure, and are used to determine the location of failure and sequence of structural breakup. No mock-up should be started until the condition and location of all known aircraft parts has been documented.

1. Determine extent of mock-up required:
 - a. Partial or complete mock-up; or
 - b. Three-dimensional mock-up.
2. Identify and label aircraft pieces and parts by looking for:
 - a. Part numbers.
 - b. Type of material.



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- c. Shape.
 - d. Dimension.
 - e. Colour.
 - f. Marks.
3. Supervise construction of support structure and reassembly of aircraft.
 4. Document damage and note any patterns on associated pieces.

4.5.5 Fire Damage

1. Match up parts to determine what was burned.
2. Be aware of parts that were not burned.
3. Determine location and source of ignition.
4. Determine when fire started (pre-impact, post-crash, etc.).
5. Post-impact fire may obscure or destroy evidence of in-flight fire.
6. Document soot, heat, and fire patterns.
7. In-flight fire may show effects of fire (soot, molten droplets) downstream of the origin due to airflow (Take soot samples if appropriate for laboratory analysis).
8. Smoke and flames from post-accident fires will rise vertically or be blown in the direction of surface winds.
9. Caution - mishandling wreckage will obscure or destroy evidence critical to a fire or an explosion investigation.
10. Determine the need for further laboratory examinations and the retention of aircraft parts.
11. Effects of fire:
12. Flame temperatures of in-flight fires (1600°C (3000°F) and above) will be greater than post-impact fires due to forced draft.
13. Apply evidence against known melting temperatures for materials.
14. Soot will not attach itself to surfaces which are over approximately 400°C (700°F).

4.5.6 Composite Materials

Note: For structural failures involving composites, employ the services of one or more experts in this very complex area. The following is a brief overview.

1. In the past found mostly on secondary structures, but their use is becoming more widespread.
 - a. Control surfaces;
 - b. Leading edges;
 - c. Fairings;
 - d. Interior structure (panels, seats, etc.);
 - e. Now more common in fuselage structures and skins, keel beams, and wing spars and skins. E.g. A380 and B787.



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2. Construction
 - 1) Skin - resists tension and shear loads:
 - (a). Metal;
 - (b). Fibre.
 - 2) Core - holds skins in place and resists buckling loads:
 - (c). Metal;
 - (d). Fibre;
 - (e). Foam.
3. For damage to composite materials, document:
 - 1) Inter-laminar separation;
 - 2) Direction of loose fibres;
 - 3) Direction of adhesive flow lines.
4. Bond or void failures:
 - 1) Indicates area that was never bonded;
 - 2) Smooth, clean sides between core and skin are apparent (no pull-out damage).
5. Delamination:
 - 1) Previously bonded;
 - 2) Slightly rough sides;
 - 3) Adhesive failure;
 - 4) Cohesive failure;
 - 5) Resin failure.
6. Impact damage:
 - 1) Localized breakage on leading edge;
 - 2) Small areas of skin/adhesive separation;
 - 3) Torn/crushed core;
 - 4) Use gloves to handle (small slivers may penetrate skin).
7. Fire damage

The amount of composite materials burned can indicate temperature. Resins may burn, leaving fiber and cloth (approximately 700 C (1200°F)). Dangerous residual particles could be inhaled so respirators are essential in closed areas.

4.5.7 Laboratory Testing

Determine the need for detailed laboratory analysis; a field examination may not be sufficient. If laboratory examinations are required, ensure proper documentation of the aircraft parts before removal and shipping. Clearly identify parts for shipment and specify that the package is not to be opened until the presence of an accident investigator, or a designated person.



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The group members will be expected to participate in laboratory testing activities at the determined places and times. Component testing should only begin when an appropriate test plan has been developed and the group is briefed on its content and group members agree with the plan. The test results should be documented in such a way that the test plan and the results will clearly be understood by the reader.

4.5.8 Reports

The product of the Structures Group should include a factual report of the data collected, including photographs and written descriptions of various components examined, both at the accident site and in laboratories. The attachments to the report should include structural component descriptions of parts which were found and examined as part of the group's work. Any test plans developed during the course of the investigation should also be included in the factual report of the group.

4.6 Systems Group

The Systems Group is usually responsible for three general areas of the investigation:

- a. Cockpit documentation;
- b. System and sub-system component examinations;
- c. Laboratory component testing and teardown examinations.

Aircraft systems are grouped into several general categories, including hydraulic, fuel, electrical, avionics, pneumatic, and mechanical systems.

Note: *There should be close coordination between the Systems Group and the Powerplants Group for the documentation of the fuel systems.*

A senior technical investigator, normally with qualifications and experience as a maintenance engineer, will lead the Systems Group. Specialists from the operator's maintenance and quality assurance organization and the civil aviation authority would normally be members of this group. These specialists must be familiar with the aircraft systems operation and their maintenance. One or more specialists from the aircraft manufacturer with in-depth knowledge of the systems should also be assigned to this group.

If the initial findings indicate issues with a particular system, additional specialists from the aircraft and component manufacturers would be added to the group. They will be signed up as members of the team and required to comply with NTSC rules of investigation confidentiality.

4.6.1 Cockpit Documentation

The Systems Group will document post-impact control lever positions, switch positions and instrument readings. The group will also handle the recovery of flight planning information and other documents (related to the flight operations), which are found in and around the cockpit area. This work is coordinated with the Operations Group. Typically, one or more type-rated pilots from the Operations Group would work with the Systems Group members in completing the documentation of the cockpit. The following are some general guidelines for this activity:

No other groups or individuals will be allowed in the cockpit area until the system documentation has been completed. Coordination is required with other groups.



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Describe the actual condition - The term "*destroyed by fire or impact*", will not normally be used unless the fire was so intense that the only remains are molten metal etc. Specify fire damage and extent of mechanical deformation. Resolve what documentation of normal or abnormal system operation can be verified by the evidence, despite the fire damage.

Do not move levers or switches until written and photo documentation has been completed and any group concerns are resolved — ensure group member concurrence before removing components or other destructive work.

Use drawings from manuals to record instrument readings and to identify component identification.

Identify components that may be removed for laboratory testing, bench testing and teardown examinations.

Note: *In order to prevent undue damage or loss of data, ensure concurrence of the experts from the manufacturers and the operators before removing components. If removal of a component may lead to damage to the part, develop a plan in advance and obtain concurrence of all relevant experts before removing a component.*

The following information should be obtained where possible:

- a. Positions of all switches;
- b. Positions of engine and propeller control levers;
- c. Positions of flap and gear levers;
- d. Readings from all instruments;
- e. Settings of all bugs (e.g. heading, airspeed, altitude, EPR);
- f. Frequencies and settings from all radio tuning panels including volume controls;
- g. All trim settings;
- h. Condition and documentation of the electrical panels and circuit breaker panels.

Note: *Key instrument and switch positions should be photographed before any effort is made to analyze those positions. Soot, dirt, or glass damage may temporarily obscure instrument readings but readings may be obtained by cleaning or removing the glass.*

4.6.2 System and Sub-System Documentation

Determination should be made of system integrity, component condition, actuator and valve positions, etc. Priority and degree of concentration on a particular system will be dependent upon the accident circumstances. For example, if the CVR or FDR provide early indications of a particular system malfunction, the Systems Group should concentrate on those components.

Note: *Just because preliminary information may suggest a particular system malfunction, DO NOT neglect full documentation of all other systems.*

Coordination with Structures Group is a must (to coordinate access to the wreckage and to coordinate parallel group efforts). Documentation of the following subsystems and items is typically the responsibility of the Systems Group unless otherwise assigned by the IIC.



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- a. Before documentation, ensure that immediate needs for preservation are being met (e.g. cover avionics if rain is forecast). Photograph the area and details first.
- b. Use schematic diagrams from applicable manuals to document components and systems as they are identified.
- c. Describe location and actual condition of each component as found. Do not move or change position of actuators, valves, switches, or controls until documented.
- d. Measure actuator extended length. Be certain to be specific in describing points of measurement. Photograph actuators, valves, switches and controls that are potentially relevant to the accident. Do not assume "non-involvement" of any components.
- e. Record the following information from each component that is potentially involved, when possible:
 - 1) Nomenclature;
 - 2) Manufacturer;
 - 3) Part number;
 - 4) Serial number;
 - 5) Position in aircraft.
- f. Determine whether electronics and avionics may have recoverable memory. Recover electronics and avionics with 30-50 cm (12-18 in) of wire harness, rather than simply removing the avionics box. Only disconnect at the plug connection if aircraft is salvageable and memory retrieval is not possible or necessary.

4.6.3 ATA (Air Transport Association) Specification 100

1. Organize documentation of various systems according to ATA Specification 100:
2. Air Conditioning, Chapter 21 - air cycle equipment, valves, bearings, impellers, ducting connections, thermocouples, switches.
3. Auto Flight, Chapter 22 - cockpit control settings, servomotors.
4. Communications, Chapter 23 - operation and indications.
5. Electrical Power, Chapter 24 - wire integrity (continuity, shorts, arcing), switches, circuit breakers, electric generators.
6. Fire Protection, Chapter 26 - extinguisher bottles, discharge indications.
7. Flight Controls, Chapter 27 - pre-impact position and integrity, travel of control surface, control cable continuity.
8. Hydraulic Power, Chapter 29 - hydraulic fluid quantity and quality, valves, pumps, filters, tubing.
9. Ice and Rain Protection, Chapter 30 - anti-icing ducting, wiper controls.
10. Instruments, Chapter 31 - needle imprints, internal gears, non-volatile memory.
11. Landing Gear, Chapter 32 - actuators, up/down locks.



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12. Lights, Chapter 33 - light bulb filaments, interior/exterior lights.
13. Navigation, Chapter 34 - frequencies, control knob positions.
14. Oxygen, Chapter 35 - crew/passenger oxygen bottles, lines, generators.
15. Pneumatics, Chapter 36 - ducting, joints.
16. Vacuum/Pressure, Chapter 37.

4.6.4 Laboratory testing and component teardowns

Determine the need for detailed laboratory analysis; examination at the accident may not be sufficient. If a particular subsystem component, or components, is critical to the resolution of the accident, a detailed examination and analysis may be required. This may include bench testing and disassembly. If laboratory examinations are required, ensure proper documentation of the parts before removal and shipping.

Clearly identify the parts for shipment and specify that the package is not to be opened until the presence of an accident investigator, or a designated expert.

The group members will be expected to participate in laboratory testing activities at the determined places and times. Component testing should only begin when an appropriate test plan has been developed and the group is briefed on its content. Test results should be documented in such a way that the test plan and the results are clearly understood by the reader.

***Note:** Procedures for off-scene laboratory systems examinations and tests, as well as reports of the findings, will be completed using the same procedures as for on-scene work.*

4.6.5 Reports

The product of the Systems Group should include a factual report of the data collected, including photographs and written descriptions of various components examined, both at the accident site and in laboratories. The attachments to the report should include systems descriptions and their operations as found and documented as part of the group's work. Any test plans developed during the course of the investigation should be included in the factual report.

