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Manual of Aircraft Accident and Incident Investigation

Part IV
Reporting

Approved by the Secretary General and published under his authority

First Edition — 2003

International Civil Aviation Organization

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AMENDMENTS

The issue of amendments is announced regularly in the *ICAO Journal* and in the monthly *Supplement to the Catalogue of ICAO Publications and Audio-visual Training Aids*, which holders of this publication should consult. The space below is provided to keep a record of such amendments.

RECORD OF AMENDMENTS AND CORRIGENDA

AMENDMENTS			
No.	Date applicable	Date entered	Entered by

CORRIGENDA			
No.	Date of issue	Date entered	Entered by

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 will be 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 both accident and incident investigations and, 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*;
— *Accident/Incident Reporting (ADREP) Manual* (Doc 9156);
— *Accident Prevention Manual* (Doc 9422);
— *Manual of Civil Aviation Medicine* (Doc 8984);
— *Human Factors Training Manual* (Doc 9683);
— *Human Factors Digest No. 7 — Investigation of Human Factors in Accidents and Incidents* (Circular 240).

This manual, which supersedes Doc 6920 in its entirety, will be amended periodically as new investigation techniques are developed and new information becomes available.

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 University Street
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 and the causes 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 record of all the relevant facts (including any conflicting evidence);

— an analysis of the relevant facts;

— conclusions in the form of findings and causes; and

— safety recommendations.

The findings and the causes 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 THE 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 which 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 following format:

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 sub-groups to handle specific tasks within the terms of reference of the group, should be explained. For example, in the case of the Operations Group, sub-groups such as a Witness Group and a Performance Group are sometimes formed. 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.

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.

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.

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.

Safety recommendations

The group report should include information on any safety issues established, safety actions already taken, and proposals for safety recommendations.

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, and 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 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 and Causes) and Safety Recommendations.

1.3.3 Detailed guidance on the format and content of the Final Report is at Appendix 1 to Chapter 1.

1.3.4 For the reporting on small investigations conducted by one or two investigators, some States have found that the completion of an accident report form has some advantages over drafting a full Final Report. Detailed information can easily be recorded by completing the appropriate sections of an accident report form. Narratives are usually restricted to particular sections, such as an analysis of the events leading to the accident, conclusions and safety recommendations. The forms are designed to reduce the time required for recording the work of investigators. The forms can also be used as a type of investigation checklist. It is important that the accident report forms be consistent with the format of the Final Report, to the extent possible, since this facilitates reader comprehension and any subsequent electronic accident reporting.

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 e-mail, secure protection should be used when available.

1.4.2 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.

1.4.3 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.

1.5 RELEASE AND DISTRIBUTION OF THE FINAL REPORT

1.5.1 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. The State conducting the investigation should 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 should release an interim report or should use some other means detailing the progress of the investigation and any safety issues identified.

1.5.2 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; and

g) any State which provided relevant information, significant facilities or experts.

1.6 FINAL REPORTS TO BE INCLUDED IN THE ICAO AIRCRAFT ACCIDENT DIGEST

1.6.1 The purpose of the ICAO Aircraft Accident Digest is to disseminate information to States on selected major accidents. Publication of the Digest began in 1951. States have reiterated a need for the Digest, not only as a valuable source for information on major accidents, but also as a tool for accident prevention, as a training aid for investigators and as educational material for technical schools.

1.6.2 When a Final Report has been released by a State that has conducted an investigation into an accident or an incident involving an aircraft of a maximum mass of over 5 700 kg, that State shall send to ICAO a copy of the Final Report. Whenever practicable, the Final Report sent to ICAO is to be prepared in one of the working languages of ICAO, and in the format shown in the Appendix to Annex 13.

1.6.3 The Final Reports included in the Digest are selected on the basis of their contribution to accident prevention and are usually published as received. However, lengthy reports may be abbreviated and the appendices are usually not reproduced.

1.7 EXCHANGE OF FINAL REPORTS BETWEEN STATES

1.7.1 Aircraft accident prevention is dependent, in part, on information made available from accident investigations. The causes 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.

1.7.2 ICAO also encourages States to exchange information concerning any interim safety recommendations made before the completion of the Final Report.

1.7.3 The Accident/Incident Data Reporting (ADREP) Summary provides States with information on accidents and incidents. However, the information in the ADREP Summary is brief and States that require more detailed information should request a copy of the Final Report from the accident investigation authority in the State which conducted the investigation. A list of addresses and web sites of accident investigation authorities is contained in Appendix 2 to Chapter 4 of Part I of this Manual.

1.8 ICAO ADDRESS

In accordance with the provisions of Annex 13, a copy of the Final Report shall be sent to ICAO and addressed:

International Civil Aviation Organization
Attention: AIG
999 University Street
Montréal, Quebec, Canada H3C 5H7

For electronic copies, the e-mail address is "icaohq@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. 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 as an executive summary of 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 Co-ordinated 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 should 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:

— the latitude and longitude, as well as a geographical reference to a well-known location (such as 75 km south of XYZ);

— the elevation of the accident site;

— time of the occurrence in local time (and UTC if the flight crossed time zones); and

— whether it was day, dawn, dusk or night.

1.2 Injuries to persons

1.2.1 Table 1-1 should be completed in numbers.

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

Table 1-1. Injuries to persons

Injuries	*Crew*	*Passengers*	*Total in the aircraft*	*Others*
Fatal				
Serious				
Minor				Not applicable
None				Not applicable
TOTAL				

(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.

1.4 Other damage

1.4.1 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, gender, 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; 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. For example, these details would be relevant 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, the qualifications and experience of air traffic services personnel, including age, gender, 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 Use sub-headings, 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:

— 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;

— 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;

— 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;

— 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;

— 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;

— 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;

— Defects: List any technical defects in the aircraft, engine or accessories which 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

— 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:

— Describe when, where and how the pilot obtained weather information;

— 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;

— Weather observations at the time and place of the occurrence including precipitation, ceiling, visibility, runway visual range, wind speed and direction, temperature and dewpoint;

— Actual weather on the route of the flight, including weather observations, SIGMETs, pilot reports and witness accounts;

— A general view of the weather situation (synoptic weather);

— Weather radar recordings, satellite photos, low-level wind shear alert system (LLWSAS) data, and other recorded meteorological information; and

— 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 navigation and landing aids available, such as global navigation satellite system (GNSS), non-directional radio beacon (NDB), very high frequency omnidirectional radio range (VOR), distance measuring equipment (DME), instrument landing system (ILS), 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 autoflight system, flight management system (FMS), global positioning system (GPS), and inertial navigation system (INS), including their serviceability. Relevant maps, charts, approach plates and radar recordings should also be discussed and included in, or attached to, the report.

1.9 Communications

1.9.1 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:

— Name of aerodrome, location indicator, reference point (latitude/longitude) and elevation;

— Runway identification, runway markings, runway length and slope, length of overrun, and obstructions;

— Runway conditions, such as pavement texture and grooving, rubber deposits, presence of water, slush, snow, ice, friction coefficient and braking action;

— 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);

— Runway inspection programmes and inspections carried out; and

— 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 (FDR), cockpit voice recorders (CVR), quick access recorders, engine parameter recorders, video recorders, non-volatile memory chips in aircraft systems, and other on-board or ground-based recorders.

1.11.2 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 was 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.

1.11.3 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.

1.11.4 Transcripts from the cockpit voice recordings should 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.

1.11.5 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.”

