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Doc 9756

# Manual of Aircraft Accident and Incident Investigation

Part IV — Reporting  
Third Edition, 2020



Approved by and published under the authority of the Secretary General

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retrieval system or transmitted in any form or by any means, without prior  
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## AMENDMENTS

Amendments are announced in the supplements to the *Products and Services Catalogue*; the Catalogue and its supplements are available on the ICAO website at [www.icao.int](http://www.icao.int). The space below is provided to keep a record of such amendments.

## RECORD OF AMENDMENTS AND CORRIGENDA

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## FOREWORD

The purpose of this manual is to encourage the uniform application of the Standards and Recommended Practices contained in Annex 13 and to provide information and guidance to States on the procedures, practices and techniques that can be used in aircraft accident investigations. Since accident investigations vary in complexity, a document of this kind cannot cover all eventualities. The more common techniques and processes, however, have been included. Although this manual will be of use to experienced and inexperienced investigators alike, it is not a substitute for investigation training and experience.

This manual is issued in four separate parts as follows:

- Part I — Organization and Planning;
- Part II — Procedures and Checklists;
- Part III — Investigation; and
- Part IV — Reporting.

Because this manual deals with accident, serious incident and incident investigations, for reasons of brevity, the terms “accidents” and “accident investigation”, as used herein, apply equally to “incidents” and “incident investigation”.

The following ICAO documents provide additional information and guidance material on related subjects:

- Annex 13 — *Aircraft Accident and Incident Investigation*;
- *Manual on Accident and Incident Investigation Policies and Procedures* (Doc 9962);
- *Manual on Regional Accident and Incident Investigation Organization* (Doc 9946);
- *Human Factors Training Manual* (Doc 9683);
- *Manual of Civil Aviation Medicine* (Doc 8984);
- *Hazards at Aircraft Accident Sites* (Circular 315);
- *Training Guidelines for Aircraft Accident Investigators* (Circular 298); and
- *Human Factors Digest No. 7 — Investigation of Human Factors in Accidents and Incidents* (Circular 240).

This manual, which supersedes the *Manual of Aircraft Accident Investigation* (Doc 6920) in its entirety, will be amended periodically as new investigation techniques are developed and new information becomes available.

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:

The Secretary General  
International Civil Aviation Organization  
999 Robert-Bourassa Boulevard  
Montréal, Quebec  
Canada H3C 5H7

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# Chapter 1

## THE FINAL REPORT

### 1.1 GENERAL

1.1.1 The Final Report of an aircraft accident investigation is the foundation for initiating the safety actions which are necessary to prevent further accidents from similar causes. Therefore, the Final Report on an accident must establish in detail what happened, how it happened and why it happened. The findings, causes and/or contributing factors of the Final Report should lead to safety recommendations so that appropriate preventive measures can be taken.

1.1.2 The Final Report should provide:

- a) a record of all the relevant facts (including any conflicting evidence);
- b) an analysis of the relevant facts;
- c) conclusions in the form of findings, causes and/or contributing factors; and
- d) safety recommendations.

The findings, causes and/or contributing factors of a Final Report should point clearly to the safety issues that need to be addressed.

1.1.3 The Final Report is usually the report of the investigator-in-charge or the accident investigation authority. The report should cover in detail all relevant aspects of the investigation. When the investigation of an accident is organized by establishing specialized groups, each group chairperson should submit a written report to the investigator-in-charge together with all supporting documentation and data covering the facts and findings established. The Final Report will be drafted based, to a large extent, on the reports of the various groups. The investigator-in-charge is responsible for ensuring that the Final Report is written in a consistent and uniform style.

1.1.4 The investigation of a general aviation accident seldom requires organization into groups. Such investigations are usually carried out by one or two investigators. As in the case of a major investigation, the responsibility for the completeness and quality of the Final Report rests with the investigator-in-charge and the accident investigation authority.

### 1.2 GROUP REPORTS

In consultation 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. 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. A group report should be presented in the format outlined in 1.2.1 to 1.2.5.

### 1.2.1 Introduction

This section gives brief identification details of the accident and lists the names, titles and affiliations of the group members. Matters of organization, such as the forming of subgroups to handle specific tasks within the terms of reference of the group, should be explained. For example, in the case of the Operations Group, subgroups such as a Witness Group and a Performance Group are sometimes formed. The terms of reference for the group and subgroups, and brief details of the time and location of investigation activities, should also be recorded in this section.

### 1.2.2 Investigation

The facts, conditions and circumstances established by the group should be presented under appropriate headings describing the areas investigated. For example, in the case of the 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 attached to the group report.

### 1.2.3 Analysis

The analysis discusses the significance of the facts stated in the previous section of the group report and presents the group's analysis of those facts as they pertain to the terms of reference of the group. This information should be presented in a logical way that leads to, and supports, the findings.

### 1.2.4 Conclusions

The conclusions section of the group report should contain the substantiated findings of the group's investigation. An indication of the findings of the group which are considered to be factors in the accident will assist the investigator-in-charge in the drafting of the Final Report.

### 1.2.5 Safety recommendations

The group report should include information on any safety issues established, safety actions already taken, proposals for safety recommendations and other forms of safety action, as appropriate.

## 1.3 FORMAT AND CONTENT OF THE FINAL REPORT

1.3.1 An investigation into an aircraft accident is not complete until all the relevant facts revealed by the investigation, the analysis of the facts, the conclusions and the safety recommendations have been recorded in the Final Report. The Final Report should be structured logically and written in clear and concise language. The report should explain what happened, how it happened, why the accident happened, and it should address the safety issues involved. A standardized format of the Final Report assists in the production of a complete and reliable record of the investigation of the accident.