4.7 Powerplants Group

The Powerplants Group is responsible for documenting the engines, propellers, engine-related components, and auxiliary power units. Depending on the assignments and participation of the Structures Group and the Systems Group, the Powerplants Group might also document the engine nacelles, pylons, and thrust reversers. Close coordination between all the technical groups is important to ensure thorough documentation and to avoid overlap of work or overlooking certain data..

The Powerplants Group is led by a senior technical investigator as chairperson. This person will ideally have qualifications and experience as a powerplant engineer. Members of the group should include specialists from the engine manufacturer and the airline maintenance organization. It might also include a specialist from the aircraft manufacturer and the civil aviation authority with expertise in powerplants.



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Initial investigation efforts should be focused on documenting evidence associated with the normal operation of the engine(s). A determination of normal engine operation at impact is most helpful for the investigation and can save needless documentation, tests, and analysis later on.

Operating the engines, especially at high power, may leave evidence, such as propeller blade cuts in the ground or on trees, and fan and compressor rub or rotational damage (turbine engines). Efforts to document this evidence should be made before disturbing the accident site.

If any evidence, such as flight crew statements, FDR or CVR data, suggests that the powerplant(s) may be a causal factor, examine for evidence of pre-impact fire, uncontained failures, or separation of engine or engine-related components.

As the investigation progresses, the integrity of the engine, mounts, engine and propeller controls, and fuel and oil supply systems should be documented through visual examination or borescoping before disturbing the wreckage. Any potentially relevant and recoverable recorders and computers with nonvolatile memory of engine or system parameters and in-flight faults should be recovered for examination and potential data retrieval, regardless of their apparent condition. For example, electronic engine controls (EEC) on many engines contain non-volatile memory that might prove useful to validate engine operation before the accident. Airline maintenance personnel can often download undamaged EECs. Damaged EECs must be recovered and it will normally be necessary for them to be examined at the manufacturer for possible recovery of data.

If conclusive evidence of normal engine operation before impact cannot be documented at the accident site, additional testing, disassembly, and laboratory examination may be required.

Document, as part of the aircraft wreckage diagram, engine-related components relative to aircraft structure and relative to the initial point of impact. Include the final position of each engine relative to the normal position of the engine. If parts broke off the engine(s) before ground impact, document the engine part distribution and path of travel. Identify and tag all engines and engine components by model and serial numbers as shown on data plates or by other identifying marks. Also, document in-flight and ground fire damage.

The following is a working list of documentation items for the Powerplants Group.

4.7.1 Turbine Engine

(inlet, compressor, combustor, turbine, systems, accessories and components).

1. Inlet
 - a) Debris, mud distribution, foreign object damage, or ice ingestion damage; scrapes and scratches and their location inside the inlet (Objects ejected from a rotating engine sometimes leave helical tracks as they fly forward).
 - b) Bird or animal remains; if found, they may be sent to an appropriate laboratory for analysis and species identification.
2. Compressor
 - a) Degree, uniformity, and direction of rotor blade airfoil bending, leading edge and trailing edge blade breakage, and any rub marks on the leading edges



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and the trailing edges of the blades; suspicious fractures of a blade, disk, or shaft fractures.

- b) Blade integrity or damage and, if visible, uniformity of mud coating on stators, blades, and cases (using borescope through bleed ports or inspection plates).
 - c) Inlet guide vane (IGV) damage. If engine utilizes variable (inlet guide vanes (IGVs)), check inlet case and stator vane actuators for impact markings to determine stator position at impact.
 - d) Anti-ice valve positions and appropriate anti-ice plumbing.
 - e) Nose cone damage, displacement and condition of PT2 or TT2 probes (PT2 and TT2 probes should be unobstructed and have anti-ice or de-ice systems intact).
 - f) Oil leakage in the vicinity of the front bearing.
 - g) Degree of compressor rotation or binding.
3. Combustor
- a) Integrity of combustor mounting structure.
 - b) Combustor burn-through, blowouts, and large cracks. Combustors can sustain many small cracks without performance degradation. Note if distress is immediately downstream of a fuel nozzle, which might indicate excessive heat.
 - c) Condition of fuel nozzle. Note any obstructions on the nozzle that may distort or disrupt spray pattern. Even minute "streaking" of spray pattern can lead to severe burner and turbine distress downstream of the nozzle.
 - d) Condition of igniter.
4. Turbine
- a) Physical condition of all visible stages of blades and stators, including degree and direction of rotor blade bending, leading edge and trailing edge blade damage, rub or scrape marks, and any debris.
 - b) Evidence of overheat in the first-stage nozzle guide vanes. Note any molten metal impinged on vanes.
 - c) Damage to pressure and temperature exhaust probes, cones and struts.
 - d) Evidence of leakage in the area of the rear turbine bearing.
 - e) Degree of turbine rotation.
 - f) Twisting or bending of shaft (if visible).
5. Systems, accessories and components
- a) Oil
 - (a). Condition of the engine/CSD oil, magnetic plugs in the gearbox, and oil scavenge lines.
 - (b). Obtain oil sample from lubricating tank. Compare to previous oil samples from the same engine.



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- b) Fuel
 - (a). Main fuel and fuel control filters.
 - (b). Fuel control linkage positions, integrity, and continuity and freedom of linkage movement. Check for presence of fuel in the fuel control.
 - (c). Obtain fuel samples.
Note: *Coordinate the acquisition and analysis of fuel samples with the Operations Group, which is typically responsible for obtaining fuel samples from the fuelling trucks and the fuel tanks.*
- c) Bleed and breather air
 - (a). Major damage or disruptions to bleed ducts and breather tubes.
 - (b). Aircraft and engine bleed systems for evidence of ingestion of dirt, vegetation, or debris (might provide indication of engine speed, EPR, and thrust by relating individual engine bleed operating schedules (i.e. starter, surge, air conditioning) to bleed locations where ingested material was found.
- d) Accessories
 - (c). Accessory gear box and tower shaft integrity (attempt to rotate N2 rotor by means of the starter drive pad or other accessory drive pad).
 - (d). Check starter for evidence of in-flight engagement and possible disintegration.
 - (e). Check generator or alternator for evidence of high electrical loads.
- e) Engine components
 - (f). Damage or displacement of various attached components and wiring.
 - (g). Surge bleeds valve position.

4.7.2 Reciprocating engines

(Power section, induction and exhaust system, accessory section)

Power section

1. Impact damage and evidence of pre-impact damage to each cylinder.
2. Freedom of crankshaft rotation. If feasible, remove damaged cylinders or other obstructions to crankshaft rotation.
3. Condition of valves and piston heads, especially for indications of detonation or pre-ignition (as necessary, by borescope).
4. Remove rocker box and pushrod covers and, if possible, rotate engine to observe valve motion. Examine rocker arms, pushrods, springs, and valve keepers for breakage and wear.
5. Check compression. If necessary, remove a representative number of cylinders to determine internal condition and power train continuity within the engine.
6. Leak-check removed cylinders by placing upside down and filling with kerosene (no leakage should be present). Intake and exhaust valves should not be damaged.



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7. Uniformity of pistons; if necessary, clean and weigh pistons. Check piston rings for movement (rings should not be loose, rounded, or frozen). Note condition of cylinder walls for piston ring marks, scrapes, etc.
8. Amount of wear on crankshaft counter weight dampers, if abnormal.

Induction and exhaust systems

1. Induction system blockage.
2. Impellers and blowers (for turbo or supercharged engines). Evidence of internal blower fire, decoupling, or rotational scoring. Clutches and linkages of blower controls. Oil leakage at impeller seals and inside the intake pipes (oil deposits indicate seal leakage and may result in heavy gray or white smoke).
3. Carburetor: position of carburetor heat door (if installed). Examine carburetor for fuel in the bowl, float level and general condition of jets.
4. Condition of inlet air scoops, carburetor air screens.
5. Security, rigging, and position of carburetor linkages (OFF, AUTO-LEAN, AUTO-RICH).
6. Bends and folds in exhaust pipes.

Accessory section

1. Fuel pump, freedom of rotation, and evidence of rotational scoring on gear housing pockets. Integrity of drive splines and coupling shafts.
2. For fuel injected engines, examine the master control, vapor vents, boost, and venturi suction.
3. For twin row fuel injection engines, examine condition of flow dividers and synchronization of injection pumps.
4. Evidence of fuel leaks, condition of injector lines, and condition of control diaphragms and diaphragm actuating devices.
5. Operation and security of fuel discharge valves.
6. Integrity and continuity of tank-to-engine fuel lines.
7. "As found" positions of the main engine, fuel, cross-feed and firewall shutoff valves.
8. Obtain fuel samples from the aircraft fuel tanks, pumps, and lines, and from fuel source tanks or trucks, as required. Obtain a list of aircraft refueled from the same supply source and establish if they have had any fuel-related operational difficulties. If necessary, obtain fuel samples from other aircraft which were refueled from the same sources.
9. Examine oil filters for contamination and proper installation.
10. Oil pressure relief valve position.
11. Oil type and quantity. Obtain oil sample if possible.
12. Integrity and condition of oil lines (if collapsed or kinked, determine if this is pre-impact condition).
13. Magnetic sump plugs.



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14. Condition of oil pump, ability of gear drive to rotate, and evidence of rotational scoring.
15. Oil tank and cooler condition, proper installation, and condition of vents.
16. Spark plugs, ignition harness and wires, magnetos, coils, rotor caps, and distributor electrodes.

4.7.3 Propellers

Blade condition, blade angles.

- a. Associated hydraulic/electrical/mechanical controls for each propeller.
- b. Presence and spacing of any propeller slash marks.
- c. Propeller governors.

Note: Examination of propeller mechanisms and controls requires special expertise and tools that generally would require the assistance of the manufacturer's experts familiar with damaged propeller components. Some airline maintenance facilities and manufacturer or DGCA approved overhaul facilities would also have such expertise and tools.

4.7.4 Auxiliary Power Unit (APU)

Documentation and investigation of APUs will follow the general guidance provided for turbine engines.

4.7.5 Nacelles and Pylons

(in coordination with the Structures Group)

- a. In-flight and ground fire damage, include sooting or scorching on adjacent surfaces.
- b. Punctures or penetrations caused by liberated engine parts.
- c. Integrity and security of cowl latches.
- d. Mud and debris forced into inlet cowl, or between engine accessories, and cowl panels.
- e. Position of flap and cooling door actuator shafts.
- f. Major scrapes and penetrations by external foreign objects (e.g. trees).
- g. Integrity of pylon to wing/fuselage fuse-pins and clevises.
- h. Check pylon fuel and hydraulic lines for pre-accident leaks and check condition of electrical power lines.

4.7.6 Thrust Reversers

(in coordination with the Structures Group and the Systems Group)

- a. Post-impact position (i.e. stowed, or amount deployed) as indicated by reverser lock latches and reverser actuator positions.
- b. Operating mechanisms to determine if the final position of the reverser was due to flight crew actions or impact forces.
- c. Impact or fire damage to the entire assembly including the linkages.



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4.7.7 Reports

The product of the Powerplants Group's examinations should be a factual report of the engines, including photographs of relevant items to confirm the findings. Any teardowns, inspections, or functional testing of engines or components should be included in the factual report, as well as relevant photographs.