1.12 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 break up 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 sub-headings in this section, such as structures, power plants, instruments, flight controls and systems. The descriptions under each sub-heading should embrace the significant

facts determined by the group which was responsible for the detailed investigation. Under appropriate sub-headings 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.

1.13 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.

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 emergency locator transmitters.

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:

— first notification of an accident to the emergency services and the response time;

— emergency lighting in the aircraft (installation, activation, functioning and failures);

— communications;

— passenger behaviour and carry-on baggage;

— emergency exits (types of exits and their use);

— evacuation slides (types of slides, activation and their use);

— injuries sustained in the evacuation; and

— 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 is 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.

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:

— operator;

— maintenance organizations;

— air traffic services;

— aerodrome administration;

— meteorological services;

— aircraft manufacturer;

— certification and licensing authority; and

— 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:

— safety culture;

— resources and financial viability;

— management policies and practices;

— internal and external communications; and

— 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

1.18.1 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 is essential to the analysis and conclusions parts of the report.

1.19 Useful or effective investigation techniques

1.19.1 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 accident, should be included under the appropriate Sections 1.1 to 1.18. 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. As well, 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 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 sub-headings for the analysis part will ensure that the investigators know their drafting assignments. Such an outline will also indicate to the investigators how the sub-headings will come together in forming the analysis part of the Final Report. An example of such an outline is provided in Table 1-2.

3. CONCLUSIONS

This part should list the findings and the causes established in the investigation. The conclusions are drawn from the analysis. However, it is essential to maintain the same degree of certainty in a conclusion as was established in the analysis. For example, if the discussion in the analysis indicates that an event or circumstance was likely, then the finding should contain the same qualifier (likely).

3.1 Findings

3.1.1 The findings are statements of all significant conditions, events or circumstances in the accident sequence. The findings are significant steps in the accident sequence, but they are not always causal or indicate deficiencies. Some findings point out the conditions that pre-existed the accident sequence, but they are usually essential to the understanding of the occurrence. The findings should be listed in a logical sequence, usually in a chronological order.

3.1.2 All findings must be supported by and directly related to the factual information and the analysis. No new factual information should be introduced in the findings.

3.1.3 It is customary to report on certain conditions in every investigation, such as the validity of licences, the training and experience of the flight crew members, the airworthiness and maintenance of the aircraft, the loading of the aircraft, and whether there was a pre-impact failure. The following findings are typical of what is usually included:

— The flight crew members were licensed and qualified for the flight in accordance with existing regulations;

— The maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures;

Table 1-2. Example outline for the analysis part

EXAMPLE OF SUB-HEADINGS 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 sub-headings in the analysis part, as follows:

2.1 General

2.2 Flight operations

- 2.2.1 Crew qualifications
- 2.2.2 Operational procedures
- 2.2.3 Weather
- 2.2.4 Air traffic control
- 2.2.5 Communications
- 2.2.6 Aids to navigation
- 2.2.7 Aerodrome

2.3 Aircraft

- 2.3.1 Aircraft maintenance
- 2.3.2 Aircraft performance
- 2.3.3 Mass and balance
- 2.3.4 Aircraft instrumentation
- 2.3.5 Aircraft systems

2.4 Human Factors

- 2.4.1 Psychological and physiological factors affecting the personnel involved

2.5 Survivability

- 2.5.1 Rescue fire service response
- 2.5.2 Analysis of injuries and fatalities
- 2.5.3 Survival aspects

The tentative sub-headings in the analysis part may require adjustments as the investigation progresses, but the list identifies the major areas that should be covered in the analysis. The list is a good starting point as it indicates to the investigators where each drafting assignment for the sub-headings will fit into the analysis part as a whole.

— The mass and centre of gravity of the aircraft were within the prescribed limits; and

— There was no evidence of airframe failure or system malfunction prior to the accident.

3.1.4 Significant events and factors that were investigated in detail, but eliminated in the analysis, should also be stated in the findings. For example, findings such as "flight crew fatigue was not a factor in the accident" and "there was no malfunction of the elevator control system" should be considered when a comprehensive investigation was made into these aspects. Areas of ambiguity should be identified and stated, for example, "the investigation was unable to establish whether the pilot-in-command or the co-pilot was the pilot flying the aircraft at the time of the accident".

3.1.5 Some States present the causes of the accident separately from the findings under their own heading. Other States indicate in the list of findings which of the findings were causes of the accident, for example by adding after such a finding "(causal factor)" or "(contributory factor)".

3.1.6 Examples of frequently used findings in accident reports are listed in Appendix 5 to Chapter 1.

3.2 Causes

3.2.1 Causes are those events which alone, or in combination with others, resulted in injuries or damage. A cause is an act, omission, condition or circumstance which if eliminated or avoided would have prevented the occurrence or would have mitigated the resulting injuries or damage.

3.2.2 The determination of causes should be based on a thorough, impartial and objective analysis of all the available evidence. Any condition, act or circumstance that was a causal factor in the accident should be clearly identified. Seen together, the causes should present a picture of all the reasons *why* the accident occurred. The list of causes should include both the immediate causes and the deeper or systemic causes. No new information should be introduced in the causes. The causes should be presented in a logical order, usually chronological order, bearing in mind that it is essential that all the causes be presented. The causes should be formulated with preventive action in mind and linked to appropriate safety recommendations.

3.2.3 Some States list the causes, usually sequentially as they occurred, without attempting to prioritize the causes. Other States would prioritize the causes by using terms such as primary causes and contributing causes.

3.2.4 When certain of a cause, a definite statement should be used; if reasonably sure of a cause, a qualifying word such as "probable" or "likely" should be used. The causes statement is usually a reiteration of statements made at or near the end of the analysis and in the findings. For example, if the analysis and the findings state that a cause-related event or circumstance was "probable", then the causes statement should contain the same qualifier (probable).

3.2.5 When there is insufficient evidence to establish why an accident occurred, there should be no hesitation in stating that the causes remain undetermined. In many instances, the most likely scenario could be stated provided that a qualifier, such as "likely" or "probable" is included. However, a list of possible causes should not be given.

3.2.6 The causes should be formulated in a way which, as much as practicable, minimizes the implication of blame or liability. Nevertheless, the accident investigation authority should not refrain from reporting a cause merely because blame or liability might be inferred from the statement of that cause. An example of a formulation of the causes is given in Table 1-3.

4. SAFETY RECOMMENDATIONS

4.1 In accordance with Annex 13, the sole objective of the investigation of an accident shall be the prevention of accidents and incidents. Therefore, the determination of appropriate safety recommendations is of utmost importance. The safety recommendations are actions which should prevent other accidents from similar causes or reduce the consequences of such accidents. In order to ensure that appropriate action is taken, each safety recommendation should include a specific addressee. This is usually the appropriate authority of the State which has responsibility for the matters with which the safety recommendation is concerned.

4.2 Annex 13 requires that at any stage of the investigation of an accident, the accident investigation authority of the State conducting the investigation shall recommend to the appropriate authorities, including those in other States, any preventive action that is considered necessary to be taken promptly to enhance aviation safety. The interim safety recommendations made during the

Table 1-3. Example of causal statements

EXAMPLE OF FORMULATION OF CAUSES

One accident — same causes

The causes of this accident were:	**The causes of this accident were:**
• the failure of airport management to identify and correct poor runway drainage;	• the known and uncorrected lack of runway drainage;
• the failure of the air traffic controllers to inform the flight crew that there was standing water on the runway;	• lack of communication between the ATC and the flight crew regarding the degenerated runway condition;
• the flight crew's mismanagement of the aircraft's airspeed; and	• the aircraft crossing the threshold 16 knots above V_{ref}; and
• the flight crew's mismanagement of thrust reversers.	• the late application of reverse thrust.