1.3.2 In a major investigation, the investigator-in-charge receives the group reports and is responsible for the development and the drafting of the Final Report. The Final Report should be a comprehensive report of the whole investigation. The factual information collected during the investigation should form the basis for the analysis section of the report, which leads to and supports the establishment of the findings, causes and/or contributing factors, and safety recommendations. The standardized format for the Final Report, which is contained in the Appendix to Annex 13,

provides a well-structured record of the investigation. The Final Report contains five parts: Introduction (Title and Synopsis), Factual Information, Analysis, Conclusions (Findings, Causes and/or Contributing Factors) and Safety Recommendations.

1.3.3 Detailed guidance on the format and content of the Final Report is in Appendix 1 to Chapter 1. Appendix 2 provides guidance on report-writing conventions, and Appendix 3 presents a list of symbols and abbreviations which might be used in a Final Report. Appendix 4 contains a list of descriptive technical and Human Factors terms and their definitions while Appendix 5 lists examples of findings that might be used in accident reports.

1.3.4 The Final Report of an investigation, including its recommendations, is the catalyst for preventing further occurrences. Therefore, the Final Report must establish in detail what happened, how it happened and why it happened. For reporting on small investigations, many States have created abbreviated report formats that contain only the history of flight, information on the deficiencies discovered by the investigation, analysis of the factors contributing to the occurrence, and findings related to the deficiencies. Short reports have some advantages, including the reduction of resources required for the investigation and the time required to produce the Final Report.

1.3.5 Some States have created report forms that contain narrative sections, wherein the sequence of events is described; point-form sections, wherein free text can be entered; and check-off boxes for certain parameters that will facilitate data storage and extraction for statistical programmes. A well-designed form could serve as an investigation checklist and/or as the Final Report of the investigation.

## 1.4 CONSULTATION ON THE DRAFT FINAL REPORT

1.4.1 In accordance with Annex 13, the State conducting the investigation shall send a copy of the draft Final Report to the State which instituted the investigation and to all States that participated in the investigation, inviting their significant and substantiated comments on the report. The State conducting the investigation should also send copies of the draft Final Report to the operator and the organizations responsible for type design and final assembly of the aircraft, through the State of the Operator, the State of Design and the State of Manufacture, respectively, in order to enable the operator and such organizations to submit comments on the draft Final Report. When sending the draft Final Report to recipient States, the State conducting the investigation should consider using the most appropriate means available, such as facsimile, e-mail, courier service or express mail. When the draft Final Report is sent by electronic means, secure transmission methods should be used, when available.

1.4.2 States shall not circulate, release or give access to a draft report or any part thereof, any group reports or any other investigation documentation obtained during an investigation of an accident, without the express consent of the State which conducted the investigation, unless such reports or documents have already been published or released by that latter State.

1.4.3 If the State conducting the investigation receives comments within sixty days of the date of the transmittal letter, it shall either amend the draft Final Report to include the substance of the comments received or, if desired by the State that provided the comments, append the comments to the Final Report. Usually, comments to be appended to the Final Report are restricted to non-editorial, specific technical aspects of the Final Report, upon which no agreement could be reached.

1.4.4 If the State conducting the investigation receives no comments within sixty days, it shall issue the Final Report, unless an extension of that period has been agreed by the States concerned.

## 1.5 RELEASE AND DISTRIBUTION OF THE FINAL REPORT

1.5.1 The State conducting the investigation shall release the Final Report in the shortest possible time and, if possible, within twelve months of the date of the occurrence. If the report cannot be released within twelve months, the State conducting the investigation shall release an interim statement on each anniversary of the occurrence detailing the progress of the investigation and any safety issues raised.

1.5.2 Related to the release of Final Reports, Annex 13, 6.6.1 recommends that *“If the State conducting the investigation does not make the Final Report or an interim statement publicly available within a reasonable timeframe, other States participating in the investigation are entitled to request in writing from the State conducting the investigation express consent to release a statement containing safety issues raised with such information as is available. If the State conducting the investigation gives express consent or does not reply to such a request within 30 days, the State making the request should release such a statement after coordinating with participating States.”* An important aspect of this recommendation is the concept of a reasonable timeframe and what this may constitute.

1.5.3 The possibilities that may cause a delay in the publishing of the Final Report need to be assessed. A worldwide review related to the release of Final Reports assessed 1 157 occurrences of fatal accidents between 1990 and 2016 involving civil aircraft of a maximum mass of over 5 700 kg. The review determined that of the occurrences where a Final Report was generated and made publicly available, 25 per cent were made publicly available within one year of the occurrence; 65 per cent within two years; 84 per cent within three years; and 94 per cent were concluded in four years. In addition to the aforementioned, the following factors should be taken into consideration in determining a “reasonable timeframe” for the issuance of the Final Report or an interim statement:

- a) the availability of an interim statement(s) released by the State conducting the investigation on each anniversary of the occurrence, detailing the progress of the investigation and any safety issues raised, should the Final Report not be publicly available within twelve months;
- b) the level of complexity of the investigation of the occurrence may extend the time necessary to finalize the investigation, which may result in the Final Report being published in a two- to four-year period, as indicated above;
- c) a higher credibility is usually given to safety lessons shared promptly, which are likely to have a stronger impact on accident prevention and on the enhancement of safety; and
- d) the prompt sharing of safety lessons on systemic deficiencies (e.g. those not solely related to a specific aircraft type, operator, manufacturer, maintenance organization, or air navigation service provider) may provide safety benefits at a global level, including to States not participating in the investigation.