4.8 Maintenance Records Group

Review of the aircraft maintenance records can range from the IIC merely reviewing the aircraft and engine logbooks of a general aviation aircraft. Or, it could involve a large airline with a complex maintenance organization and overhaul facilities, which would require the formation of a Maintenance Records Group.

The Maintenance Records Group is responsible for reviewing all maintenance records to evaluate the service and maintenance history of an aircraft involved in an accident to determine if the required maintenance had been performed and if any anomalies in the maintenance history of the aircraft may be relevant to the accident.

The data from this group will address the approved maintenance program, indicators of the adequacy of inspection, airworthiness directives and service bulletin compliance that might be related to the accident, time, and cycles on the aircraft engines and applicable components, and time and cycles since last overhaul or major inspections of the airframe and critical system components.

A senior technical investigator will lead the Maintenance Records Group. Specialists from the operator's maintenance and quality assurance organization and the DGCA would normally be part of this group. These specialists must be familiar with the maintenance program, so that they can assist with the review of records.

A specialist from the aircraft manufacturer and/or the airline or maintenance organization, who developed the aircraft's maintenance program, will usually, also be assigned to this group. In cases involving engine issues, or other large components, a specialist from the engine or component manufacturer, would be assigned to the group. It is also useful in some accidents to include a type-rated pilot in the group.

Note: *Since large aircraft and large engines may be manufactured in different countries, in accordance with ICAO Annex 13, the State of Manufacture would appoint an Accredited Representative with technical advisers from the aircraft and engine manufacturers.*

The work of the Maintenance Records Group function will require coordination with the airline and is frequently performed at the maintenance headquarters of the airline.

For accidents in Indonesia involving an airline from another State, much of the work of the Maintenance Records Group would be conducted outside of Indonesia and in cooperation with the relevant State's aircraft accident investigation authority and DGCA. Depending on the circumstances, all or part of the work could be delegated to the other State with mutual agreement in accordance with ICAO Annex 13.

Note: *Many airlines convert hard-copy maintenance (hand-written) records to computer data files. A review of computer printouts can be useful and efficient; however, the maintenance records investigation must also review the original (raw data) records to determine if the original data were*



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converted properly. Experience has revealed that errors can be introduced when the hand-written forms are converted (typed) to computer files.

The maintenance records investigation may extend into design, certification, manufacturing, and maintenance management. The areas could include standards and procedures, quality assurance, equipment and facilities, and maintenance personnel selection and training issues.

The collected data from all these areas of interest are studied to determine the effectiveness of the maintenance system and its potential relevance to the issues associated with the accident. The investigators must take into account maintenance system differences from one airline to another and the regulations that govern them. Large airlines are governed by regulations, which are rigid and thorough, while general aviation operators are less rigorously regulated. Therefore, it is important to review the approved maintenance program for the operator with respect to the applicable operating specifications and rules. Further, international operators operating into and out of Indonesia are governed by the regulations in their States.

The significance of improper or inadequate maintenance, servicing, or inspection of an aircraft becomes most evident after a thorough review of the relevant records. These data may indicate a need to explore further any records relative to the aircraft type under investigation. The adequacy of a maintenance program should never be assumed based upon the size or apparent sophistication of its operation or records system. The Maintenance Records Group chairperson will alert the investigation team to any system or component that becomes suspect through the records review. In this manner, the Maintenance Records Group will reduce the potential for overlooking possible system or "hardware"-related problems during the wreckage examination at the accident site.

For general aviation accidents in which extensive modifications to the aircraft have been accomplished, the investigation process is expanded. This expansion will include modification and engineering data relative to supplemental type certificates (STC) and major repairs and modifications.

During the investigation process, the Maintenance Records Group should focus on the following specific objectives:

1. Collecting a sufficient amount of general maintenance history information, such as airframe and engine operating times and cycles, recent maintenance discrepancies, recent scheduled maintenance, etc. to serve as a reference database for all members of the investigation team.
2. Researching and evaluating the maintenance aspects of specific issues brought to the attention of the Maintenance Records Group by other group chairmen or the IIC.
3. Proactively analyzing previous maintenance activities and trends associated with the accident aircraft in an attempt to uncover issues that may not be discernible to other groups because of the destruction of evidence in the aircraft systems and structures.
4. Reviewing the operator's, repair station's, and contract maintenance provider's programs, policies, procedures, and work environment to determine whether any of these may have contributed to the accident sequence.
5. Evaluating the DGCA safety oversight activities of the subject operator to



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determine whether the DGCA safety oversight program may be associated with the accident circumstances.

6. When the operator is from outside of Indonesia, close coordination with the accredited representative is important in order to understand the State regulations and maintenance program of the airline involved in the accident.

4.8.1 Notification

Because the Maintenance Records Group will need to quickly gather information about issues that may provide direction for the IIC and other groups, the Maintenance Records Group chairperson may launch to the location of the initial organizational meeting as part of the major accident investigation go team, or the group chairperson may proceed directly to the operator's maintenance base. Immediately after notification and before launching, the group chairperson should ensure that either he or the IIC notify the aircraft owner/operator about impounding all maintenance and service records pertaining to the accident aircraft. The owner will be responsible for the records' safekeeping until the group chairperson or his/her representative arrives to take possession. These records may extend back to the date of the aircraft's manufacture. In some situations, the group chairperson may want to request that the regulator/safety oversight agency (CAA) in the State of the operator takes possession of the records of the last 90 days until the group arrives.

During the initial contact with the owner/operator, it should be stressed that any and all records pertaining to the accident aircraft must be retained for review by the group, including photographing or copying. This is important to emphasize because many airlines use a complex system of computerized record-keeping in addition to their required/approved program.

Although the data from these additional programs is not normally reviewed in the process of ongoing DGCA oversight, it is essential in aircraft accident investigation that the operator makes this additional data available. It will not be necessary for the group to retain original documents as long as suitable copies of necessary records are obtained for the record of the accident.

4.8.2 Convening the group

After the preliminary steps have been taken to impound the records and establish the group, the group chairperson should proceed to the maintenance facility or other location of the impounded records. The investigators will usually find the operator and his employees ready to cooperate in any way. The group chairperson should suggest that one of the company's technical personnel be available to assist in deciphering any unclear or confusing write-ups in the maintenance log. Additionally, the group chairperson should take the following steps to enhance the group's effectiveness:

1. Arrange for a secure conference-type room to be set aside for the exclusive use of the group for at least one week. If possible, this room should be located in the building that houses the operator's maintenance administration offices. Whatever room is used, it should be able to be locked so that the records can be secured in this room during non-working hours.
2. Attempt to acquire a dedicated phone line for the group. If possible, the line should be routed to the group's workroom if not already located there.
3. Ensure that a computer is available to the group for the processing of field



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notes on a daily basis (bring a notebook computer if possible). Because the Maintenance Records Group will deal with a very large volume of data daily, it is recommended that field notes be composed on an ongoing basis. Arrange for any secretarial or reproduction assistance as early as possible.

4. Have a complete set of up-to-date operational and maintenance handbooks/manuals regarding the subject aircraft.
5. If the group is meeting at a remote location, it will also be helpful to arrange for contact with the IIC immediately after each morning's group chairmen coordination meeting. This will provide the Maintenance Records Group the opportunity to be informed about any new issues or special areas of concern that were brought up in that meeting.
6. Brief any members who were not present at the IIC's initial organizational meeting about party participation in the investigation. Remind all group members that their participation is required for the duration of the investigation; also remind them about the restrictions on dissemination of information by any organization other than the appointed accident investigation team.
7. If you are working in a secure area that requires visitors to be escorted (e.g. a maintenance hangar), attempt to acquire temporary identification badges. This will allow group members to enter and move about the facility without being restricted or challenged.
8. Acquire or bring with you an accordion file with at least 30 partitions to facilitate the storage and easy retrieval of the massive amounts of data that will be collected.
9. Before reviewing any records, be sure to provide each group member an index sheet delineating the Air Transport Association (ATA) chapter codes. Almost every piece of data reviewed will reference these codes.
10. Divide the members of the group by assigning each person certain ATA codes.
11. Coordinate with the IIC to decide the extent and priorities of the records review. Decide on documents to be copied or data to be extracted for the report.
12. Advise all group members of the time and location of the daily Maintenance Records Group progress meetings. Hold progress meetings or discussions periodically to make the group aware of the entire effort. Awareness of the pertinent facts by all group members is necessary.

4.8.3 Program briefing

Before reviewing documentation that relates specifically to maintenance performed on the accident aircraft or the operator's maintenance systems, it is essential that the group chairperson brief the group about the maintenance program and activities they are about to review. The group chairperson should advise the operator that the group would need to be briefed on the operator's overall maintenance program. Provide the operator with a list of documents that should be made available during the briefing and allow the operator at least 2 hours to prepare the briefing and gather the documentation.



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Documents to be provided at the briefing include the following (if applicable):

1. Parts “D” and “E” of the operating specifications:
 - a) General aircraft maintenance requirements
 - b) Short-term escalation authorization
 - c) Leased aircraft maintenance program (U.S.)
 - d) Leased aircraft maintenance program (foreign)
 - e) Parts-borrowing authorization/program
 - f) ETOPS maintenance program authorization
 - g) Maintenance inspection time limitations
 - h) Minimum equipment list (MEL) and configuration deviation list (CDL) authorization/ program
 - i) Mass and balance control procedures.
2. The operator’s Maintenance Manual.
 - a) A diagram (with names) showing the structure of the maintenance management system and organization. This diagram should delineate management positions down to the level of shop supervisor for each shop (e.g. avionics, engines, etc.).
 - b) A list of all maintenance and non-maintenance bases (to include the maintenance level classification of each base).
 - c) A list of all contract maintenance providers (to include maintenance level authorizations and the primary point of contact at each station).
 - d) A copy of the components repetitive inspection list for the accident aircraft model.
 - e) Expect a list of 100+ component inspections listed by ATA code.
 - f) A copy of the conditional inspections list for the aircraft model involved in the accident. These inspections are only performed when the aircraft has experienced some uncommon condition (e.g. severe turbulence, hard landing, flapoverspeed, etc.).
 - g) A copy of the general airframe and engine manuals.
 - h) A copy of the aircraft’s flight crew operations manual.
 - i) A list of all of the operator’s aircraft by make, model, and nationality and registration marks.

When these documents are provided, the operator should brief the group on the following maintenance program topics:

- a. Program type. Type of maintenance program authorized and under what regulation it is performed.
- b. Scheduled and phase inspection program. Include type of checks, time intervals, locations where checks are performed, description of splitting checks into sub phases or intervals, and a list of those checks performed by contract



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maintenance providers.

- c. Contract maintenance program. Include scope and limitations of the program, method of coordination for on-call maintenance, operator oversight and guidance, records movement and tracking of work performed.
- d. Deferred maintenance policy. Include tracking process, crew notification, and deadline extension.
- e. MEL and CDL policy. Include tracking process, crew notification, and deferral extension.
- f. Airworthiness directive (AD) compliance program. Include tracking system, repetitive inspection compliance methods, procedure for converting applicable portions of ADs to engineering orders (EO), or engineering authorizations (EA). A list of ADs applicable to the accident aircraft should also be sought from DGCA as a means of verifying compliance.
- g. Maintenance record-keeping system. Include type of DGCA-approved system (or other regulator), description of supplemental systems, method of data collection/entry, tracked items/events, data retrieval/printout capabilities.