Note. — The causal statement to the left implicates three groups of persons -— the flight crew, the airport management and the air traffic controllers. Since the formulation of causes should not be blame-setting in nature, the statement on causation should focus on functions that in the example case were not performed at the level required for safe operation. Such a functional statement logically leads to corrective or preventive measures that should be recommended to prevent future accidents.

investigation may be presented in the safety recommendations part of the Final Report. Also, the preventive actions taken in response to the interim recommendations should be presented, as well as any other preventive actions taken by the appropriate authorities and the industry, such as changed operating procedures by the aircraft operator and the issuance of service bulletins by the manufacturer. Some States present the interim safety recommendations and describe the preventive actions taken in the factual information part, Section 1.18, in lieu of including this information in the safety recommendations part. Publishing the preventive actions taken in the Final Report has significant accident prevention value for those involved in similar operations.

4.3 A safety recommendation should describe the safety problem and provide justification for safety actions. An example of a recommendation is given in Table 1-4. Attention should be focussed on the problem rather than the suggested solution. Consideration should be given to whether a safety recommendation should prescribe a specific solution to a problem or whether the recommendation should be flexible enough to allow the addressee latitude in determining how the objective of the recommendation can be achieved. A safety recommendation should identify what actions to take, but leave scope for the authorities responsible for the matters in question to determine how to accomplish the objective of the recommendation. This is particularly important if all the salient facts are not available and additional examination, research and testing appears necessary. In addition, the accident investigation authority may lack the detailed information and experience required to evaluate the financial, operational and policy impacts on the addressee of specific and detailed recommendations.

4.4 During aircraft accident investigations, safety issues are often identified which did not contribute to the accident but which, nevertheless, are safety deficiencies. These safety deficiencies should be addressed in the Final Report. Some States include safety recommendations not related to the causes of the accident in the safety recommendations part of the Final Report. Other States have adopted means other than the Final Report to notify the appropriate authorities of safety deficiencies that are not related to the accident, although the actions taken are usually described in the Final Report.

4.5 In summary, the safety recommendations should include a convincing presentation of the safety problem with the attendant safety risks deriving from it, as well as a recommended course of action for the responsible authority

to take in order to eliminate the unsafe condition. The safety recommendations should identify what action is required, but should leave considerable scope for the implementing authority to determine how the problem will be resolved.

APPENDICES

The appendices should include, as appropriate, any pertinent information considered necessary to understand the report, such as a glossary, supporting technical reports, accident site diagrams, photographs and flight recorder data. Graphics and diagrams should have a professional appearance and should show only the information required for understanding the report. The appendices should be numbered and listed in the table of contents. The following is a list of appendices commonly found in a Final Report:

— communications transcripts;
— flight data recorder readouts;
— flight plan and loadsheet;
— technical investigation reports;
— pertinent pages from manuals and handbooks;
— pertinent maintenance records;
— maps and diagrams; and
— photographs.

Table 1-4. Example of a safety recommendation

EXAMPLE OF THE WORDING OF A SAFETY RECOMMENDATION

Consider the following safety recommendation:

"ICAO should establish a working group to clarify the international Standards and Recommended Practices in Annex 14 regarding the marking of runway centrelines in relation to co-located threshold markings and turn-around areas."

In accordance with the guidance above, the addressee (in this example ICAO) should be given sufficient latitude in determining how to achieve the objective of the recommendation. It should be left to ICAO to determine how the work is to be undertaken, e.g. working group, consultant or panel. A general statement, such as "international requirements" could also be used, thus leaving it to ICAO to determine whether Standards, Recommended Practices and/or guidance material would be appropriate to meet the objective of the recommendation. Based on the foregoing reasoning, the following formulation of the safety recommendation would be preferable:

"The (accident investigation authority) recommends that ICAO re-examine the international requirements in Annex 14 regarding the marking of runway centrelines in relation to co-located threshold markings and turn-around areas."

Appendix 2 to Chapter 1
REPORT WRITING CONVENTIONS

1. GENERAL GUIDELINES

The purpose of writing any report is to convey the facts of the subject of the report to its readers in a succinct, clear, unambiguous and well organized manner. When drafting the Final Report, the writer should not assume that everyone who reads the report is familiar with the technical details. Therefore, information should not be omitted because it is obvious to the writer. The writer should remember that the readers will not have visited the accident site, nor did they participate in the investigation. The writer's responsibility is to present the reader with a word picture of the accident and the investigation. The writer should assume that the reader is intelligent but uninformed and will analyse the facts presented in order to test the conclusions of the Final Report. For example, if it is obvious to the writer that the weather was not a factor in the accident, this should be clearly stated, but nevertheless the reader should be provided with enough weather information to substantiate the conclusion.

2. EDITORIAL STANDARDS

2.1 Convey an attitude of impartiality and write objectively

2.1.1 The report should not favour any party involved with the accident, e.g. the pilot, the operator, the aircraft manufacturer or special interest groups, such as advocates for noise abatement, nor should it reflect prejudice against any party.

2.1.2 The straightforward descriptive narrative which avoids flowery descriptions and human interest items should be used. Clues to the investigator's personality or prejudices should not be apparent to the reader. The indiscriminate use of adjectives and adverbs is usually not acceptable in accident report writing.

2.1.3 The writer should write to express the facts, not to impress the reader. If the Final Report must delve into complicated areas such as aerodynamics, metallurgy, and the operation of aircraft systems, the subject should be explained in a way that it is easy to understand. To maintain the readability of the body of the Final Report, complex subjects may be explained in an appendix to the Final Report.

2.1.4 Subjects of equal importance should be given equal coverage when describing the facts, conditions and circumstances.

2.2 Clarity

2.2.1 The use of an outline, such as that provided in the Appendix to Annex 13, is a commonsense approach to the task of writing the Final Report.

2.2.2 Clarity in report writing can be enhanced by reporting sequentially. The *History of the flight*, for example, should describe the flight in a logical sequence from start to finish. Placing events out of sequence tends to confuse the reader.

2.2.3 Each sentence should be a logical unit. The writer should keep the subject of the sentence and its verb close together. Long asides between the subject and the verb interrupt the flow of the sentence. The information should be organized logically within each section and grouped under an appropriate heading.

2.2.4 The writer should provide the reader with a lead-in and context for new information or ideas by first referring to any related information already presented.

2.2.5 Pronouns, especially "this", "that" and "it" should be placed close to their antecedents to ensure clarity. A pronoun should refer to a specific antecedent rather than an implied antecedent.

2.2.6 Sentences should begin with the real subject of the sentence, rather than with subjects such as "It is..." or "There are...".

2.2.7 The writer should select the words that best describe the situation. Vague terminology should be avoided, for example, "Damage to the aircraft *appeared* to be the result of impact loading" and "It was *presumed* that the aircraft started to cartwheel after striking the left wingtip". Words such as *appeared, seemed* and *presumed*

are not precise enough for the factual part of the report. The investigator must report evidence found and not that which *appeared, seemed*, or was *presumed* to have been.

2.2.8 The findings and statements in the report must be unambiguous and subject to only one interpretation.

2.3 Conciseness

2.3.1 Long sentences might make it difficult for the reader to comprehend the point the writer is trying to make. This does not mean that the report should consist entirely of simple sentences. Long sentences are acceptable if understandable. Any sentence which must be re-read to be understood is too long.