1.5.4 In addition to the release and distribution of the Final Report within the State, the State conducting the investigation shall send the Final Report, with a minimum of delay, to:

- a) the State which instituted the investigation;
- b) the State of Registry;
- c) the State of the Operator;
- d) the State of Design;
- e) the State of Manufacture;

- f) any State having suffered fatalities or serious injuries to its citizens;
- g) any State which provided relevant information, significant facilities or experts; and
- h) ICAO, if the involved aircraft is of a maximum mass of over 5 700 kg.

## 1.6 RELEASE AND DISTRIBUTION OF SAFETY RECOMMENDATIONS

1.6.1 At any stage of the investigation of an accident or incident, the investigation authority of the State conducting the investigation shall recommend, in a dated transmittal correspondence to the appropriate authorities (including those in other States, and to ICAO when ICAO documents are involved), any preventive action that it considers necessary to be taken promptly to enhance aviation safety.

1.6.2 A State that receives safety recommendations shall inform the proposing State, within ninety days of the date of the transmittal correspondence, of the preventive action taken or under consideration, or the reasons why no action will be taken.

1.6.3 A State conducting the investigation, or any other State issuing a safety recommendation, must implement procedures to record the responses to the safety recommendation issued. A State that receives a safety recommendation must implement procedures to monitor the progress of the action taken in response to that safety recommendation.

1.6.4 States are required to inform ICAO, i.e. the Accident Investigation Section of ICAO's Air Navigation Bureau, in a dated transmittal correspondence, of issued safety recommendations of global concern (SRGCs) as well as the responses received concerning these recommendations. An SRGC is defined as "a safety recommendation regarding a systemic deficiency having a probability of recurrence, with significant consequences at a global level, and requiring timely action to improve safety". Examples of what is and what is not an SRGC are listed in Appendix 6 to Chapter 1.

1.6.5 For the purpose of advancing aviation safety, SRGCs, as well as the responses received thereto, sent to ICAO will be recorded in an ICAO central database that is publicly available. States, even if they are not the addressee of the SRGC, should regularly monitor this database for awareness and adoption of timely corrective action as appropriate.

*Note.— Appendix 6 to this chapter contains more detailed guidelines on the identification, drafting and follow-up of safety recommendations.*

1.6.6 In general, safety recommendations are addressed to a State's regulatory/safety oversight agency and may not be widely disseminated. To this effect, the ICAO central database is a means to enhance awareness of other States' regulatory/safety oversight agencies, accident investigation authorities, airlines, etc. about SRGCs and their responses for the purpose of accident prevention measures, resulting in the enhancement of safety.

## 1.7 ELECTRONIC LIBRARY OF FINAL REPORTS

1.7.1 In accordance with the provisions in ICAO Annex 13, a State shall send to ICAO a copy of the Final Report on its investigations into accidents and incidents involving aircraft of a maximum mass of over 5 700 kilograms. Whenever practicable, the Final Report sent to ICAO is to be prepared in one of the working languages of the Organization. Final Reports can be sent in hard copy but preferably in electronic format. The Final Report shall be a public document in the interest of accident prevention.

1.7.2 Final Reports received by ICAO will be stored on the ICAO Electronic Library of Final Reports (e-Library) and posted on the AIG website, which is accessible through the ICAO public website at <https://www.icao.int/safety/airnavigation/AIG/Pages/E-library-of-Final-Reports.aspx>. In this way, safety lessons learned during investigations and information captured in Final Reports will be made available to a wide audience, including safety investigators, other safety officers and interested parties.

## 1.8 EXCHANGE OF FINAL REPORTS BETWEEN STATES

1.8.1 Aircraft accident prevention is dependent, in part, on information made available from accident investigations. The causes and/or contributing factors of accidents, especially those in which large aircraft are involved, are of interest to all States and, in particular, to those States operating similar aircraft types. Therefore, prompt dissemination to all States of the findings of aircraft accident investigations can be a major contribution to aviation safety. To facilitate the exchange of accident information, all States are encouraged to disseminate their Final Reports to other States. Use of the Internet can expedite such dissemination.

1.8.2 ICAO also encourages States to exchange information concerning any safety recommendations that were made before the completion of the Final Report.

1.8.3 The Final Reports of accidents and incidents submitted to ICAO are available in the e-library of Final Reports on the AIG website, which is accessible through the ICAO public website. However, as some Final Reports may not be available in the e-library, States that require information pertaining to these Final Reports should request a copy of these Final Reports from the accident investigation authority of the State which conducted the investigation. Appendix 2 to Chapter 4 of Part I of this manual lists the addresses and contact numbers of States' accident investigation authorities, as reported to ICAO. An up-to-date list can be found on the AIG website, which is accessible through the ICAO public website.

## 1.9 ICAO ADDRESS

Final Reports being sent to ICAO should be sent using one, or both, of the following addresses:

By mail: International Civil Aviation Organization  
Attention: AIG Section  
999 Robert-Bourassa Boulevard  
Montréal, Quebec, Canada H3C 5H7

By email: [ADREP@icao.int](mailto:ADREP@icao.int)

## Appendix 1 to Chapter 1

### FORMAT AND CONTENT OF THE FINAL REPORT

To enable the Final Report to be presented in a convenient and uniform manner, a standardized format is contained in the Appendix to Annex 13. However, that format may be adapted to the circumstances of the accident or incident. Detailed guidance on completing each section of the Final Report is provided below.