4.8.4 Immediate Action Items

While the operator is preparing the briefing and collecting the requested documents, the following actions should be taken:

- a. Perform a cursory review of the accident aircraft's maintenance log entries and maintenance history printout for the last 30 days. This review should focus on maintenance discrepancies that appear to relate to systems that are tentatively suspect based on the limited accident sequence information already available.
- b. Determine if either the operator or a contract maintenance provider performed maintenance actions on the accident aircraft in the last few days. If they have, now is the time to determine if drug testing of the individuals who performed the work should be requested.
- c. Request the operator to complete the aircraft and engine history data sheet.

4.8.5 In-depth Review of Items Specific to the Accident Aircraft

Review the following items for the accident aircraft:

1. Aircraft maintenance logs for the last 90 days. Make sure to record the station identifier, mechanic's identification number, and ATA chapter code for any suspicious write-up or corrective action.
2. Aircraft maintenance history data printout for the last 120 days. The operator should be able to print out this history by an ATA code and for any time period that you feel is important.
3. All non-routine work cards for the last periodic check and for the last "D" or "C" level Heavy Check. For a transport category aircraft, there will probably be hundreds of cards from a "C" or "D" check.
4. All overhaul records for the aircraft's engines, propellers, and primary system components.
5. Routine work cards. If there is a suspect system or component, the routine work cards signed off during the last applicable inspection should be requested. Each action box on the relevant card should be reviewed for



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inspection findings and corrective actions taken.

6. Conditional inspection history for the life of the aircraft. Because these inspections are only performed if the aircraft has sustained a special or unusual condition, it is important to search the work cards for evidence of damage and repairs.
7. Contract maintenance before the accident flight. Talk directly to the contract shop supervisor to determine if maintenance was performed. The operator may not yet be aware of all contract maintenance actions taken before the aircraft's last flight.
8. Aircraft damage report. This might be the only place that will say if the aircraft was damaged while out of service (e.g. service truck colliding with engine pylon while aircraft was parked at gate overnight).
9. List of major repairs and alterations. In one case in which an aircraft sustained an in-flight loss of control, reviewing this list helped to determine that the accident aircraft was the only aircraft with the newest thrust reverser modification in the operator's entire fleet.
10. A list of all STC (supplemental type certificate) work that has been accomplished on the accident aircraft.
11. Engine condition monitoring data for the last 30 days. There may be a formal or informal program or just untracked data recorded on the daily aircraft maintenance log. If you are provided with raw data only, ask the operator if it can display the data in a graphic format. Provide this data to the Powerplants Group.
12. Engine change log. This log will show you which aircraft within the operator's fleet the engines on the accident aircraft have been on in the past. If there is a suspect engine, you can review its maintenance history (by engine ATA code) for the period it was on the previous aircraft.
13. Engine and airframe vibration monitoring data. Collect this data and provide to the Powerplants Group and the Structures Group.
14. List of MEL/CDL items currently being carried on the accident aircraft. Determine from the master MEL the category (A, B, C, or D) of any carried items, and whether any B or C category items are on an extension.
15. List of all ADs for the accident aircraft. Compare with the official DGCA list for the aircraft. Confirm compliance date and methods. If there is a suspected problem with a component or system that has any ADs written against it, review a copy of the EO or EA that was written by the operator to carry out the applicable portions of the AD.
16. Service difficulty reports (SDR) or maintenance defect reports (MDR) (compiled by the US FAA) for any suspect component. Data may be obtained through the FAA liaison, or by calling (+1- 405) - 954-6509.
17. Be very specific and narrow the request as much as possible (there may be thousands of MDRs for a specific model of aircraft).
18. List of service bulletins/letters, by titles, which apply to the accident aircraft and its components.
19. Operator's list of cancellations/diversions/deviations for the accident aircraft (and all others of the same model) for the last 6 months. If possible, have data listed separately for each maintenance base.



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20. Mass and balance sheet. If mass or center of gravity might be an issue, check the compliance date, location, and method used for the last mass and balance check. If electronic scales were used, check the method and date of calibration and certification.
21. Import and return-to-service documentation. If the accident aircraft or its engines were imported from another country in the recent past, review all import process documentation and the actions taken qualifying/certifying the aircraft to be returned to service.
22. In-depth review of the operator's programs, policies, and work conditions.

In addition to the group's review of the accident aircraft's maintenance history, the following programs, policies and conditions should be considered for review:

Maintenance Training Program

Evaluate the in-house training program for engine, airframe and systems, to include curriculum, instructor qualification/training, participation percentage, recurrent training, training on special systems, and record-keeping. Determine percentage of participation in manufacturer's resident training courses. Workers should be interviewed to get their opinion of initial and recurrent training. Also evaluate the in-house training of maintenance inspectors.

Note: *The Operator's Manual--Human Factors in Aviation Maintenance, published by the FAA on June 6, 2005, (<http://www.hf.faa.gov/opsmanual>) contains detailed materials that can be useful for investigating maintenance training issues.*

Environmental Conditions/Human Factors

Evaluate the work conditions for line and hangar maintenance personnel (day and night shifts). Evaluate the lighting, temperature, ventilation, dryness, noise, hazards (e.g. weak or unstable work scaffolds), size and roominess of work area, hazardous waste collection and disposal. Review assigned shift consistency, amount of overtime, and rest break adequacy. Interview workers to get their opinion about relationships with supervisors, management, parent company, and unions. Get the workers' opinions on the clarity of manuals, work cards, and oral instructions.

Shift-change Program

Determine how workers on the oncoming shift know where the previous shift left off in the performance of any uncompleted maintenance tasks. Ensure the program is really being used and that it identifies any components or hardware disconnected or removed simply to gain access to the component being worked on.

Reliability Program

How does the operator identify and track repeat write-ups, line and hangar maintenance rejects (completed maintenance tasks that were determined to be unacceptably performed at inspection sign-off), and part infant mortality (i.e. parts determined to be not airworthy when received new from the manufacturer). Get a copy of the operator's DGCA-approved program.

Tool Control Program

Determine how personal and company owned tools are accounted for after each shift change. Determine how a tool is tracked when temporarily at another base. Review procedures followed when a tool appears to be missing. Find out what type



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of inspection the operator performs to make sure personal tool boxes do not contain loose, excess, or unapproved hardware.

Supplemental Structural Inspection Program (SSIP)

Review the operator's corrosion prevention control program. Make sure the required reports are being sent to the US FAA Aircraft Certification Office (ACO) and manufacturer for findings of level 2 and 3 corrosion. Review the aging aircraft inspection status sheet for the fleet.

Repetitive Inspection Program

Acquire a copy of the component repetitive inspection list for the model of aircraft involved in the accident. Review the program to ensure that all components for the accident aircraft are being inspected at required intervals.

Parts Receiving Program

If a specific off-the-shelf part is suspect, review the program by which the operator receives, inspects, and incorporates parts into its system. Review the documentation to make sure that the suspect part was "approved" and "airworthy" when installed on the aircraft.

Functional Check Flight (FCF) Program.

Determine what type of maintenance actions requires an FCF. Review the operator's program for FCF pilot qualification, maintenance technician participation and qualification, flow chart/checklist usage, and documentation of data and final airworthiness determinations.

Foreign Object Damage (FOD) Program

Review program for hangar and line maintenance. Determine if the program is actually being used.

Review of the DGCA (or other regulator) surveillance and oversight programs.

- a. Evaluate the work program of the Airworthiness Inspector (AWI). Document the extent of the AWI's responsibilities, percentage of time spent with this operator, percentage of time spent in each major area, and any assistance provided by other inspectors. Evaluate the qualifications and experience of the AWI and any assigned assistant AWIs. Included in this review the AWI individuals' previous maintenance experience.
- b. Review required inspections, inspection status, inspection information/comments, and any trend data for this operator. Review any action letters between the AWI and the operator.
- c. Interview line maintenance workers, hanger maintenance workers, and local DGCA inspectors not associated with the involved operator to get insight into the AWI's working relationship with the operator's supervisory maintenance personnel.

The Maintenance Records Group report should cover, as a minimum:

- a. Type of maintenance program.
- b. List of documents reviewed.
- c. Historical data on aircraft and engines.



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- d. Serial numbers.
- e. Times and cycles for airframe, engines, and relevant components.
- f. Times and cycles since last major inspections.
- g. Times and cycles since last line checks.
- h. Any deviations from requirements found in the records.
- i. Any unresolved/repetitive maintenance defects.

4.9 Survival Factors Group

The Survival Factors Group is responsible for developing and documenting the following: impact and occupant dynamics including accident injury mechanisms; evacuation and post-evacuation survival; search and rescue; fire fighting; collecting and reviewing reports and written records on these subjects; aircraft interior configuration and damage; cabin crew training; and post-mortem examinations and toxicological analyses of fatalities

The Survival Factors Group chairperson should establish the following guidelines with the group members so that the group can function as effectively as possible:

1. Group members should refrain from discussing the accident in public and, in particular, the work of the Survival Factors Group. At times, work will involve extremely sensitive areas of the investigation (body recovery and identification, personal effects, injuries sustained by survivors and fatalities, etc.). Conversations, if overheard by the press, insurance representatives, or relatives of passengers and crew, could cause unnecessary grief and could be misinterpreted or misquoted.
2. If, at any time, the work of the Survival Factors Group is of such a nature that a group member would prefer to be assigned to another task within the group or to another group, the group chairperson is to be notified. Group members will remain until the completion of the field phase of the investigation at the accident site.
3. During progress meetings, the group chairperson may call upon group members to present certain detailed findings which they were responsible for developing or documenting.

Survival Factors Group checklist items are included in the following recommended report outline. Relevant investigation data should be inserted in the appropriate section, unless not applicable to the occurrence.

4.9.1 Aircraft Configuration

1. Use an aircraft interior arrangement diagram that shows seating configuration, galleys, exits, etc.
2. Describe the location of emergency equipment including the location and type of exits, personal breathing equipment (PBE), megaphone, etc.

4.9.2 Crew Information

4.9.2.1 Flight Crew Interviews

The flight crew interviews are conducted by the Operations Group. The Survival Factors Group chairperson will coordinate with the Operations Group chairperson to



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develop the following Survival Factors related information, whether the group participates in the flight crew interviews or not:

- a. Seatbelt and shoulder harness security before and after impact.
- b. Difficulty releasing restraints.
- c. Seat adjustment (position).
- d. Seat security after impact.
- e. Difficulties during escape.
- f. Aided flight attendants and passengers.
- g. Description of injuries and how they were sustained.
- h. How the flight crew evacuated the aircraft.
- i. Describe emergency training/date of most recent training and extent of hands-on training in the use of exits, evacuation slides, etc.
- j. Use of oxygen, PBE, etc.

4.9.3 Flight Attendant

4.9.3.1 Training

Obtain flight attendant training and personnel records for initial, transition, and recurrent training. Describe the extent of hands-on training using training devices and actual aircraft.