2.3.2 The writer should avoid unnecessary repetition, and extraneous and irrelevant data, which might confuse the reader and may cloud the reader's comprehension of the conclusions.

2.4 Consistency

The writer should verify that the terminology used is consistent throughout the report. The writer should use the same terms for the same things, and should spell, hyphenate and abbreviate words consistently. When using abbreviations, the writer should spell out the words in full followed by the short form in parentheses the first time they are used. Thereafter, the abbreviations should be used. All the abbreviations used should be included in a glossary.

2.5 Gender

Avoid gender stereotyping, such as referring to the investigator-in-charge or an engineer by using the pronoun "he".

3. ACTIVE VS. PASSIVE VOICE

3.1 The choice of voice has a great effect on the force of the narrative. The active voice is more vigorous and less ambiguous than the passive. Use of the passive voice often leads to wordiness, fuzziness and sometimes grammatical errors. In most cases, the active voice is preferable. For example, "When the pilot detected a fuel leak..." is preferable to "When a fuel leak was detected by the pilot...".

3.2 The passive voice is more appropriate in some cases, such as:

— when the agent, or doer of the act, is unknown;
— when a reference to the actor is inappropriate; and
— when the agent is less important than the action, e.g. "The two survivors were rescued...".

3.3 The writer should recognize when each voice is appropriate and not overuse the passive voice.

4. READ AND REVISE

4.1 Revising is a part of writing. Few investigators can express clearly on the first attempt what they intend to convey. One means of improving clarity is through the write – read, re-write – re-read process. The writer should review what he/she has written and check if it needs further clarification, shortening, rearrangement or other changes. Experienced writers find advantage in setting the report aside for a day or more before making a critical review to ensure that it conveys the intended meaning. Soliciting comments from other investigators often pinpoints ambiguous areas of the report in which the writer should make improvements. Comments from other investigators should be accepted as constructive and not as personal criticism.

4.2 The writer should edit the report to ensure that it is logical and consistent. Some of the common traps in drafting a report are:

— Hasty generalization: basing a conclusion on too few instances, e.g. "Three of the ten witnesses agreed that the pilot was flying too low";

— Using absolute words such as "always" or "never": such words are seldom appropriate, e.g. "Mid-air collisions are always the result of pilot inattention";

— Oversimplification: linking two events as if one caused the other when the relationship between them is more complex, e.g. "This practice violated fundamental flying principles";

— Asserted conclusion: drawing conclusions from insufficient data, e.g. "Based on wide experience, the experts concluded that landing accidents are the result of unstable approaches";

— Post hoc fallacy: assuming that because one event follows another, the second event was caused by the first, e.g. “Inexperienced pilots are more susceptible to CFIT accidents”;

— Either/or fallacy: assuming that a complicated question has only two possible answers, e.g. “The choice was to fly the mission in accordance with the company directives or not to fly it at all”;

— *Non sequitur*: drawing a conclusion that bears no logical relation to the facts presented, e.g. “Because of his position as Director of Flight Operations, he was fully qualified to assess the qualifications of his pilots”; and

— False analogy: suggesting that because two things or situations share some similarities, they must be alike in other ways, e.g. “Flying an aircraft at night is no different to flying it during the day in IMC”.

5. TONE OF EXPRESSION

5.1 Blame or liability

5.1.1 Annex 13 states that it is not the purpose of the investigation to apportion blame or liability. Nevertheless, blame or liability might sometimes be inferred from the findings. When such is the case, it is essential that all the causes established be clearly presented in the report. To do otherwise would jeopardize the objective of the investigation which is the prevention of accidents and incidents.

5.1.2 Avoid words or phrases that have connotations of blame. For instance, use the statement “The operator *did not* notify...” rather than “The operator *failed* to notify...”. An investigator should not write from the perspective of a regulator who is concerned about non-compliance with rules and regulations, nor from the perspective of a manager in a company, where determination of support for disciplinary or legal action may be an objective.

5.2 Contravention of regulations and orders

5.2.1 Deviations from the accepted norms of compliance with regulations and procedures should be clearly identified when relevant to the accident. The nature of the regulation and the extent of the deviation should be described in sufficient detail in order to explain the safety implications of the deviation. The analysis should explain the reasons why the deviation created a hazard.

5.2.2 For a contravention to be included as a cause, it should be clear that complying with the regulation or procedure could have prevented the accident or lessened the consequences of the accident.

5.3 Human suffering

The writer must recognize the human suffering that is associated with an accident by using respectful and discreet language in the report. If sensitive information must be reported because it pertains to the causes or safety deficiencies, it should be reported with due sensitivity.

6. COMMONLY USED LANGUAGE

Many accident investigation authorities employ standardized phraseology for the details which are recorded in any Final Report on an accident, such as crew qualifications and aircraft serviceability. Refer to Appendix 5 to Chapter 1 — Commonly used findings.

7. GLOSSARY

A glossary should be appended to the Final Report. Only the abbreviations used in the report should appear in the glossary.

Appendix 3 to Chapter 1
SYMBOLS AND ABBREVIATIONS

1. INTRODUCTION

1.1 This appendix presents a list of symbols and abbreviations which might be used in a Final Report. Note that symbols which are comprised of letters are presented among the abbreviations.

1.2 When compiling a glossary of abbreviations for an accident report, include only those abbreviations used in the report.

2. SYMBOLS

°	Degree (examples °C (temperature) and 1° (angle))
%	Per cent (example 95% fan speed (N_1))
'	Minute
”	Second

3. ABBREVIATIONS

A	
AC	Alternating current Advisory circular
ACARS	Aircraft communications addressing and reporting system
ACAS	Airborne collision avoidance system
ACC	Area control centre
AD	Airworthiness Directive
ADF	Automatic direction-finder
ADI	Attitude direction indicator
ADIZ	Air defence identification zone
ADS	Automatic dependent surveillance
AFCS	Automatic flight control system
AFIS	Aerodrome flight information service
AFTN	Aeronautical fixed telecommunication network
AGL	Above ground level
AIC	Aeronautical information circular
AIP	Aeronautical Information Publication
AIREP	Air-report
AMSL	Above mean sea level
ANO	Air navigation order
AOA	Angle of attack
AOC	Air Operator Certificate
AOM	Aircraft Operating Manual
APP	Approach control office Approach control Approach control service
APU	Auxiliary power-unit
ARTCC	Air route traffic control centre
ASI	Airspeed indicator
ASR	Airport surveillance radar
ATC	Air traffic control
ATCC	Air traffic control centre
ATFM	Air traffic flow management
ATIS	Automatic terminal information service
ATPL	Airline Transport Pilot Licence
ATS	Air traffic services
AVASIS	Abbreviated visual approach slope indicator system
B	
C	
C	Degrees Celsius (Centigrade) Centre (runway identification)
CAA	Civil aviation authority Civil aviation administration
CADC	Central air data computer
CAM	Cockpit area microphone
CAS	Calibrated airspeed
CAT	Clear air turbulence Category
CAVOK	Visibility, cloud and present weather better than prescribed values and conditions (cloud and visibility OK)
CFIT	Controlled flight into terrain
CG	Centre-of-gravity
cm	Centimetre(s)
C of A	Certificate of airworthiness
CPL	Commercial Pilot Licence
CRM	Crew resource management
CRT	Cathode-ray tube
CTA	Control area
CVR	Cockpit voice recorder

D

DA	Decision altitude
DA/H	Decision altitude/height
DC	Direct current
DFDR	Digital flight data recorder
DH	Decision height
DME	Distance measuring equipment