#### INTRODUCTION (TITLE AND SYNOPSIS)

The title of the Final Report should contain the following information: name of the operator; manufacturer, model, nationality and registration marks of the aircraft; and place and date of the accident.

The introduction should contain brief information on the notification of the accident to national and foreign authorities, the identification of the accident investigation authority conducting the investigation, the accredited representation from other States and brief information on the organization of the investigation. The authority releasing the report, as well as the date of release, should also be given.

The introduction should contain a synopsis which briefly describes the accident. It should provide an overview of the accident flight, a statement of why the accident happened and a brief summary of the injuries and damage. The synopsis could be described in an executive summary to the Final Report and should usually not exceed one page in length.

The title page, or the inside cover, may contain a statement on the accident prevention objective of the investigation and the Final Report. It may also be stated that it is not the purpose of the investigation and the Final Report to apportion blame or liability. For example, the following text may be considered: "In accordance with Annex 13 to the Convention on International Civil Aviation, it is not the purpose of aircraft accident investigation to apportion blame or liability. The sole objective of the investigation and the Final Report is the prevention of accidents and incidents."

The introduction may also contain a statement regarding the responsibility for implementing the safety recommendations. For example, the following text may be considered: "Unless otherwise indicated, recommendations in this report are addressed to the regulatory authorities of the State having responsibility for the matters with which the recommendation is concerned. It is for those authorities to decide what action is taken."

The introduction should contain a reference to the time of day used in the report and the differential between local time and Coordinated Universal Time (UTC).

A table of contents, a list of abbreviations used in the report and a list of appendices will enhance the readability of the report.

#### 1. FACTUAL INFORMATION

This part of the Final Report is descriptive in character and should be a comprehensive record of the facts and circumstances established in the investigation. When the investigation was conducted by groups, the report should

comprise a consolidation of the relevant information from the group reports. Supporting documents, such as photographs, diagrams, relevant parts of flight recorder readouts and technical reports, should be included or appended to the report. However, only those documents, or portions thereof, which are required to support the facts, analysis and conclusions shall be appended to the Final Report.

The collection of Human Factors information is an integral part of the investigation. Thus, the Human Factors information should be integrated into the appropriate areas of the factual part of the report, rather than being placed under a separate heading. Human Factors information should be presented in a language that is consistent with the presentation of the other factual information.

The factual information part of the Final Report should contain a description of all the events and circumstances directly related to the occurrence. The sequence should begin as far back in time as is necessary to include the significant events which preceded the accident. This part also contains all factual information, i.e. information resulting from direct verification, which is essential for the development of the analysis, conclusions and safety recommendations. The significance of the facts should not be explained in the factual information part. Such discussions should be presented in the analysis part.

## 1.1 History of the flight

1.1.1 The history of the flight describes the significant events which preceded the accident, in chronological order, when this is practicable. The information is usually obtained from sources such as flight records, flight data recorders, cockpit voice recorders, air traffic services records and recordings, and witness accounts. The information should be correlated to local time or UTC if the flight involved more than one time zone. The information presented in this section of the report should be based on established facts. Usually the flight number, the type of operator and operation, the crew briefing and flight planning, the departure point and time of departure, and the point of intended landing will be given, followed by a description of the events leading to the accident, including navigational details and relevant radio communications. It is important to give a description of the flight and the pertinent events as they occurred, including a reconstruction of the significant portion of the flight path, if appropriate. Evidence which facilitated the reconstruction of the sequence of events, such as witness accounts, cockpit voice recorder and air traffic services transcripts, should be mentioned.

1.1.2 In the history of the flight section, the objective is to enable the reader to understand how the accident happened but to avoid any analysis of why the accident occurred.

1.1.3 With regard to the location of the occurrence, include:

- a) the latitude and longitude as well as a geographical reference to a well-known location (such as 75 km south of XYZ);
- b) the elevation of the accident site;
- c) the time of the occurrence in local time (and UTC if the flight crossed time zones); and
- d) whether it was day, dawn, dusk or night.

## 1.2 Injuries to persons

1.2.1 Table IV-1-1 should be used to summarize injuries to persons. This table should be completed using numbers.

**Table IV-1-1. Injuries to persons**

| <i>Injuries</i> | <i>Crew</i> | <i>Passengers</i> | <i>Total in the aircraft</i> | <i>Others</i>  |
|-----------------|-------------|-------------------|------------------------------|----------------|
| Fatal           |             |                   |                              |                |
| Serious         |             |                   |                              |                |
| Minor           |             |                   |                              | Not applicable |
| None            |             |                   |                              | Not applicable |
| TOTAL           |             |                   |                              |                |

1.2.2 Fatal injuries include all deaths determined to be a direct result of injuries sustained in the accident. Serious injury is defined in Chapter 1 of Annex 13. For statistical purposes, ICAO classifies a fatal injury as an injury which results in death within thirty days of the accident. The heading “Others” in the table refers to persons outside the aircraft who were injured in the accident. When the accident involves a collision between two aircraft, a separate table should be used for each aircraft.

1.2.3 Also, the nationalities of the passengers and the crew should be listed by stating the number of fatalities and serious injuries for each nationality.

## 1.3 Damage to aircraft

1.3.1 This section should contain a brief statement of the damage sustained by the aircraft in the accident (destroyed, substantially damaged, slightly damaged, or no damage). A detailed description of damage to relevant aircraft components and systems should be included in Section 1.12 — Wreckage and impact information.