4.9.3.2 Interview (conducted by Survival Factors Group)

Request permission to tape or digitally record the interviews. If a recorder is used, the interviewer and interviewee will identify themselves as well as the date, time, and location of the interview and others present. Also, a copy of the recording will be provided to the interviewee.

- a. Name and business address (flights in the last 24 - 72 hours and 30 days).
 - 1) Position occupied.
 - 2) Observation of flight including pre-flight duties. Location of children, elderly, obese, handicapped, mobility impaired. Were infant restraints used - seat location.
 - 3) Pre-impact precautions by flight attendants and passengers.
 - 4) Description of impact forces.
 - 5) Security of cabin furnishings, debris, galleys, carry-on baggage, hat racks, seats, emergency lighting.
 - 6) Security of seat after impact.
 - 7) Security of seat belt/shoulder harness before and after impact, difficulty releasing the seat belts (note any failures).
 - 8) Behavior of passengers.
 - 9) Description of flight attendant's pre and post accident activities.
 - 10) Difficulty opening doors, assess conditions outside, deploying and inflating slides, using oxygen, rafts, etc.
 - 11) Observations of trapped passengers.



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- 12) Description of rescue/fire fighting activities.
- 13) Description of injuries and how they were sustained.
- 14) Were infant restraints used - seat location.
- 15) Trouble with passengers during flight.
- 16) How much liquor was served?
- 17) Was any emergency equipment used, i.e., flashlights, megaphones, oxygen, PBE.
- 18) Observations of floor path emergency lights, illumination inside\outside aircraft.

4.9.4 Passengers

List the number of adult males and females, children, infants and handicapped. List the age ranges for each. Determine the location of child safety seats, the occupant's age, injuries, etc.

Obtain passenger names, addresses, and telephone numbers from the airline.

Have sufficient numbers of Passenger Statement Forms and Passenger Questionnaires for distribution to each passenger. It will be necessary to mail these forms to passengers who have left the area; every attempt should be made to interview these passengers by telephone.

4.9.4.1 General Instructions for Passenger Interviews

Prior to interviewing hospitalized survivors, permission will be obtained from the hospital administrator and the attending physician.

It may not always be possible for the group chairperson to attend all passenger interviews. Consequently, group members will be asked to conduct these interviews or attend interviews conducted by the Operations Group or the Witness Group as the Survival Factors representatives.

The purpose of these interviews will be to elicit Survival Factors oriented information and to secure a signed statement of the interviewee's observations at the conclusion of the interview.

Before the interview, group members will decide on the questions to be asked and who will take notes. The questions to be asked will be approved by the group chairperson prior to any interviews. The group chairperson, if present, will conduct the interviews. The person taking notes should make every effort to record only pertinent information; continuous writing can inhibit the interviewee from being completely candid and spontaneous.

A technique which has been successful in interviewing survivors is to permit the interviewee to discuss his/her observations without interruption. The person designated as note-taker only jots down pertinent information.

At the conclusion of the interviewee's statement, some specific questions are asked to clarify certain areas of interest. Minimum notes are taken again. At the conclusion of the questions, the interviewee is asked to write and sign a formal statement. The previously taken notes will aid in assuring the statement contains all the necessary information. If the interviewees cannot or will not write a statement, a statement may be written for him. If the interviewee refused to sign the statement,



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this will be included in the notes of the interview and the prepared statement form and the statement will be signed by the interviewer(s). If recorded electronically, a signed statement is not necessary.

It is not suggested that every passenger interview be tape recorded because of the time necessary to review and summarize these interviews during the field phase of the investigation.

Each surviving passenger will be given a questionnaire and requested to complete the necessary information as soon as possible; arrangements should be made to collect the questionnaires during the field phase of the investigation.

4.9.4.2 Passenger Interviews

1. Name, address, age, mass, height, handicapped, mobility impairment, etc.
2. Seat number - if in exit row, was the passenger briefed and read exit opening instructions.
3. Read safety card, watched flight attendant safety demo, watched safety video.
4. Noted the locations of exits other than one used to board aircraft.
5. Seat numbers of traveling companions.
6. Location and storage of carry-on baggage.
7. Observations of flight until the accident; brace position.
8. Security of seatbelt (before and after impact).
9. Security of seat (after impact).
10. Description of impact forces - direction, magnitude.
11. Description of cabin - location and type of debris.
12. Description of escape (time, difficulties, smoke, fire, egress routes, etc.).
13. Description of fire fighting operations (location of fire, smoke, etc.).
14. Description of rescue operations.
15. Description of injuries and how they were sustained.
16. Obtain interviewee permission for the release of medical records.
17. Description of other passengers after the accident and during egress.
18. Use of child safety seats and restraint of children/infants who did not occupy child safety seats.

4.9.5 Wreckage Site and Aircraft Damage

4.9.5.1 Description of Site

The following information will be obtained in coordination with the Structures Group chairperson. Coordination will be necessary to assure accurate documentation while avoiding redundant or conflicting information (The Structures Group will usually document this information, eliminating any need for the Survival Factors Group to cover the same information).

Distance, heading, and relative bearing of ground scars and aircraft components from main wreckage.



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Description of group scars (length, width, depth, distance, bearing, and heading along impact path and to main wreckage site).

Description of obstacles and structures struck by the aircraft (height, construction).

Description of terrain (elevation, slope and grade, soil).

4.9.5.2 Aircraft Damage

Describe aircraft damage as it relates to fire pattern, egress, fuselage and wing crush, etc.

1. Exterior damage

- a) Describe external cockpit and fuselage/cabin damage; supplement the description with photographs, sketches, drawings, etc.
- b) Direction, location, and dimensions of structural deformation.
- c) Location and damage to seats and cabin equipment outside the aircraft.
- d) Description of thermal and smoke damage.
- e) Blocked exits, deployed escape slides, and ropes.
- f) Evidence of fire fighting/rescue activity.

2. Interior damage

Describe the internal condition of the cockpit and cabin and summarize the results of any systems and component examinations. Supplement the information with photographs, sketches, drawings, etc.

3. Cockpit

- a) Condition of instrument panel, pedestal, and overhead panels (crash impact and secondary impact evidence, direction and measurements of deformation, thermal damage, etc.).
- b) Condition of control yoke, rudder pedals, and floor (fractures, impact evidence, direction and measurements of deformation, etc.).
- c) Condition of windshields, windows, and escape hatches (impact evidence, direction and measurements of deformation, thermal damage, escape hatch locking mechanism, escape rope\slide device, etc).
- d) Flight crew life support equipment (evidence that smoke masks, goggles or oxygen mask\system were used, direction of damaged oxygen mountings, first aid kit, crash ax, PBE, medical kit, etc).
- e) Condition of flight crew seats (impact evidence, direction and measurements of deformation, thermal damage, integrity of tie-downs and rails, direction in which seat and tie-down components separated, etc.).
- f) Record manufacturer of seats, model numbers and rated loads.
- g) Condition and operability of the flight crew's seatbelts, shoulder harnesses, release mechanisms, inertia reel.
- h) Record manufacturer of restraint systems model numbers, date of manufacture, and rated loads.
- i) Cockpit door (locked, direction of opening and measurements of deformation, thermal damage, operable\jammed escape panels, condition of locks, etc.).



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- j) Miscellaneous (securing of luggage, flight bags, etc.).
- k) Examine and record location of personal effects found in the cockpit.
- l) Perform tests as necessary on equipment.

4. Cabin

- a) Description of overall cabin deformation, floor disruptions, location of upset\separated seats, location of thermal damage, location of separated ceiling panels, location of separated overhead storage bins\racks, location of separated galley\buffet equipment, etc.
- b) Condition of each of exit found in place, extent of damage, operational check if possible, location in wreckage, power assist systems, etc.
- c) Compare safety card instructions against actual equipment and operation (doors, slides, rafts, life vest, oxygen systems, etc.).
- d) Conditions of flight attendant seats and passenger seats (impact evidence, direction and measurements of deformation, thermal damage, integrity of tie-downs and rails, direction in which seat and tie-down components separated.
- e) Record manufacturer of passenger seats and flight attendant seats, model numbers, date of manufacture, and rated loads.
- f) Condition and operability of safety belts, shoulder harnesses and inertia reels.
- g) Record seat belt\shoulder harness manufacturer(s) date of manufacture, model numbers, and rated loads. To facilitate the tabulation of damage to seat(s), safety belts and cushions, the following (or similar) table can be used, and then attached to the group report.

Row/Seat	Safety Belt	Seat Back	Seat Pan	Seat Legs	Floor Attach
----------	-------------	-----------	----------	-----------	--------------

1A _____

1B _____

1C _____

1. Security of carry-on luggage and the security of designated storage areas (under seats, overhead bins, hand-held).
2. Security of cargo space in the cabin (combi aircraft).
3. Security of each galley\buffet unit (damaged latches, inserts, etc.). Record galley manufacturer and model number.
4. Record location of personal effects found in cabin.
5. Perform tests on equipment as required to determine failure mode(s).
6. Review cabin maintenance logs and obtain copies of pages as necessary. Determine what corrective actions were taken to clear the write-up(s).



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5. Emergency systems

Document the condition of emergency systems and the results of any testing performed on equipment\systems.

- a. Condition of the public address systems (component, system checks).
- b. Condition of emergency equipment (oxygen, flashlights, first-aid kits, megaphones, etc.).
- c. Condition of emergency lighting systems (components, system checks, position of emergency lighting control switch).
- d. Description and condition of evacuation alarm system (arming, location actuation).
- e. Condition of each emergency escape slide (stowed or deployed, inflated, damaged, etc.) and record manufacturer of slides model number, and date of last overhaul, date of manufacture, incorporation of service bulletins, etc.
- f. Condition of life rafts or slide/rafts.
- g. Record manufacturer of life rafts and life vests, model number, dates of manufacture, TSO, etc.
- h. Describe other emergency equipment on board, location and use.
- i. If the aircraft is at an unusual attitude, measure the height of the exit sills above the terrain.

4.9.6 Medical and pathological information

4.9.6.1 Injury table

The following table summarizes the injuries sustained:

Flight crew	Cabin crew	Passengers	Others	Total
<hr style="border-top: 3px double #000;"/>				
Fatal				
<hr/>				
Serious				
<hr/>				
Minor				
<hr/>				
None				
<hr/>				
Total				
<hr/>				

Note: Use footnotes to indicate number of infants (up to 24 months), children 25 months to 16 years, and handicapped/mobility-impaired passengers.

4.9.6.2 Survivor injuries

Describe in general the injuries sustained by survivors.

- a. Ask when and how their injuries were sustained.
- b. In some jurisdictions, it may be necessary to obtain a release from the injured passengers for their medical records if they are necessary to the investigation.
- c. To facilitate the tabulation of injury data, the following or a similar table can be used as an attachment to the factual report.