E

E	East Eastern longitude
EAS	Equivalent airspeed
ECAM	Electronic centralized aircraft monitor
EICAS	Engine indication and crew alerting system
EFIS	Electronic flight instrument system
EGPWS	Enhanced ground proximity warning system
EGT	Exhaust gas temperature
ELT	Emergency locator transmitter
EMI	Electromagnetic interference
EPR	Engine pressure ratio
ETA	Estimated time of arrival Estimating arrival
ETD	Estimated time of departure Estimating departure

F

FAF	Final approach fix
FAP	Final approach point
FAR	Federal Aviation Regulations
FCOM	Flight Crew Operating Manual
FD	Flight director
FDAU	Flight data acquisition unit
FDM	Flight deck management
FDR	Flight data recorder
FIR	Flight information region
FIS	Flight information service
FL	Flight level
FMC	Flight management computer
FMS	Flight management system
FOD	Foreign object damage (also the object)
FSS	Flight service station
ft	Foot (feet)
ft/min	Feet per minute

G

g	Normal acceleration
GNSS	Global navigation satellite system
GPS	Global positioning system
GPWS	Ground proximity warning system

H

h	Hour(s)
HF	High frequency (3 000 to 30 000 kHz)
Hg	Mercury
hPa	Hectopascal
HSI	Horizontal situation indicator
HUD	Head-up display
Hz	Hertz (cycle per second)

I

IAF	Initial approach fix
IAS	Indicated airspeed
IFR	Instrument flight rules
IIC	Investigator-in-charge
ILS	Instrument landing system
IMC	Instrument meteorological conditions
INS	Inertial navigation system
IRS	Inertial reference system
ISA	International standard atmosphere

J

JAR	Joint Aviation Requirements

K

kg	Kilogram(s)
kHz	Kilohertz
km	Kilometre(s)
km/h	Kilometres per hour
kN	Kilonewton
kt	Knot(s)

L

L	Litre(s) Left (runway identification)
LDA	Landing distance available
LED	Light emitting diode
LF	Low frequency (30 to 300 kHz)
LLWS	Low-level wind shear
LOFT	Line-oriented flight training
LORAN	Long range air navigation system

M

m	Metre(s)
M	Mach number

MAC	Mean aerodynamic cord
MDA	Minimum descent altitude
MDA/H	Minimum descent altitude/height
MDH	Minimum descent height
MEL	Minimum equipment list
MET	Meteorological Meteorology Meteorological services
MHz	Megahertz
min	Minute(s)
MLS	Microwave landing system
mm	Millimetre(s)
MMEL	Master minimum equipment list
MOC	Minimum obstacle clearance (required)
MOPS	Minimum operational performance standards
MSA	Minimum sector altitude
MSL	Mean sea level
mu	Coefficient of sliding friction

N

N	North Northern latitude Newton
N_1	Engine fan speed (high pressure turbine speed)
N_2	Engine compressor speed
NDB	Non-directional radio beacon
NDT	Non-destructive testing
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)
NM	Nautical mile(s)

O

OAT	Outside air temperature
OCA	Obstacle clearance altitude
OCH	Obstacle clearance height
OCL	Obstacle clearance limit
OCS	Obstacle clearance surface
OPS	Operations

P

PA	Public address system
PANS	Procedures for Air Navigation Services
PAPI	Precision approach path indicator
PAR	Precision approach radar
PCU	Power control unit
PIC	Pilot-in-command
PIREP	Pilot report
P/N	Part number

Q

QA	Quality assurance
QAR	Quick access recorder
QFE	Atmospheric pressure at aerodrome elevation (or at runway threshold) (pressure setting to indicate height above aerodrome)
QNH	Altimeter sub-scale setting to obtain elevation when on the ground (pressure setting to indicate elevation above mean sea level)

R

RA	Radio altimeter Resolution advisory
RCC	Rescue coordination centre
RESA	Runway end safety area
RF	Radio frequency
RFFS	Rescue and fire fighting service
RMI	Radiomagnetic indicator
RNAV	Area navigation
RPM	Revolutions per minute
RTF	Radiotelephony
RVR	Runway visual range

S

s	Second(s)
S	South Southern latitude
SAR	Search and rescue
SAS	Stability augmentation system
SB	Service Bulletin
SCAS	Stability and control augmentation system
SDR	Service difficulty report
SEM	Scanning electron microscope
SI	International system of units
SID	Standard instrument departure
SIGMET	Significant meteorological information (information concerning specified en-route weather phenomena which may affect the safety of aircraft operations)
SL	Service Letter

SMC	Surface movement control
SMR	Surface movement radar
S/N	Serial number
SPECI	Aviation selected special weather report
SRA	Surveillance radar approach
SSR	Secondary surveillance radar
STAR	Standard instrument arrival
STOL	Short take-off and landing
SVR	Slant visual range

T

t	Tonne
TAF	Terminal aerodrome forecast
TAR	Terminal area surveillance radar
TAS	True airspeed
TAWS	Terrain awareness and warning system
TCAS	Traffic alert and collision avoidance system
TCH	Threshold crossing height
TDP	Take-off decision point
TDZ	Touchdown zone
TMA	Terminal control area
TODA	Take-off distance available
TORA	Take-off run available
TRACON	Terminal radar approach control
TWR	Aerodrome control tower Aerodrome control

U

UAC	Upper area control centre
UAR	Upper air route
UHF	Ultra-high frequency (300 to 3 000 MHz)
ULB	Underwater locator beacon
UTC	Coordinated Universal Time

V

VASIS	Visual approach slope indicator system
VFR	Visual flight rules
VHF	Very high frequency (30 to 300 MHz)
VMC	Visual meteorological conditions
VOR	VHF omnidirectional radio range
VSI	Vertical speed indicator
VTOL	Vertical take-off and landing

V SPEEDS

V_1	Decision speed
V_2	Take-off safety speed
V_{MCA}	Minimum control speed in the air
V_{MCL}	Minimum control speed during landing approach with all engines operating
V_{MO}/M_{MO}	Maximum permissible operating speed or maximum permissible operating Mach number
V_{NE}	Never exceed airspeed
V_R	Rotation speed
V_{REF}	Reference landing approach speed, all engines operating
V_S	Minimum calibrated speed in flight during normal stall manoeuvre
V_{S1}	Stalling speed (“clean” configuration)

W

W	West Western longitude

X

Y

Z

Appendix 4 to Chapter 1
AVIATION TERMINOLOGY

INTRODUCTION

This appendix comprises two sections. The first section is titled Descriptive Technical Terms and lists technical terms which have a specific meaning and an explanatory definition. The second section presents some commonly used Human Factors Terms.

1. DESCRIPTIVE TECHNICAL TERMS

Arcing. Visible effects (burn spots, fused metal) of an electrical discharge between two electrical connections. Also: flash over.

Battered. Damaged by repeated blows or impacts.

Bent. Deviated from original line or plane usually caused by lateral force. Also: creased, folded, kinked.

Binding. Restricting movement, such as tightened or sticking condition, may result from high or low temperature or a foreign object jammed in mechanism. Also: sticking, tight.

Bowed. Curved or gradually deviated from original line or plane often caused by lateral force or heat.

Brinelling. Circular surface indenting of bearing races, usually caused by repeated shock loading of the bearing. False brinelling is wear caused by bearing rollers sliding back and forth across a stationary race, while true brinelling is plastic displacement of material.

Broken. Separated by force into two or more pieces. Also: fractured.

Bulged. Swollen outward locally. Usually caused by excessive local heating or differential pressure. Also: ballooned, swelling.