1.3.2 Further guidance for the determination of aircraft damage is provided in Attachment E to Annex 13. In addition, an aircraft should/could be classified as “destroyed” when the main structural elements and/or systems are substantially damaged to the extent that it would be impractical to return the aircraft to an airworthy condition. Examples of damages that would merit classification as “destroyed” are as follows:

- a) damage to an aircraft where the structure is deformed, crushed, demolished or consumed by fire to such an extent that the make and model is not readily distinguishable without viewing its written documents, data plate or insignia;
- b) most of the parts are damaged and need to be replaced or repaired;
- c) for large aircraft, keel beam damage that exceeds the structural repair manual (SRM);

- d) fuselage broken in two or more sections;
- e) multi-site damage locations that exceed the SRM, such as engine separation, wing separated or broken, or empennage separated or broken; and
- f) aircraft is submerged in saltwater for 24 hours or longer.

*Note 1.— A classification of “destroyed” is usually associated with a hull loss, meaning that the aircraft is damaged beyond economical repair. However, an aircraft may be repaired for other reasons, such as historical value. Therefore, a technical determination of damage classification “destroyed” is not to be affected by the decision of whether to repair or rebuild an accident aircraft.*

*Note 2.— Occurrence where the aircraft damage is coded as “destroyed” is to be classified as an “accident”.*

## 1.4 Other damage

Make a brief statement of damage sustained by objects other than the aircraft, such as buildings, vehicles, navigation facilities, aerodrome structures and installations, and any significant damage to the environment.

## 1.5 Personnel information

1.5.1 Provide a brief description of the qualifications, experience and history for each flight crew member (pilot, co-pilot and flight engineer) including age, type and validity of licences and ratings; flying experience (total hours), types flown and hours on the type; hours flown in the last 24 hours, 7 days and 90 days prior to the accident; results of recent training and mandatory and periodic checks; experience on route and aerodrome involved in the accident; relevant information on duty time and rest periods in the 48 hours prior to the accident; and significant medical history and medical checks. Also, state the position occupied by each flight crew member and identify who was flying the aircraft.

1.5.2 When relevant to the accident, give a brief statement of the duties and responsibilities of the cabin crew as well as their qualifications, experience, and training. These details would be relevant, for example, if the accident involved an evacuation of the aircraft.

1.5.3 When relevant to the accident, include a brief statement of the validity of licences and ratings as well as the qualifications and experience of air traffic services personnel, including age, position manned, total experience (in years), and details of experience specific to the position manned. Details of training and pertinent checks should be included as well as duty times and rest periods in the 48 hours prior to the occurrence.

1.5.4 When relevant to the accident, information on maintenance personnel and other personnel involved should include qualifications, experience, time on duty, shift work rosters, workload and the time of the day.

1.5.5 When relevant to the occurrence, this section would also include information on any personal or medical factors that could have influenced human performance.

1.5.6 Use subheadings, as appropriate, to organize the information in this section.

## 1.6 Aircraft information

1.6.1 When relevant to the accident, provide a brief statement of the airworthiness and maintenance of the aircraft including the following information:

- a) *General information:* Aircraft manufacturer and model, serial number and year of manufacture; nationality and registration marks, validity of the Certificate of Registration; name of the owner and the operator; and validity of the Certificate of Airworthiness;
- b) *Aircraft history:* Total flying hours since manufacture, since overhaul and since last periodic inspection. Include relevant information on maintenance log and maintenance documentation, compliance (or otherwise) with airworthiness directives, manufacturer service bulletins and aircraft modification status;
- c) *Helicopters:* Main rotor and tail rotor types and serial numbers. When relevant, include total time, time since overhaul, time since inspection, and certificated time and cycle limits for relevant components;
- d) *Engines and propellers:* Engine manufacturer and model, position on the aircraft and engine or engine module serial numbers; engine overhaul period if an engine failure occurred; and total hours, hours since overhaul and hours since last inspection, for each engine. If relevant, provide the same information for the propellers;
- e) *Fuel:* Type of fuel used and type of fuel authorized. Also, state the amount of fuel on board and how it was determined, its specific gravity, and its distribution in the fuel tanks;
- f) *Accessories:* In respect of any component which failed, give details of the manufacturer, type, model, part and serial number, certificated time and cycle limits, and operating time since manufacture and since overhaul;
- g) *Defects:* List any technical defects in the aircraft, engine or accessories that were discovered during the investigation or recorded in the appropriate log and not cleared. Indicate whether the defects were recurring and whether the flight was permissible under the aircraft master minimum equipment list. If there were no defects, make a statement to that effect; and
- h) *Aircraft load:* The maximum certificated take-off mass and landing mass, actual take-off mass and mass at the time of the occurrence should be given. Also, state the certificated limits for the centre of gravity of the aircraft, and the centre of gravity at take-off and at the time of the occurrence. Include a description of the operator's loading control system, the load distribution and its security, and how the details of the aircraft mass and centre of gravity were established.

1.6.2 Describe any aircraft part or system which had a bearing on the accident. Similarly, describe operational procedures, performance limitations and other aircraft-related circumstances which played a role in the accident. The objective is to enable the reader to fully understand how the accident happened.

1.6.3 The availability, serviceability and use of transponder, airborne collision avoidance system (ACAS) and traffic alert and collision avoidance system (TCAS), ground proximity warning system (GPWS) and terrain awareness warning system (TAWS) should be stated. The relevant systems should be discussed in detail for near-collisions, mid-air collisions, approach and landing accidents and controlled flight into terrain accidents.