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SEAT	AGE	SEX	HT	WT	INJURIES	(F,S,M,N)	MAIS*																																												
<p><i>Note: The use of Maximum Aviation Injury Scale (MAIS), is based on the American Association of Automotive Medicine 1980) can further categorize injuries as follows.</i></p> <table border="1"> <thead> <tr> <th>AIS (Severity)</th> <th>Crew members</th> <th>Passengers</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td colspan="4">=====</td> </tr> <tr> <td>1. Minor</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2. Moderate</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3. Serious (life threatening)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4. Severe (not life threatening)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>5. Critical (survival uncertain)</td> <td></td> <td></td> <td></td> </tr> <tr> <td>6. Fatal</td> <td></td> <td></td> <td></td> </tr> <tr> <td>7. Insufficient Information</td> <td></td> <td></td> <td></td> </tr> <tr> <td>8. Unknown</td> <td></td> <td></td> <td></td> </tr> <tr> <td>9. Total</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>								AIS (Severity)	Crew members	Passengers	Total	=====				1. Minor				2. Moderate				3. Serious (life threatening)				4. Severe (not life threatening)				5. Critical (survival uncertain)				6. Fatal				7. Insufficient Information				8. Unknown				9. Total			
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8. Unknown																																																			
9. Total																																																			

4.9.6.3 Fatal Injuries

Describe fatal injuries sustained by the occupants of the aircraft.

Coordination will be necessary with the Human Performance Group chairperson when contacting the medical examiner/coroner's office to assure that autopsies are performed on the flight crew and cabin crew members as a minimum and that, as a minimum when possible specimens are required for toxicological analyses of drugs and alcohol.

Post mortem examinations

1. Each crew member must be positively identified.
2. Post mortem examinations should be made on each cockpit occupant.
3. Post mortem examination should be made on flight attendants, passengers, and persons on the ground as the circumstances of the accident indicate.
4. Gross injury descriptions should include all fractures, dislocations, lacerations, amputation, burns, and condition of clothing.
5. Toxicological and microscopic examinations as necessary, should be performed on all cockpit occupants, selected flight attendants and passengers, and other selected victims as the situation warrants.
6. All body photographs should show body number.
7. The following photographs should be taken by local authorities:
 - 1) At the accident site before a body is moved.
 - 2) At place of examination - anterior and posterior both clothed and unclothed.
 - 3) At post-mortem - close-up photographs of lesions, embedded foreign objects, fractures, internal injuries, etc.
8. If autopsies cannot be performed, X-rays should be made of cockpit occupants,



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cabin crew members, and selected passengers to identify fractures, imbedded foreign objects, etc., as well as gross descriptions of injuries.

9. Obtain body location charts/diagrams and numbers, ID process, photos, and post-mortem reports.

4.9.6.4 Toxicological Analyses

NTSC and the IIC will arrange with the relevant authority in Indonesia to conduct toxicological, biochemical and microscopic examinations. Sufficient quantities of samples must be taken to assure adequate specimens are available for use by the laboratories.

4.9.7 Emergency Response

In some instances a separate group may be formed to develop this information.

4.9.7.1 Search and Rescue (SAR)

(Ref. ICAO Annex 12 - Search and Rescue)

Describe the search and rescue efforts particularly if the accident occurred in a remote area and identify any problems the SAR units encountered (communications, weather, etc.).

- a. Describe the notification, response and the activities at the accident site.
- b. Interview involved personnel as required.
- c. Determine number and types of SAR units involved and pertinent times, as well as the number of responding personnel.
- d. Determine how many persons were rescued alive and how many non-survivors were removed from the accident site.
- e. Obtain reports on the air and ground search and rescue operations from participating organizations. Use maps and sketches to show search areas. Obtain photos and video tapes.
- f. Problems encountered during the SAR operation (communication, command control coordination, etc.).

4.9.7.2 Aircraft Rescue and Fire Fighting (ARFF) Response

Describe the on and off airport fire fighting operations from ARFF notification to their arrival on site and any problems responding.

1. Determine when, by whom, and how the fire department(s) were notified of the emergency/accident.
2. The time necessary to complete fire fighting and rescue operations.
3. Who was the on-scene commander and was a field command post used.
4. Describe the communications network.
5. Describe any difficulties encountered responding to the accident site.
6. Obtain or make map of the accident site indication access routes, runways, location of vehicles, wind direction, etc. Obtain photos and video tapes.
7. Quantity and type of fuel on board the aircraft.
8. Describe the origin, and propagation of the fire.



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9. Describe fire and rescue conditions when ARFF units first arrived at the accident site.
10. Interview fire fighters as required. Describe tactics used, e.g. how.
11. Obtain the activity reports made by the responding fire departments. Describe any problems during the ARFF response.
12. Airport CFR Index - was a NOTAM issued?
13. Summarize the responding equipment as follows:

VEHICLES/ UNIT NO.	PERSONNEL ABOARD	TRAVEL TIME/DIST	AGENT CAPACITY	DISCHARGE RATE	QUANTITIES USED
-------------------------------	-----------------------------	-----------------------------	---------------------------	---------------------------	----------------------------

=====

Crash Trucks

1. _____
2. _____

Quick Reaction Vehicles

1. _____
2. _____

Engine Companies

1. _____
2. _____

Ladder Companies

1. _____
2. _____

Ambulances

1. _____
2. _____

Rescue Squads

1. _____
2. _____

Helicopters

1. _____
2. _____

4.9.7.3 Law Enforcement Response

Describe involvement of local (and airport) law enforcement agency departments.

- a. Interview department personnel as required.



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- b. Determine number of responding units, pertinent times, and number of personnel involved.
- c. Obtain relevant police activity reports, photos, and video tapes.
- d. Describe security perimeter and associated problems with traffic, site security, and crowd control.
- e. Describe staging areas and any traffic control problems.

4.9.7.4 Medical Response

Describe the efforts of local hospitals and medical personnel.

- a. Determine when and by whom hospitals were notified and the extent to which the hospitals implemented their disaster plans.
- b. Did medical personnel respond to the accident site (i.e. was a triage area established) and, if so, at what time?
- c. What services did the hospital provide, i.e. ambulance, helicopter, equipment, etc?
- d. Clock times when first and last patients arrived at each hospital.
- e. Date and critique of most recent disaster drill.

4.9.7.5 Disaster preparedness

Depending upon the circumstances, describe the community disaster preplanning (or lack thereof) which enabled them to deal with the situation.

- a. Description of local community disaster plan(s).
- b. Dates of community disaster drills and, if so, were there any problems.
- c. Determine which disaster plans were implemented for this emergency and, if so, were there any problems.
- d. Interview appropriate personnel if necessary.
- e. Obtain copies of all pertinent disaster plans, response reports, and critiques by local disaster planning offices involved in this response.
- f. Describe command post(s), equipment, and communications; note any command, communication, and coordination problems.

4.9.7.6 Airport certification

- a. Review airport disaster plan (copies of portions of the plan may be required). Dates of tabletop and full-scale disaster exercises.
- b. From the airport or the DGCA, obtain copies of the annual certification reports.

4.9.7.7 Survival aspects

Summarize based upon the interviews and the condition of the aircraft wreckage, all aspects affecting occupant survival. Describe all aspects of the emergency evacuation process.

4.9.7.8 Flight crew

Describe the flight crew's involvement in the post accident and evacuation processes.

- a. Outline the flight crew's duties and responsibilities during evacuation.



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- b. Description of the flight crew's efforts to assist passengers during evacuation.
- c. The flight crew's account on how and when they exited the aircraft.
- d. The flight crew's observations of the ARFF activities and passenger evacuation.

4.9.7.9 Cabin Crew

Describe the flight attendants' involvement in the emergency, the evacuation, and post evacuation.

- a. Outline the flight attendants' duties and responsibilities during an emergency evacuation.
- b. Description of the flight attendants' preparation of passengers for evacuation.
- c. The flight attendants' assistance of passengers during the evacuation.
- d. The flight attendants' account of how and when they exited the aircraft.
- e. The flight attendants' observations of the ARFF activities and passenger evacuation.

4.9.7.10 Passengers

Summarize from the passenger interviews and statements their observations prior to, during and after the emergency evacuation/accident.

- a. Description of how passengers exited or were rescued from the aircraft.
- b. Difficulties during egress.
- c. Observations of ARFF activities.
- d. Description of how passengers were injured, i.e., what they impacted or what struck them.
- e. An aircraft seating diagram and symbols to denote injury, exit used, seat damage, etc.

4.9.8 Reports and attachments

The Survival Factors Group factual report will contain all materials obtained as part of the group's investigation, as well as numerous attachments. The following is but a few of the possibilities.

Each attachment should have its own cover sheet.

1. Passenger list.
2. Flight crew and cabin crew statements.
3. ARFF activity reports and police reports.
4. Disaster plans.
5. Test reports.
6. Toxicology reports.
7. Safety card.
8. Injury chart.
9. Passenger interviews, statements, and questionnaires.
10. Photographs



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Note: Autopsy reports or similarly sensitive medical materials, should not be included in factual reports. Rather, the relevant results may be summarize/paraphrased in the factual report and the actual documents, including photographs, must be held for restricted distribution.

4.10 Human Performance Group

4.10.1 General

A Human Performance Group may not be formed for all investigations. Rather, the human performance investigator may be assigned to other groups to provide expertise in the areas of interest that arise during the investigation.

A human performance investigator will typically launch on a major accident investigation as part of the initial team at the accident site. The human performance investigator is often attached as a specialist to another group, especially the Operations Group and the Air Traffic Services Group, until such time as a Human Performance Group is formed, if necessary. Even after a Human Performance Group is formed, there may be important interviews (such as interviews of surviving crew members) for which the human performance investigator joins another group in order to minimize the number of persons present in the interviewing room.

Human performance issues may not only involve pilots and air traffic controllers, they may arise in other areas, such as maintenance and inspection, cabin safety, equipment and procedures design and certification, management at the airline, the DGCA, or the aircraft manufacturer. Human performance considerations may also be directed at larger systemic issues, such as corporate culture, company policy, training, and design.

Note: The human performance investigators should refer to the ICAO Safety Management Manual (SMM) (Doc 9859), the Human Factors Training Manual (Doc 9683), and Human Factors Digest No. 7 - Investigation of Human Factors in Accidents and Incidents (Circular 240) for additional references regarding this complex area of expertise. Both documents contain extensive and current material to supplement and assist in the investigation of human performance.

4.10.2 Activities and procedures of the human performance investigator

The human performance investigation center on the six general areas listed below. In some cases, the work of the human performance specialist may parallel that of an operations specialist or air traffic services specialist, except that the human performance specialist examines certain evidence in greater depth.

In other cases, such as medical and equipment design issues, the human performance specialist may be the lead collector of evidence for an investigation.

Human Performance Factors - General areas of investigation

1. Behavioral

- 1) 24-72 hour history;
- 2) Operator behaviour;
- 3) Life habit patterns;
- 4) Life events.



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2. Medical

- 1) General health;
- 2) Sensory acuity;
- 3) Drug/alcohol ingestion;
- 4) Fatigue.

3. Operational

- 1) Experience/familiarity/habit patterns;
- 2) Training;
- 3) Operating procedures;
- 4) Company policies.

4. Task

- 1) Task information;
- 2) Task components;
- 3) Task-time relationship;
- 4) Workload.

5. Equipment Design

- 1) Workspace interface;
- 2) Display/instrument panel design;
- 3) Control design;
- 4) Seat design/configuration.