Burned. Oxidized destructively. Usually caused by higher temperature than the parent material can withstand.

Burrs. A rough edge or a sharp projection on the edge or surface of the parent material.

Carboned. Covered by an accumulation of carbon deposits. Also: carbon-covered, carbon-tracked, coked.

Chaffed. Worn by frictional damage. Usually caused by two parts rubbing together with limited motion.

Checked. Cracked on the surface. Usually caused by heat.

Chipped. Broken away at the edge, corner or surface of the parent material. Usually caused by heavy impact; not flaking.

Collapsed. Inwardly deformed original contour of a part. Usually due to high pressure differentials.

Corroded. Gradually destroyed by chemical action. Often evidenced by oxide build-up on the surface of the parent material. Also: rusted, oxidized.

Crack. Visible partial separation of material.

Crossed. Damaged parent material of parts due to improper assembly (as in the case of crossed threads) or parts rendered inoperative (as in the case of crossed wires).

Curl. A condition where the tip(s) of compressor or turbine blades have been curled over due to rubbing against engine casings.

Dented. Damage by impact of a foreign object resulting in a surface indentation with rounded bottom. Parent material is displaced, but seldom separated. Also: peened.

Deposits. A build-up of material on a part either from foreign material or from another part not in direct contact. Also: metalizing.

Disintegrated. Separated or decomposed into fragments. Excessive degree of fracturing (breaking) as with disintegrated bearings. Complete loss of original form. Also: shattered.

Distortion. Extensive deformation of the original contour of a part usually due to impact of a foreign object, structural stress, excessive localized heating or any combination of these. Also: buckled, depressed, twisted, warped.

Eccentricity. Part(s) wherein the intended common center is displaced. Also: non-concentric.

Electrical circuits — grounded. Circuits in which the current has a path to ground.

Electrical circuits — open. Incomplete electrical circuit due to separation at or between electrical connections.

Electrical circuits — shorted. Circuits in which the current has an undesired path between leads or circuits that are normally at different electrical potentials.

Eroded. Component from which material has been carried away by flow of fluids or gases; may be accelerated by heat or grit.

Fatigue. The progressive failure of a part under repeated loading.

Flattened out. Permanent loss of curvature beyond tolerance limits. Usually caused by compression.

Frayed. Worn into shreds by rubbing action.

Fretting. Removal of material by rubbing.

Fusing. Joining together of two materials. Usually caused by heat, friction or electrical current flow.

Galling. Chafing or severe fretting caused by relative movement of two surfaces under high contact pressure.

Glazing. Undesirable development of a hard, glossy surface due to rubbing action, heat or varnish.

Gouging. Scooping out of material usually caused by a foreign object. Also: furrowed.

Groove(s). Smooth, rounded furrow or furrows of wear, usually wider than scoring, with rounded corners and a smooth groove bottom.

Hot-spot. Result of subjection to excessive temperature usually evidenced by change in colour and appearance of part. Also: heat discoloured, overheated.

Melted. Deformed from the original configuration due to heat, friction or pressure.

Mis-match. Improper association of two or more parts.

Mis-positioned. Improperly installed part which may damage the installed part or two associated parts. Also: mis-aligned, reversed.

Nick. A sharp surface indentation caused by impact of a foreign object. Parent material is displaced, seldom separated.

Out-of-round. Part with inconsistent diameter.

Out-of-square. Part with deformation of right angle relationship between part surfaces.

Peeling. A breaking away of surface finishes such as coatings and plating. Peeling would be flaking of large pieces. A blistered condition usually precedes or accompanies peeling. Also: blistered, flaked.

Pick-up. A transfer of metal from one surface to another. Usually the result of rubbing two surfaces together without sufficient lubrication.

Pit. A small irregular shaped cavity in the surface of the parent material usually caused by corrosion, chipping or electrical discharge.

Plugged. Totally or partially blocked pipe, hoses, tubing, channelling or internal passages. Also: clogged, obstructed, restricted.

Porous. State of material caused by internal voids. Usually applied to cast material or welds.

Rolling-over. Lipping or rounding of a metal edge. Also: lipped, turned.

Rubbed. Moved with pressure or friction against another part.

Rupturing. Excessive breaking apart of material usually caused by high stresses, differential pressure, locally applied force or any combination of these. Also: blown, burst, split.

Score(s). A deep scratch or scratches made by sharp edges of foreign matter.

Scratches. Light narrow, shallow mark or marks caused by movement of a sharp object or particle across a surface. Material is displaced, not removed.

Seized. Parts bound together. May be due to expansion or contraction due to high or low temperature, foreign object jammed in mechanism or lack of lubricant. Also: frozen, jammed, stuck.

Sheared. Body divided by cutting action. Also: cut.

Spalled. Sharply roughened area characterized by progressive chipping-away of surface material. Not to be confused with flaking.

Stretching. Enlargement of a part. May result from exposure to operating conditions or excessive force. Also: growth.

Stripping. A condition usually associated with fastener threads or electrical insulation. Involves removal of material by force.

Torn. Separated by pulling apart.

Worn. Consumption of material of a part as a result of use.

2. HUMAN FACTORS TERMS

This section presents a selection of Human Factors terms which are likely to be encountered when writing the Final Report on an accident. Knowledge of these terms will facilitate the identification and formulation of the Human Factors aspects which were present in the accident.

HUMAN FACTORS

Acute fatigue. The result of excessive physical and/or mental activity during a short period. A temporary condition that may be reversed by adequate rest.

Channelized attention. A mental state which exists when a person's full attention is focused on one stimulus to the exclusion of all others. This becomes a problem when the person fails to perform a task or process information of a higher priority and thus fails to notice or has no time to respond to cues requiring immediate attention.

Chronic fatigue. The result of long exposure to successive periods of acute fatigue, over many days or weeks, without adequate rest periods for recovery.

Cockpit authority gradient. The relative skills and experience in a particular environment that are factors in determining the extent of the pilot's authority.

Cognitive saturation. The information to be processed exceeds an individual's span of attention.

Complacency. A state of reduced conscious attention caused by a sense of security and self-confidence. Behaviour characteristics of complacency include overconfidence and boredom, both of which can significantly degrade performance.

Confirmation bias. An expectation of an event may diminish an individual's ability to recognize evidence that events are not developing as anticipated.

Distraction. The interruption and redirection of attention by environmental cues or mental processes.

Fascination. An attention anomaly in which a person observes environmental cues, but fails to respond to them.

Fatigue. The progressive decrease in performance due to prolonged or extreme mental or physical activity, sleep deprivation, disrupted diurnal cycles, or life event stress.

Habit pattern interference. Behaviour in which the subject reverts to previously learned response patterns which are inappropriate to the task at hand.

Illusion. An erroneous perception of reality due to limitations of sensory receptors and/or the manner in which the information is presented or interpreted.

Inattention. Inattention is usually due to a sense of security, self-confidence or perceived absence of threat. Boredom is a form of inattention due to an uninteresting and undemanding environment. Complacency is another form due to an attitude of overconfidence, laxity or lack of motivation.

Pressure. A type of stress resulting from the demands of management, peers, self-induced goals, time, environmental factors or man-machine relationship.

Situational awareness. The ability to keep track of the prioritized significant events and conditions in the environment of the subject.

Spatial disorientation. Unrecognized, incorrect orientation in space.

Stress. Mental or physical demand requiring some action or adjustment.

Vigilance. Maintenance of the appropriate level of conscious attention for the assigned task. Lapses in attention may occur after a person has been at a monitoring task for a period of time.