## 1.7 Meteorological information

1.7.1 Provide a brief statement on the relevant meteorological conditions, including the forecast and actual weather, together with an appreciation of the weather in retrospect. When relevant to the occurrence, the following information should be included:

- a) Describe when, where and how the pilot obtained weather information;
- b) Weather forecast: Route and aerodrome forecasts available to the pilot, and details of any weather briefing obtained by the pilot prior to departure or received en-route;
- c) Weather observations at the time and place of the occurrence including precipitation, ceiling, visibility, runway visual range, wind speed and direction, temperature and dew point;
- d) Actual weather on the route of the flight including weather observations, SIGMETs, pilot reports and witness accounts;
- e) A general view of the weather situation (synoptic weather);
- f) Weather radar recordings, satellite photos, low-level wind shear alert system (LLWSAS) data, and other recorded meteorological information; and
- g) Natural light conditions at the time of the accident, such as day (sunlight or overcast), twilight (dawn or dusk; when relevant, the time of sunrise or sunset at the applicable altitude should be included), night (dark or moonlight) and when relevant, the position of the sun relative to the direction of the flight.

1.7.2 The amount of meteorological information to be included in this section depends on the significance of the meteorological factors in the occurrence. A detailed description of the forecast and weather observations is appropriate for a weather-related occurrence whereas a brief summary of the weather is appropriate when the weather was not a factor.

## 1.8 Aids to navigation

1.8.1 Include relevant information on ground-based navigation and landing aids available, such as non-directional radio beacon (NDB), very high frequency omnidirectional radio range (VOR), distance measuring equipment (DME), instrument landing system (ILS), precision approach radar (PAR), and visual ground aids as well as their serviceability at the time of the accident.

1.8.2 When relevant, include pertinent information on equipment on board the aircraft, such as auto flight system, flight management system (FMS), global positioning system (GPS), inertial navigation system (INS), aircraft communication addressing and reporting system (ACARS), enhanced ground proximity warning system (EGPWS), TCAS and electronic flight bag (EFB), including their serviceability. Availability of relevant maps, charts, approach plates, pertinent air-based navigation (such as global navigation satellite system (GNSS)), surveillance data from primary and secondary radar equipment, automatic dependent surveillance — broadcast (ADS-B), automatic dependent surveillance — contract (ADS-C), satellite communication (SATCOM) and satellite data should also be discussed and included in, or attached to, the report. The information should include the effectiveness of the pertinent systems at the time.

## 1.9 Communications

Describe the communication facilities available to the flight crew and their effectiveness. Describe the communications with the air traffic services and other communications relevant to the flight, including reference to communication logs and transcripts of recordings. When essential to the analysis and understanding of the occurrence, pertinent extracts from the transcripts of air traffic services communications recordings should be included in this section or attached to the report.

## 1.10 Aerodrome information

1.10.1 When the occurrence took place during take-off or landing, include information concerning the aerodrome and its facilities. When relevant, include the following information:

- a) Name of aerodrome, location indicator, reference point (latitude/longitude) and elevation;
- b) Runway identification, runway markings, runway length and slope, length of overrun, and obstructions;
- c) Runway conditions, such as pavement texture and grooving, rubber deposits, presence of water, slush, snow, ice, friction coefficient and braking action;
- d) Lighting, such as runway, taxiway and stopway lighting; and visual aids, such as visual approach slope indicator system (VASIS) and precision approach path indicator (PAPI);
- e) Runway inspection programmes and inspections carried out; and
- f) Bird and wildlife programmes.

1.10.2 If the aircraft was taking off from, or landing on, an area other than an aerodrome, relevant information on the take-off or landing area should be given.

1.10.3 This section should be divided into departure aerodrome information and destination aerodrome information, if both aerodromes were pertinent to the occurrence.

## 1.11 Flight recorders

1.11.1 Provide the particulars for each flight recorder, such as manufacturer, model, number of parameters recorded, recording medium and duration of the recording. The recorders would include flight data recorders (FDRs), cockpit voice recorders (CVRs), flight crew-machine interface recordings (FCMIR), quick access recorders/direct access recorders (QARs/DARs), engine parameter recorders (such as electronic engine control (EEC)), health and usage monitoring systems (HUMS), airborne image recorders (AIRs), data link recorders, lightweight recorders, non-volatile memory chips in aircraft systems, other on-board data storage equipment, and communication and/or video storage devices, or ground-based recorders.

1.11.2 Describe the performance of the means for timely recovery of flight recorder data as required by Annex 6 — *Operation of Aircraft*, Part I — *International Commercial Air Transport — Aeroplanes*, 6.3.6 *Flight recorder data recovery*. When applicable, describe the location and retrieval of automatic deployable flight recorders, including the performance of the emergency locator transmitter(s) (ELT(s)) for locating the recorder, or the recovery of any transmitted flight recorder data.

*Note.— Guidance on approving the means to locate an aircraft in distress and make flight recorder data available in a timely manner is contained in the Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery (Doc 10054).*

1.11.3 Describe the condition of the recorders on recovery, in particular their exposure to fire and impact forces. If the flight recorder(s) could not be recovered, the reasons should be explained. If data were not recorded or could not be extracted, describe the reasons for the malfunction or loss of data. Include techniques used to extract data and any problems encountered. If the recorders operated properly, a short statement to this effect should be made and the pertinent data presented.

1.11.4 In this section, provide information recorded by the flight recorders. Because of the length of a flight data recording read-out report, include here, or in an appendix to the Final Report, only those parts of the read-out reports which are pertinent to the analysis and findings.