6. Environmental

- 1) External conditions;
- 2) Internal conditions;
- 3) Illumination;
- 4) Noise/vibration/motion.

As a member of the investigation team at a major aviation accident, the human performance investigator has specific areas of responsibility during the field phase of the investigation and in the weeks to follow. Like other investigators, the human performance investigator focuses at first on the collection of "perishable" information, which would include arrangements for toxicological testing, and collection of information and witness statements regarding the 72 - hour history of the personnel involved.

As the investigation proceeds, the human performance investigator can focus more on the "less perishable" information, which would include general background statements and information from public records. Specific areas of human performance involvement would include the following:

- a. Arrangements for analysis of the toxicological samples should be coordinated with the Survival Factors Group. Most toxicology specimens -- including urine and blood -- should be drawn as soon as practical after the accident to provide valid samples for toxicological testing. These samples are typically drawn by hospital personnel (for living subjects) or pathologist (for deceased subjects) before the investigator arrives at the accident site. It is the responsibility of the human performance investigator to ensure that toxicology samples are



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collected, stored and tested properly. When first notified of the accident, and before leaving for the accident site, the investigator should ensure that timely requests are made through the proper authorities for toxicological samples from all relevant air traffic services personnel and surviving flight crew members. After arriving at the accident site, the human performance investigator interacts with the medical and test laboratory authorities to track and assist with proper storage and testing of the samples. Activities include locating and documenting the available samples, assisting as needed in arranging for laboratory testing, maintaining a proper chain-of-custody, discussing with the laboratories the desired tests, and obtaining and interpreting the toxicology results.

- b. Requesting the air traffic services communications recordings. The air traffic services facilities record air-to-ground communications on large audiotapes on a continuous basis. Securing of these tapes is essential. Upon request, the ATS and airport authority will provide the investigators with a copy of the recorded communications relevant to the accident on an audio cassette tape. The ATS specialists on the investigation team will assist with the completion of relevant transcripts of the communications. In some cases, a human performance investigator may also be interested in recordings of the pilot's earlier flight legs to examine the pilot's earlier performance or to have a sample of the pilot's speech under routine conditions.
- c. Such material can normally also be obtained from the ATS. It is a responsibility of the human performance investigator, in coordination with the ATS Group chairperson, to request appropriate communications tapes and transcripts from the ATS and the airport authority in a timely manner.
- d. Obtaining information for the 72-hour history. A critical part of the human performance investigation is tracing the activities prior to the accident of the pilots, air traffic controllers, or other individuals of importance to the investigation. The purpose of this history is to determine such information as sleeping and eating history, purpose and preparation for the accident flight, unusual activities or events, mood, crew interaction, and other information that could prove critical to understanding the accident. The time period of 72 hours is typical, but other time periods are examined at the discretion of the investigator.
- e. Information related to the 72-hour history is considered "perishable" since memory tends to become less accurate and less detailed over time (and since some witnesses become difficult to locate with the passage of time). Those witnesses who are of prime interest would include: the last person to talk with the individual; anyone with professional contact during the 72-hour period; anyone with whom the individual lived; anyone with whom the individual was having a relationship; immediate family; and anyone in the general public who came in contact with the individual, including taxi drivers, hotel staff, and neighbours. These individuals are so central to the 72-hour history that it is usually worth interviewing them even if they feel their exposure was modest and they indicate that everything seemed routine. Simply knowing that everything seemed routine can be of significant value to the investigation.
- f. Examining all material from the wreckage related to human performance. The human performance investigator should examine and document all material found in the wreckage with relevance to human performance, including paperwork, personal effects, and any medications (counting the number of pills in the container in the case of medication).



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- g. Obtaining general background information on the individual. When human performance failures occur in an accident, it is often possible to find problems in the individual's background that foretell the problems of the accident. A careful human performance investigation would develop information related to issues such as previous accidents and professional difficulties, approach to flying, personality characteristics, and major life events including medical, financial, and emotional changes in the recent past.

A principal source of background information is interviews with persons familiar with the individual. These interviews may take place during the field phase of the investigation or during the weeks following.

Background information is considered "perishable", but less so than information related to the 72-hour history (which is often obtained from the same individuals).

Those witnesses who are of prime interest would include: close family members, supervisors, professional colleagues with whom the individual worked, personal physicians, previous employers, and close friends. When individuals are deceased, the family members are normally not interviewed until after the funeral, although this can vary at the discretion of the interviewer. Some background interviews can be completed by telephone at the discretion of the investigator.

Background records. A human performance investigation should include a review of background records including records of previous accidents, airman records, and personnel, training, and medical records. These help to establish previous job history, discipline record, training strengths and weaknesses, and medical issues. The investigation may also include checks of judicial authority records. In the case of medical records and judicial records, there may be confidential material which is not appropriate for public reports but is valuable at suggesting areas for further investigation.

Corporate culture. In some cases, the stage is set for accidents by corporate events far removed in time and place from the actual occurrence. Companies vary in the degree that they emphasize safety in their operations, and individuals involved in accidents may be affected by the actions and decisions of even well-intentioned company officers and managers.

Note: *This portion of the investigation should be coordinated closely with the Operations Group, or with other relevant Groups (Air Traffic, Maintenance Records, etc.), depending on the circumstances and safety issues of the occurrence.*

To investigate management, organization, and corporate culture issues, an investigator should talk to individuals knowledgeable about the company (including employees and others who may have first-hand knowledge). The investigator should interview other employees, supervisors, and managers, including the Chief Executive Officer, as appropriate. Focus on company history and policy in areas such as pay, morale, flight and duty time schedules, workload, sick leave, size of workforce, turnover rate of workers and managers, training, equipment, maintenance, promotion progress, financial condition of the company, and safety office and safety programs.

Examine the adequacy of operating procedures, as well as the extent to which these procedures are adhered to. Does the company say one thing and do something else? By talking to people, observing employees in action, and examining records,



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obtain a view of the employee's commitment to performing a job well, and the company's commitment to assuring that employees perform all tasks at the highest level of safety possible. One of the most important "trouble signs" to alert an investigator that corporate culture issues may be involved is probably: multiple mistakes by different employees in different circumstances.

4.10.3 Checklists with Human Performance Questions

A short checklist of common human performance questions is supplied at the end of this section for use by investigators at interviewing individual witnesses. Additional questions are often suggested by the details of the specific accident and may include training and management issues. By listening closely to witness descriptions, and by asking simple questions to reach a "common sense" understanding of the accident, 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 at length what they know, without influence from the interviewer. As the interview progresses, more pointed questions are normally asked to focus the witness on topics that were not fully addressed.

Following this standard human performance checklist is a special checklist for interviews on corporate culture issues in order to provide guidance in this often subtle area of investigation.

4.10.4 Human Performance Standard Checklist

Activities in last 72 hours:

- a. When was the last time you (the pilot, the controller, etc.) worked before the accident?
- b. When did you work during the previous three days? What were your other activities during this period?
- c. When did you go to sleep the previous night (or previous three nights)? When did you wake up? Did you feel well-rested?
- d. What is your normal work schedule? When are days off, vacations? When was your last vacation?
- e. Describe your activities on the day of the accident up to the accident. When/what did you eat? Any rest breaks?
- f. Was this an unusual schedule?
- g. Accident history

Have you been involved in any previous accidents? Have you been disciplined for your performance? Have you received commendations for your performance?

- h. Life changes - in the past year:
 - 1) Have you had major changes in your health (good or bad)?
 - 2) Have there been major changes in your financial situation (good or bad)?
 - 3) Have there been major changes in your personal life (e.g. separation, divorce, birth, death, changes in the health of immediate family/close friends)?
- i. Medical/drugs



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- 1) How is your health?
 - 2) What is the name and the address of your personal doctor?
 - 3) How is your vision? Do you wear corrective lenses? The name of your eye doctor? Prescription?
 - 4) How is your hearing? Do you wear a hearing aid? The name of your doctor?
 - 5) Do you take prescription medicine? What medicine and how often? When was the last time you took it before the accident?
 - 6) Do you drink alcohol? When and what was your last drink before the accident?
 - 7) Do you smoke tobacco? Last use before the accident?
 - 8) Do you use illicit drugs?
 - 9) In the 72 hours before the accident, did you take any drugs, prescription or non-prescription that might have affected your performance?
- j. Workload
- 1) How was the workload on the day of the accident?
 - 2) How was the workload affected by the weather?
- k. Environmental
- 1) Any problems with the aircraft?
 - 2) Any problem with noise, vibration, temperature?
 - 3) Any problems with visibility (instruments, signals, etc.)?
- l. Mood
- 1) What was the mood of the other crew members before the accident? During the accident? After the accident?
 - 2) Had the crew members flown together before?
 - 3) Did the crew members get along personally? Did they see each other socially?
 - 4) What did they talk about?
 - 5) How did the pilots get along with the passengers and flight attendants?
- m. Background
- 1) What was the pilot like personally?
 - 2) Was he married? Any children? What were his living arrangements?
 - 3) What level of education did he complete?
 - 4) How did the pilot get interested in aviation? Where did the pilot get training? What were previous jobs?
 - 5) What did the pilot like about flying? About this job? About the aircraft?
 - 6) How familiar was the pilot with the accident route? With the accident airport?
 - 7) What was the deadline for completing the trip?



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- 8) What were the pilot's greatest strengths as a pilot? Were there areas in which the pilot could have improved?
- 9) Did anyone ever complain about flying with this pilot?
- 10) Did the pilot ever complain about the company or equipment?
- 11) Did the pilot experience any emergency/incident/problem during a previous flight? What happened?
- 12) Did the pilot receive training in cockpit resource management?

4.10.5 Corporate Culture Checklist

- a. Compared to industry standards, how is:
 - 1) Pay.
 - 2) Morale.
 - 3) Flight and duty time schedules.
 - 4) Overtime.
 - 5) Sick leave.
 - 6) Employee assistance program.
 - 7) Size of workforce/workload to perform required tasks.
 - 8) Turnover rate of workers.
 - 9) Turnover rate of managers.
 - 10) Reasons for turnover.
 - 11) Quality of new hires.
 - 12) Training.
 - 13) Equipment.
 - 14) Maintenance.
 - 15) Promotion opportunities.
 - 16) Financial condition of the company.
 - 17) Relationship between company and company labor unions.
 - 18) Number of disciplinary actions/number of grievances.
- b. In the past several years, has the company undergone a significant expansion or scaling back of its operations?
- c. How much overtime is there? Mandatory or volunteer? Is the employee paid extra for overtime work?
- d. What pre-employment background screening is done for new hire candidates?
- e. What complaints do you hear from employees? What complaints do you hear from managers?
- f. How would you describe labor-management relations? What is the relationship with the union's Safety Committee?
- g. Has the company entered bankruptcy protection? Has it entered a recent merger? What happened?