Appendix 5 to Chapter 1
COMMONLY USED FINDINGS

The following findings might be used in aviation accident reports and are presented here as examples only. The investigator-in-charge must ensure that each finding in an accident report is pertinent, valid and in the proper context.

1. AIRCRAFT

— The aircraft was certified, equipped and maintained in accordance with existing regulations and approved procedures.

— The aircraft had a valid Certificate of Airworthiness and had been maintained in compliance with the regulations.

— The maintenance records indicated that the aircraft was equipped and maintained in accordance with existing regulations and approved procedures.

— The aircraft was airworthy when dispatched for the flight.

— The mass and the centre of gravity of the aircraft were within the prescribed limits.

— There was no evidence of any defect or malfunction in the aircraft that could have contributed to the accident.

— There was no evidence of airframe failure or system malfunction prior to the accident.

— The aircraft was structurally intact prior to impact.

— All control surfaces were accounted for, and all damage to the aircraft was attributable to the severe impact forces.

— The aircraft was destroyed by impact forces and a post-impact fire.

— Due to the destruction of the aircraft by the impact and fire, it could not be determined whether any pre-impact failure or system malfunction contributed to this accident.

— The destruction of the aircraft by impact and fire precluded determination of any material failure or system malfunction.

— The position of the fuel selectors could not be determined due to the extensive fire damage.

— The fuel sampled was of the proper grade and quality, and contained no contamination.

— The fuel that remained in the aircraft fuel tanks was uncontaminated and of the recommended grade.

— The engine(s) stopped from fuel exhaustion (no usable fuel on board).

— The engine(s) stopped from fuel starvation (usable fuel on board).

— The intercom system, flight deck lighting and other standby electrical services failed some four minutes before impact as a result of a rapid decay in battery power for which no explanation was found.

— The obsolescent design of the aircraft's primary flight instruments and radio navigation systems contributed to the loss of situational awareness of the crew at a time of high crew workload.

— The worn condition of the left tire reduced braking effectiveness in the wet runway conditions.

— Propeller blade damage and twist was consistent with the engine producing power at impact.

— The propeller(s) exhibited chord-wise scratching and torsional damage indicative of the engine producing power at impact.

2. CREW/PILOT

— The flight crew/pilot/co-pilot was licensed and qualified for the flight in accordance with existing regulations.

— The flight crew/pilot/co-pilot was properly licensed, medically fit and adequately rested to operate the flight.

— The flight crew/pilot/co-pilot was in compliance with the flight and duty time regulations.

— Although the aircraft was equipped for instrument flight, the pilot was not qualified for IFR flight.

— The pilot's degraded performance was consistent with the effects of fatigue, but there was insufficient evidence to determine if the pilot's degraded performance contributed to the accident.

— Although the pre-flight rest period was adequate and the flight duty time was within the company flight time limitations, the two-hour turnaround in the middle of the night may have reduced the alertness levels of the two pilots.

— The pilot's actions and statements indicated that his/her knowledge and understanding of the aircraft systems was adequate/inadequate.

3. FLIGHT OPERATIONS

— The flight was conducted in accordance with the procedures in the company Operations Manual.

— The flight crew carried out normal radio communications with the relevant ATC units.

— The pilot attempted to continue visual flight in instrument meteorological conditions.

— There was insufficient height available to effect a recovery from the stall.

— During (phase of flight), the aircraft began an uncommanded turn to the right/left.

— During flare for touchdown, the pilot lost control of the aircraft in a strong gust of wind.

— The aircraft was fitted with a radio altimeter, but the operator's procedures did not require reference to it during non-precision approaches.

— The wind conditions in which the pilot landed the aircraft were outside the limits detailed in the Flight Manual and the Operations Manual.

— Braking performance analysis indicated that, in the conditions existing at the time of the accident, the aircraft could not have stopped on the runway available.

— The incorrect handling of the airframe de-icing system resulted in a considerable accretion of ice or snow during the descent.

— The continuation of the landing with the airspeed above the calculated threshold speed resulted in touchdown beyond the normal touchdown point.

— The pilot made an early decision to divert towards a suitable aerodrome while attempting to determine the extent of the emergency.

4. OPERATOR

— The presentation of the operator's Emergency Checklist was inadequate for use under conditions of stress.

— The Standard Operating Procedure for the non-handling pilot to monitor the progress of the approach was not effective in preventing the pilot flying the aircraft from descending below the published approach profile.

— The operator's Quality Assurance system had not identified frequent deviations from the requirements of the Aircraft Maintenance Manual over a considerable period of time.

— The Crew Resource Management training arranged by the operator did not promote good flight deck communication.

5. AIR TRAFFIC SERVICES AND AIRPORT FACILITIES

— The approach/approach radar controllers were properly licensed, medically fit and correctly rated to provide the service.

— The number of air traffic controllers on duty in the tower was (not) in accordance with the regulations.

— The air traffic controller's workload was assessed as low/moderate/high with normal complexity.

— The air traffic controller gave conflicting clearances to the two aircraft.

— The air traffic controller issued a clearance to ... (flt #) which caused a loss of separation to another aircraft (flt #).

— The air traffic controller requested (flt #) to (turn, climb, descend) immediately to avoid traffic.

— ATC provided prompt and effective assistance to the flight crew.

— Use of incorrect RT terminology by the flight crew when declaring the emergency negated an effective response from ATC.

— All aerodrome approach aids and lighting facilities were operating normally at the time of the accident.

— The airport was not equipped with a facility to record the Secondary Surveillance Radar. The lack of data significantly impaired the reconstruction of the aircraft's descent profiles, given the limited information available from the FDR fitted to the aircraft.

6. FLIGHT RECORDERS

— The aircraft was not equipped with a flight data recorder (FDR) or a cockpit voice recorder (CVR); neither was required by regulation.

— The 30-minute closed loop cockpit voice recorder tape was of inadequate duration to be helpful in the investigation of this accident.

— The lack of a CVR recording covering the period of the incident prevented some details of the events from being resolved.

7. MEDICAL

— There was no evidence that incapacitation or physiological factors affected the flight crew performance.

— There was no evidence that the pilot suffered any sudden illness or incapacity which might have affected his/her ability to control the aircraft.

— Toxicological tests for common drugs/ carbon monoxide/ hydrogen cyanide were negative/ positive.

— Based on the autopsy, toxicology, and medical reports, there was no evidence to indicate that the pilot's performance was degraded by physiological factors.

— A post-mortem examination of the pilot showed that the cause of death was a coronary atherosclerosis/hypertensive heart disease. Toxicological results were negative for carbon monoxide, cyanide, volatiles and tested drugs.

— The flight crew was diagnosed as suffering from carbon monoxide (CO) exposure.

— A toxicology report revealed 0.180 per cent alcohol in the pilot's blood. The specimen was taken one hour and 12 minutes after the accident.

8. SURVIVABILITY

— The accident was not survivable due to the magnitude of the deceleration forces and the severity of the post-impact fire.

— The occupants succumbed to the effects of the post-impact fire.

— Although a shoulder harness was available, the pilot did not wear it.

— The fatal injuries sustained by the occupants might have been prevented had they worn shoulder harnesses.

9. SAFETY OVERSIGHT

— The civil aviation authority's safety oversight of the operator's procedures and operations was adequate/ inadequate.

— The civil aviation authority's safety oversight programme had not addressed the subject of the diverse nature of the operator's fleet of aircraft, in

terms of the primary flight instruments, navigation equipment, flight deck layout and its suitability for public transport operations.