1.11.5 Transcripts from the cockpit voice recordings shall be included in the Final Report or its appendices only when essential to the analysis and understanding of the occurrence. Parts of the recordings not essential to the analysis shall not be disclosed. Chapter 5 of Annex 13 contains provisions pertinent to transcribed voice recordings and should be taken into account when it is considered necessary to include such transcripts in the Final Report or its appendices.

1.11.6 If the aircraft was not required to be equipped with flight recorders, a statement along the following lines may be used: "The aircraft was not equipped with a flight data recorder or a cockpit voice recorder. Neither recorder was required by the relevant aviation regulations."

1.11.7 When applicable, describe any techniques or processes used to recover data from other devices containing solid-state memory, including methods employed for the extraction (decoding) of operational and/or engineering units from the raw data set.

1.11.8 If the flight recorders installed did not comply with ICAO Standards or national regulations, or if the recorders did not function in accordance with specifications or were not properly maintained, these deficiencies should be noted in this section of the investigation report. When applicable, a statement as to the impact of these deficiencies on the investigation should be noted.

## 1.12 Wreckage and impact information

1.12.1 Provide a general description of the site of the accident and the distribution pattern of the wreckage, including the final portion of the flight path, the impact path, the impact sequence and the location of impact impressions on the ground, trees, buildings and other objects. The impact heading, aircraft attitude (pitch, roll and yaw) and aircraft configuration at impact should be given. When relevant, the terrain surrounding the site of the accident should be described. Relevant wreckage distribution diagrams, charts and photographs should be included in this section or appended to the report. The location and the state of the major parts of the wreckage should be presented. In case of an in-flight breakup of the aircraft, a detailed description of the wreckage distribution should be provided.

1.12.2 In major accident investigations, it might be necessary to present the examination of the wreckage and the technical investigations under appropriate subheadings in this section, such as structures, power plants, instruments, flight controls and systems. The descriptions under each subheading should embrace the significant facts determined by the group which was responsible for the detailed investigation. Under appropriate subheadings also include the relevant results of special technical investigations, examinations and laboratory tests and the significance of the results obtained (see also Section 1.16 — Tests and research). When relevant, the technical laboratory and test reports should be appended to the Final Report.

1.12.3 It is important to include all pertinent material failures and component malfunctions and to indicate whether they occurred prior to, or at, impact. It is essential that failed or malfunctioning components, which are deemed to be significant to the accident, be described. A detailed description of all wreckage components is not necessary; describe only components considered to be relevant or which required examination and analysis. The inclusion of drawings of components and photographs of specific failures will enhance the Final Report. Such drawings and photographs could be presented together with the appropriate text or as an appendix.

1.12.4 When relevant, describe the performance of the underwater locating device (ULD) operating at frequency of 8.8 kHz for locating the aircraft wreckage underwater and the ULD operating at frequency of 37.5 kHz attached to the fixed flight recorders.

1.12.5 When relevant, describe the performance of the distress tracking equipment of the aircraft, which should be compliant with Standard 6.18 of ICAO *Annex 6 — Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes*.

### 1.13 Medical and pathological information

1.13.1 Describe the results of the medical and pathological investigations of the flight crew. Medical information related to flight crew licences should be included under Section 1.5 — Personnel information. When relevant to the accident, the medical investigation may also concern the cabin crew members, passengers and ground personnel.

1.13.2 The results of the pathological and toxicological examinations concerning injuries, detection of disease and factors which impaired human performance (such as carbon monoxide, oxygen deficiency, alcohol and other drugs) should be stated. If alcohol and drugs are detected, their effects on human performance, as determined by medical experts, should be presented in this section.

1.13.3 Describe the pathological evidence of significance to the survival investigation such as the relationship of injuries and pathological evidence to the deceleration forces, aircraft attitude at impact, seat design and attachments, seat belts (see also Section 1.15 — Survival aspects), break-up of the aircraft structure, smoke inhalation, decompression and any evidence of preparation for an emergency situation (such as forced landing, ditching and unlawful interference).

1.13.4 Given the provisions of Annex 13, Chapter 5, with regard to medical and private records, particular care should be taken that such information is disclosed in the Final Report only when pertinent to the analysis and conclusions of the accident. In some States, there is a requirement for the investigation authority to coordinate the release of such information with the appropriate authority for the administration of justice.

1.13.5 If the medical examinations indicate that the performance of flight crew members was not degraded, a sentence along the following lines may be used: "There was no evidence that physiological factors or incapacitation affected the performance of flight crew members."

### 1.14 Fire

1.14.1 If a fire or an explosion occurred, give a brief description of whether the fire started in flight or after ground impact. For in-flight fires, describe the effectiveness of the aircraft fire warning systems and the aircraft fire extinguishing systems. The determination of the origin of a fire, source of ignition, fuel source, duration, severity and effects on the aircraft structure and the occupants usually requires an analysis of the facts and indications and should therefore be dealt with in the analysis part of the Final Report. This section should describe the factual information which was established in the investigation related to the fire and which should then be discussed and analysed in the analysis part.

1.14.2 For fires on the ground, describe the propagation and the extent of the fire damage. The response time of the rescue fire service, access to the accident site by the rescue fire service vehicles, the type of fire-fighting equipment used, the type of extinguishing agent and the amount that was used and its effectiveness should also be described.

1.14.3 The effect of the fire on the evacuation and survivability of the occupants should be described in Section 1.15 — Survival aspects.

1.14.4 If there was no fire, a sentence along the following lines may be used: “There was no evidence of fire in flight or after the impact.”