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- h. Has this company experienced previous accidents or incidents? Violations? Commendations? What was the company response in terms of changes in policy/procedure/personnel following any accident/incident?
- i. What are the greatest strengths (as a manager) of the chief pilot? Vice-President of Operations/Maintenance? Chief Executive Officer (CEO)?
- j. Has the chief pilot, Vice-President of Operations/Maintenance, or CEO been involved in previous accidents or violations either personally or through a previous company at which he served as a manager? The DGCA should have records of this nature.
- k. What contact is there between the CEO and employees including the line employees?
- l. Do you have a corporate safety office? What are its activities? Does it report to the CEO? Executive Vice President of Operations? Vice President of Flight? Does it meet with the Board of Directors How often?
- m. How does the company communicate safety info to its employees (e.g. newsletters, videos)? If so, examine its elements and implementation. If no, document how it may have affected the occurrence.
- n. Does the company have a safety management system related to flight operations and maintenance?
- o. Is there a way for employees to bring up safety-related issues without fear of retribution (e.g., safety hotline)?
- p. If there is no safety office, to whom do employees report safety recommendations/problems? What recent safety-related issues have employees raised, and what was done in response?
- q. Is there incident reporting and incident investigation? How and to whom are incidents reported? Give a recent example of changes resulting from the internal investigation of an incident.
- r. How does the company learn of and share industry safety-related information? Does the company participate in industry safety meetings and organizations, such as Flight Safety Foundation, IATA, etc?
- s. How does the company examine trends (good and bad) in operations and maintenance?
- t. Does the company keep a safety data base or employ risk assessment? Does it employ safety audits, internal or external?
- u. Does the company provide training in crew resource management (CRM)? What does it consist of? How many hours are devoted to it?
- v. How are relations with the DGCA? What are areas of differences?
- w. How often do you see inspectors from the DGCA? What do they do when they visit your facility?

The report of the Human Performance Group investigation will vary, depending on the circumstances of the occurrence and the investigation. For example, if the occurrence involves operational issues, the human performance materials may be included in a joint factual report. Similarly, if the occurrence involves ATS issues,



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the human performance data may be included in the Air Traffic Group report. In some cases, a separate Human Performance group may be formed and a separate report would be produced that contains the factual information gathered, but always in close coordination with other relevant groups. Caution is warranted that subjective data are not documented as “factual.”

4.11 Aircraft Performance Group

4.11.1 General

The Aircraft Performance Group will be responsible for collecting factual information and conducting studies related to aircraft performance issues. Normally, an Aircraft Performance Group will be convened for any major aviation accident. An Aircraft Performance Group should be convened for accidents involving transport category aircraft and commuter category aircraft in the following situations:

1. Runway overruns;
2. Landing undershoots;
3. Windshear events;
4. Any accident for which aircraft performance factors might be suspected to be involved.

Additional engineering support would be necessary for more complex calculations, such as crash impact dynamics, analysis of aerodynamic data, etc.

The initial task of the Aircraft Performance Group is to define the motion of the aircraft. The group uses all available data, including: cockpit voice recordings, flight data recordings, recorded radar data, recorded air traffic services communications, photographs, video recordings, witness statements, ground scars, aircraft damage, aircraft configuration, mass and balance, aircraft aerodynamic data, aircraft performance data, engine data, and weather data.

Normally, the next task is to determine the various events that could have produced the defined motion, events such as weather disturbances, engine anomalies, flight control deflections, and pilot actions.

The Aircraft Performance Group usually has no need to meet until the FDR, CVR, and radar data are in a useable form and until sufficient information is available from the field phase of the investigation (usually several days after the accident). The group may also meet at the aircraft manufacturer's facility. However, using flight plan, weather, and load data, preliminary work may commence while waiting for flight recorder data.

The Aircraft Performance Group chairperson may wish to proceed immediately to the accident site on a major accident. The purpose is to become familiar with all aspects of the accident before the first Aircraft Performance Group meeting. While at the accident site, the Aircraft Performance Group chairperson will act as an adviser to the IIC in performance related issues and may perform preliminary calculations related to subjects such as time and distance correlations, accelerate/stop distances, or trajectories of separated parts.

The performance engineer may accompany other groups and assist in gathering performance related information, such as ground scar measurements, radar data, and maps. The Aircraft Performance Group is particularly interested in ground scar



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measurements from the first contact with objects to the point of main impact. Members of the Aircraft Performance Group may accompany the Aircraft Performance Group chairperson at the accident site, although normally the group would not be convened to perform duties at the accident site.

The Aircraft Performance Group chairperson may leave the accident site early in order to start the group work. Any data collected by the Aircraft Performance Group chairperson will be documented in the field notes and provided to the IIC for review before he is released from the accident site investigation. In many cases, the Aircraft Performance Group chairperson's field notes will need to be coordinated with other group chairmen to ensure consistency and completeness.

Every effort should be made to limit the Aircraft Performance Group to members who are essential to the development of the aircraft performance information. The purpose of the group membership is to elicit the necessary assistance to collect factual data and conduct studies. As the factual report is developed, the members are urged to comment on the content of the report for accuracy and completeness.

The Aircraft Performance Group members need to be performance engineers or have equivalent experience. For example, a valuable contribution to the Aircraft Performance Group is engineers from the aircraft manufacturer and the engine manufacturer.

4.11.2 Simulations and Flight Tests

If the Aircraft Performance Group determines that simulations or flight tests are required to develop the necessary factual information, the IIC will be notified and shall coordinate the request for such activity. An investigator from the Aircraft Performance Group chairperson shall supervise and report on the tests and the simulations.

4.11.3 Visibility Studies

The IIC shall determine the need for visibility studies early in the investigation, particularly for mid-air collision accidents. There is much work required to prepare for a visibility study, such as acquisition and processing of ATS radar data, processing of flight recorder data, and acquisition and computer digitization of the appropriate cockpit binocular photographs. The required time to perform these tasks is considerable.

4.11.4 Video Animations

The Aircraft Performance Group may be involved in developing data for video animations. There are two prime reasons to produce a video animation:

1. Large amounts of data can be presented on a video monitor so that more people can understand the available data.
2. Video animations also depict the element of time, something that is not readily apparent in other forms of data.

Simple animations are relatively easy to produce. Once the FDR data are available, some of that data can be displayed immediately on the video monitor. This type of display may be useful to operationally oriented investigators. However, once the engineers start adding ground tracks or airport scenes, the work load increases dramatically.



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Note: Caution should be taken to avoid adding items to an animation, which are not based on factual data, such as an FDR parameter, etc. Just because an instrument was “designed” to work a certain way, does not mean that is what actually happened. Unless there are hard data to support adding items to an animation, such items should not be inserted to avoid misleading the viewer.

4.11.5 Reports

The report of the Aircraft Performance Group will contain descriptions of the data examined, calculations, videos, computer plots, etc. For all calculations made, any assumptions used must be recorded.

4.12 Airports Group

4.12.1 General

The objective of the work of the Airports Group investigation is to determine the involvement of the airport and its facilities in the events surrounding the accident and to ascertain whether there is a need for safety actions. In most cases, the Operations Group will conduct the airports investigation. However, if airport issues are key factors to an accident, an Airports Group may be formed. Post-accident activities such as the crash, fire and rescue (CFR) response is an important element of the airports investigation. In most cases, the Survival Factors Group would conduct the investigation of fire and rescue activities. However, if an Airports Group is formed, it could cover these issues.

For runway overrun occurrences, the condition of the runway surface may be a factor and will require the use of special equipment to measure the runway friction coefficient. For occurrences involving runway contamination, the condition of the runway (standing water, snow, ice, etc.) must be documented.

Regardless of which group conducts the investigation of airport issues, the checklist below can be used to cover the relevant airport issues.

With respect to the role of the airport on the accident, the scope of the airports investigation includes an examination of the following:

1. The airport physical infrastructure
2. The procedures
3. The actions relating to the occurrence of the associated airport personnel.

With respect to CFR, the airports investigation includes an examination of the following:

1. As soon as possible after the accident, secure any appropriate documentation, including any security cameras or other video units.
2. Record post-accident observations of all appropriate equipment and systems.
3. Alert the airport duty manager of your requirements.

Depending on the accident circumstances, the investigation should interview any of the following people:

- a. Airport general manager
- b. Duty manager



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- c. Manager safety and security operations
- d. Manager airside
- e. Airport police detachment
- f. Airport fire chief
- g. Emergency response personnel involved.

4.12.2 Investigation Checklist

Examine and verify the status of any aerodrome facilities, either used by, or available to, the accident aircraft. Document the following, as appropriate:

<ul style="list-style-type: none">• Location (nearest town or city)• Elevation• Operator• License• Airport master plan and zoning• Surrounding terrain• Unique features or hazards• Information Dissemination• Dimensions• Markings• Shoulders• Elevations• Slopes• Quality of surface• Condition of surface<ul style="list-style-type: none">a. Surface contaminationb. Reported braking actionc. Measure braking action readings.• Bearing strength• Obstructions<ul style="list-style-type: none">a. Overrunb. Undershoot.• Dimensions• Bearing strength• Markings• Obstructions• Surface contamination• Airport beacon• Approach	<ul style="list-style-type: none">• Runway Displaced threshold and pre – threshold• Taxiway exit and holding• Airport guidance signs• Wind direction indicator• Obstructions• Heliport• Unserviceable areas• Snow removal and ice control• Work in progress• Foreign object damage (FOD)• Airport classification and requirements• Level of service provided• Hours of operation• Response plan• Time and method of alarm• Responding agencies• Number and type of vehicles involved• Time of arrival at the accident site• Rescue and fire fighting operations• Equipment used• Time when the evacuation was completed• Time when the fire was under control and when extinguished• Difficulties encountered• Management• Emergency planning• Security
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<ul style="list-style-type: none">• VASIs• Sequence flashing, runway identification• Runway edge, threshold/end, centerline• Runway touchdown zone• Runway exit• Helicopter aerodrome• Emergency• Aircraft radio controlled lighting• Taxiway• Obstructions• Boundary• Closed	<ul style="list-style-type: none">• Communications• Aircraft ground servicing• Bird hazard reduction• Apron management services• Availability and adequacy• Serviceability and use• NOTAMs• AIP• Differences to relevant ICAO Standards and Recommended Practices.• Runway End Safety Area (RESA).• Airport Operations Certificate and attached limitations terms.
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In addition to the above items that should be examined, the safety oversight surveillance of the airport by the DGCA needs to be examined. Determine the number of inspections, violations, and recommendations for improvement, etc. done by the DGCA for the airport. If there have been safety audits of the airport conducted, review the audit reports and action plans relevant to the occurrence circumstances.

Compare the airport infrastructure, maintenance, emergency plan, and operation with the provisions of ICAO Annex 14 and other relevant ICAO materials in order to make a determination if the airport meets the ICAO international requirements. Ascertain if there are any DGCA or Minister Decree specific requirements that are more stringent than the ICAO Standards.

Since an SMS program is an ICAO requirement for large airports, the group must examine the SMS program elements, the implementation of the program, and its effectiveness relevant to the occurrence. For smaller airports not required to meet ICAO requirements, use the ICAO requirements as a basis to document the safety management at the airport.

Since there are ICAO requirements for a periodic airport disaster exercise, the investigation may include a review of past exercises and the action plans to correct any deficiencies noted.

The report of the Airports Group will contain all factual materials examined, including photographs, maps, charts, etc.

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