— The safety oversight programme conducted by the civil aviation authority on this operator had identified deficiencies in the Crew Resource Management aspects of the company's operations. However, the oversight programme was ineffective in producing sufficient and timely improvement.

— The civil aviation authority's monitoring system had been ineffective in identifying and making the operator correct the procedural lapses.

Chapter 2

THE ACCIDENT/INCIDENT DATA REPORTING (ADREP) SYSTEM

2.1 REPORTS

2.1.1 In accordance with Annex 13, States report to ICAO information on all aircraft accidents which involve aircraft of a maximum certificated take-off mass of over 2 250 kg. ICAO also gathers information on aircraft incidents considered important for safety and accident prevention. Thorough accident and incident investigations identify safety issues in the aviation system, both at the airline level and at the national level. However, it is sometimes difficult to differentiate between isolated manifestations of a problem and systemic unsafe conditions with a potential for loss of life or property damage. Such safety issues must be validated; in part, this is done by comparing the accident and incident experience in question with the broader experience of the airline, the State and other States. This type of comparative analysis requires reliable and complete data. The Accident/Incident Data Reporting (ADREP) System operated by ICAO provides States with the data that will assist them in validating safety issues. Based on this validation process with its attendant assessment of risk, accident investigation authorities can offer meaningful recommendations for correcting unsafe conditions in the aviation system.

2.1.2 Detailed information concerning the reporting of accidents and incidents to the ADREP system is contained in the ICAO *Accident/Incident Data Reporting (ADREP) Manual* (Doc 9156).

2.2 ADREP INFORMATION AVAILABLE TO STATES

2.2.1 When ADREP reports are received from States, the information is checked and stored in a computer. The stored reports constitute a database of worldwide occurrences in order to provide States with the following services:

a) a bi-monthly summary of reports received, containing information on occurrences which have been reported to ICAO during the preceding two-month period, and providing States with up-to-date information on significant occurrences on a worldwide basis;

b) annual ADREP statistics, presenting statistical information under broad categories, such as the types of events which took place and the phases of operation in which they occurred;

c) replies to States' requests for specific information. States requesting information for specific safety problems should forward to ICAO a request for information outlining the problem under study. Replies may be sent using e-mail, facsimile, courier or mail depending on the urgency of the request and the amount of data to be sent; and

d) a record for individual States. ICAO may provide any State, upon its request, with the complete record of accidents and incidents reported by that State to ICAO, and thus serve as an occurrence database for those States which wish to take advantage of this service.

2.2.2 The ICAO ADREP database of accident and incident information is used to provide States with flight safety information. States' administrations are encouraged to request ADREP information from ICAO in order to assist them in their accident or incident investigation and prevention efforts. For example, if it is suspected in an investigation that a specific malfunction or failure has occurred, information on similar occurrences may be helpful in the investigation. ADREP information is also used by States for accident prevention studies, including those prompted by operators, manufacturers and safety organizations. Printouts are provided by ICAO with the understanding that the ADREP information will be used for accident prevention only.

2.2.3 In 2003, the ADREP database contained 28 000 reports, of which 18 000 were Accident/Incident Data Reports. Fifty-one per cent (51%) of the reports concerned airline operations and forty-nine per cent (49%) were general aviation. Seventy-five per cent (75%) were accidents and twenty-five per cent (25%) were incidents.

2.3 DATA VALIDITY

2.3.1 The validity of the safety information which ICAO provides to States depends on the detail and care with which accidents and incidents have been investigated and reported to ICAO. Thus, it is in the interest of all States to accurately report all investigated occurrences in accordance with Annex 13. Only then can ICAO provide valid and complete information required for accident prevention.

2.4 PRELIMINARY REPORT (ADREP FORM P)

2.4.1 Basic factual and circumstantial information on an accident is usually available within the first two to four weeks of the investigation. The Preliminary Report form is a simple and standard method for reporting such preliminary information. In accordance with Annex 13, when the aircraft involved in an accident is of a maximum mass of over 2 250 kg, the Preliminary Report shall be sent by the State conducting the investigation to:

a) the State of Registry or the State of Occurrence, as appropriate;

b) the State of the Operator;

c) the State of Design;

d) the State of Manufacture;

e) any State which provided relevant information, significant facilities or experts; and

f) ICAO.

2.4.2 When the aircraft involved in an accident is of a maximum mass of 2 250 kg or less, and when airworthiness or matters considered to be of interest to other States are involved, the State conducting the investigation should forward the Preliminary Report to the same States as above, but excluding ICAO.

2.4.3 The Preliminary Report shall be sent by airmail within thirty days of the date of the accident unless the Accident/Incident Data Report has been sent by that time. When matters directly affecting safety are involved, it shall be sent as soon as the information is available and by the most suitable and quickest means available.

2.4.4 An example of a completed Preliminary Report (ADREP Form P) can be found in Doc 9156.

2.5 ACCIDENT DATA REPORT (ADREP FORM D)

2.5.1 When the investigation has been completed and the Final Report has been released, the Accident Data Report is to be compiled. The purpose of the Accident Data Report is to provide a standard method for reporting accurate and complete information on an accident, including factors (causes) and safety recommendations. In accordance with Annex 13, the Accident Data Report is to be sent to ICAO by the State conducting the investigation of an accident involving an aircraft of a maximum mass of over 2 250 kg.

2.5.2 If, at the end of the investigation, it is established that some of the data in the Preliminary Report was not correct or was incomplete, this should be reflected in the Accident Data Report. When ICAO receives the Accident Data Report, the Preliminary Report information will be updated. Similarly, if a State re-opens an investigation, the information previously reported should be amended by a new report.

2.5.3 If an accident investigation has been completed and the Accident Data Report can be compiled within thirty days of the date of the accident, the State conducting the investigation should send an Accident Data Report to ICAO, instead of a Preliminary Report. In such cases, this State should also send the Data Report to the States which normally would have received the Preliminary Report.

2.6 INCIDENT DATA REPORT (ADREP FORM D)

2.6.1 Accident investigations have frequently brought to light previous incidents which were dismissed as

insignificant at the time of their occurrence. The knowledge acquired in retrospect from the accident investigations has demonstrated that these incidents, if properly investigated, could have provided the basis for remedial action, which might have prevented the accident. Therefore, it is highly desirable that incidents be investigated and the reports be given the same worldwide release as accident reports.

2.6.2 In accordance with Annex 13, if a State conducts an investigation into an incident to an aircraft of a maximum mass of over 5 700 kg, that State shall send, as soon as is practicable after the investigation, the Incident Data Report to ICAO.

2.6.3 If a State has found an incident significant enough to carry out an investigation, it is likely that safety matters are involved and it is therefore important that ICAO receive the relevant information. The types of incidents which are of main interest to ICAO for accident prevention studies are listed in an Attachment to Annex 13.

2.6.4 An example of a completed Accident/Incident Data Report (ADREP Form D) can be found in Doc 9156.

2.6.5 Copies of the Preliminary Report and the Accident/Incident Data Report shall be sent to ICAO, addressed as indicated in Chapter 1, 1.8.

2.7 CONSTRAINTS ON INCIDENT DATA REPORTS

2.7.1 Considering the sensitivity related to the dissemination of incident information, the following constraints are placed upon the use of incident data by ICAO:

a) ICAO will use incident information for the purpose of accident prevention only;

b) when ICAO conducts analyses based on incident information, it will be identified as such; and

c) ICAO will de-identify incident reports before their dissemination, by deletion of the State of Registry, the nationality and registration marks, and the name of the owner and operator.

— END —

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