### 1.15 Survival aspects

1.15.1 Give a brief description of the search and rescue activities. When applicable, include information regarding the serviceability and effectiveness of the fixed and/or portable ELT(s) or the equipment enabling the location of the wreckage and potential survivors. Pertinent information on the aircraft tracking system, in particular the autonomous distress tracking (ADT) system(s), should also be documented.

1.15.2 The location of crew members and passengers in relation to injuries sustained should be stated. The failure of structures such as seats, seat belts and overhead bins should be described. Also, the use and effectiveness of safety equipment should be reported. Aspects pertinent to the crashworthiness of the aircraft should be addressed as well as occupant survivability in relation to impact forces and fire.

1.15.3 If an evacuation was conducted, a description of the following information is usually included:

- a) first notification of an accident to the emergency services and the response time;
- b) emergency lighting in the aircraft (installation, activation, functioning and failures);
- c) communications;
- d) passenger behaviour and carry-on baggage;
- e) emergency exits (types of exits and their use);
- f) evacuation slides (types of slides, activation and their use);
- g) injuries sustained in the evacuation; and
- h) post-evacuation events.

### 1.16 Tests and research

1.16.1 Describe the results of any tests and research undertaken in connection with the investigation. Flight tests, simulator tests and computer modelling of aircraft performance are examples of the type of information that should be included in this section. Relevant details of research that are used to support the analysis should also be included.

1.16.2 The results of examinations of aircraft and engine parts may alternatively be included in Sections 1.6 — Aircraft information, 1.12 — Wreckage and impact information, or 1.16 — Tests and research.

### 1.17 Organizational and management information

1.17.1 When relevant to the accident, provide pertinent information on any organization and its management whose activities may have directly or indirectly influenced the operation of the aircraft. The organizations to be addressed in this section could include:

- a) operator;
- b) maintenance organizations;
- c) air traffic services;
- d) aerodrome administration;
- e) meteorological services;
- f) aircraft manufacturer;
- g) certification and licensing authority; and
- h) regulatory authority.

1.17.2 When deficiencies in the organizational structure and functions had a bearing on the accident, the information could include, but need not be limited to, the following factors:

- a) safety culture;
- b) resources and financial viability;
- c) management policies and practices;
- d) internal and external communications; and
- e) certification, safety oversight and regulatory framework.

1.17.3 When relevant, provide pertinent information concerning the operator, such as type and date of issuance of the air operator certificate, types of operations authorized, types and number of aircraft authorized for use, and authorized areas of operation and routes. Also, include information concerning any deficiencies found in the operator's company operations manual and other operator documentation, when the deficiencies had a bearing on the accident.

### 1.18 Additional information

Give relevant information and facts, not already included in Sections 1.1 to 1.17, which are essential to the development of the analysis and conclusions parts of the Final Report.

*Note.— Ensure that the factual information part of the Final Report contains all the technical data which are essential to the analysis and conclusions parts of the report.*

### 1.19 Useful or effective investigation techniques

When useful or effective investigation techniques have been used during the investigation, briefly describe the main features of these techniques and their pertinence to future investigations. However, the data and the results obtained, as they relate to the occurrence, should be included under the appropriate Sections 1.1 to 1.18 of the investigation report. The full report on the use of these techniques may be included as an appendix to the Final Report.

## 2. ANALYSIS

2.1 In the analysis part of the Final Report, the significance of the relevant facts and circumstances which were presented in the factual information part should be discussed and analysed in order to determine which events contributed to the accident. There might be a necessity to repeat the description of some of the evidence already presented in the factual information part; however, the analysis should not be a restatement of the facts. Also, no new facts should be introduced in the analysis part. The purpose of the analysis is to provide a logical link between the factual information and the conclusions that provide the answer to why the accident occurred.

2.2 The analysis part should contain an evaluation of the evidence presented in the factual information part and should discuss the circumstances and events that existed or may have existed. The reasoning must be logical and may lead to the formulation of hypotheses, which are then discussed and tested against the evidence. Any hypothesis which is not supported by the evidence should be eliminated; it is then important to clearly state the reasons why a particular hypothesis was rejected. When a hypothesis is not based on fact but is an expression of opinion, this should be clearly indicated. Additionally, the justification for sustaining the validity of a hypothesis should be stated and reference should be made to the supporting evidence. Contradictory evidence must be dealt with openly and effectively. Cause-related conditions and events should be identified and discussed. The discussion in the analysis should support the findings and the immediate and systemic causes and/or contributing factors of the accident.

2.3 Also, discuss and analyse any issue that came to light during the investigation which was identified as a safety deficiency, although such issue may not have contributed to the accident.

2.4 Because the Final Report is often drafted as the investigation progresses and several investigators (all the groups in a major investigation) will contribute to the analysis part of the report, the development of an outline and subheadings for the analysis part will ensure that the investigators know their drafting assignments. Such an outline will also indicate to the investigators how the subheadings will come together in forming the analysis part of the Final Report. An example of such an outline is provided in Table IV-1-2.

**Table IV-1-2. Example outline for the analysis part**

#### EXAMPLE OF SUBHEADINGS IN THE ANALYSIS PART

An aircraft impacts the ground short of the runway during an instrument approach in marginal weather. Some of the occupants are killed or injured. Based on these few facts, the investigator-in-charge can identify many of the areas to be investigated and analysed. At an early stage of the investigation, the investigator-in-charge is able to allocate drafting assignments to the investigators for tentative subheadings in the analysis part, as follows:

##### 2.1 General