Guidance on the Preparation For Investigations in Extreme and Challenging Environments

Aircraft Accident and Incident Investigation Expert Group
European Civil Aviation Conference

November 2015

FOREWORD

BY THE CHAIRMAN OF THE AIRCRAFT ACCIDENT AND INCIDENT INVESTIGATION EXPERT GROUP OF THE EUROPEAN CIVIL AVIATION CONFERENCE

JURGEN WHYTE
HEAD OF THE IRISH AIR ACCIDENT INVESTIGATION UNIT (AAIU)

On behalf of the European Civil Aviation Conference (ECAC) Aircraft Accident and Incident Investigation Expert Group (ACC), it is an honour and a privilege as Chairman of the Group to present to you our "Guidance on the Preparation for Investigations in Extreme and Challenging Environments".

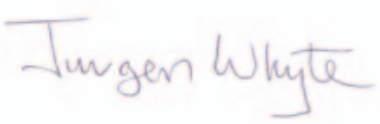
The genesis of this particular project was based on the fact that for many investigators the majority of their investigative work is carried out within their own country and as such they are normally very familiar and comfortable with the day-to-day working environments and challenges of a home investigation. However, many investigators are also tasked to travel to foreign States as an Accredited Representative, Advisor and/or Expert, to support and assist the State of Occurrence and in some specific cases travelling investigators may have to conduct or lead the investigation itself.

Many countries around the world can present unfamiliar situations and environments that will significantly challenge a visiting investigator. Unfamiliar situations could relate to cultural, social, economic, political, judicial, religious and conflict issues, while the physical location and working environment itself could offer extremes of cold and heat, desert, jungle, mountain and high altitude, to name a few. Such situations and environments may never have been previously encountered or experienced by the investigator and thus possible risks exist with regard to the safety and well-being of the individual concerned. In that regard, it was considered appropriate to provide guidance material on the subject matter.

In May of 2014, the ECAC Secretariat, with generous support from the Swiss Accident Investigation Board (SAIB), organised a workshop in Lucerne, Switzerland on "Investigations in Extreme and Challenging Environments". The workshop brought together an assembled group of over 80 safety investigation professionals who, over two days, heard detailed accounts from investigators who had first-hand experiences of working in such extreme and challenging environments.

The ECAC ACC is immensely grateful to all who organised, participated in and supported the Lucerne workshop and to those who contributed subsequently to the development and finalisation of this guidance. Many thanks to the Swiss Accident Investigation Board (SAIB) for hosting the event, to our presenters from the safety investigation authorities of Canada, Brazil, France, Italy, Singapore, Sweden, Switzerland, United Kingdom, USA and ICAO, and to our industry colleagues from Airbus and Agusta Westland, all of whom gave their time and expertise unsparingly. A special thank you to Sid Hawkins of the UK AAIB, Emmanuel Delbarre and Philippe Plantin de Hugues of the French BEA, Patricia Felden, John van Lieshout and Monique Inizan of the ECAC Secretariat and Gabrielle Hubler, ECAC Communications Officer, for their commitment and hard work in bringing this guidance to the finished product.

This guidance draws upon the extensive experience of accident investigators from around the world, so I do hope that as an 'Aide Memoire' to the investigation community, it will assist you in understanding, preparing and managing the many risks posed to investigators when conducting investigations in challenging circumstances and extreme environments.



CONTENTS

INTRODUCTION

The investigation of aviation accidents and incidents is an important element of an aviation safety regime. ECAC has dedicated the Aircraft Accident and Incident Investigation Expert Group (ACC) to that purpose and this Group is made up of the Heads of Accident Investigation Authorities from the 44 ECAC Member States, in addition to many Observers. The Group serves as a think-tank for its European members, and contributes to the thinking behind initiatives planned at the European and international level. A key focus of its activities is the exchange of experience in methods of investigation and on the difficulties sometimes encountered.

Any accident investigation has its common hazards, not least due to the factors that investigators face when dealing with grief, fatigue, and the pressure to determine the causes of accidents. Air accident investigation teams can also experience hazards that are highly individual in nature, and which may generate significant risks for the investigation team. One particular category of hazard is the accident location itself, where the risks to the personal safety and security of the investigation team can at times be both complex and extreme. Such accident locations are highly variable, with investigators having to be prepared to travel to areas that are naturally challenging – such as jungle, desert, mountainous terrain, isolated locations and in conditions of severe heat, humidity or extreme cold.

Accidents in urban locations also present a significant range of hazards for investigation teams. These are generally less naturally extreme, but often pose complex social and operational challenges during the field phase of an investigation.

This document draws upon the personal experience of accident investigators to help the investigation community understand and manage the risks posed by challenging and extreme environments. The guidance is set out in two sections:

SECTION 1: Planning and preparation, proposes a variety of measures that are not specific to any particular hazardous location, but which if adopted, can assist in preparing investigators for their task in all challenging environments.

SECTION 2: Challenging and extreme environments, proposes measures that can be adopted when deploying to specific locations, to enable investigators to prepare and respond to the hazards posed by these environments.

SECTION 1: Planning and preparation

1.1. Introduction

There are a range of measures that can be used to ensure that investigations in challenging and extreme environments are both safe and effective. Investigators have found from experience that the following measures are worth considering when preparing for the investigation task in these environments:

- Training;
- Preparation;
- Organisation;
- Management;
- Dealing with people;
- Media;
- Family Liaison.

1.2. Training

Preparedness is essential when planning difficult missions, with specialist knowledge and skills often being required to ensure that tasks are undertaken effectively. Accident investigation training provides some basic knowledge, but there are a wide range of topics that could also be considered to help improve the skills and competency of investigators. Training may be provided on a once only basis, but some training may also need refreshing at specified intervals. Safety Investigation Authorities (SIAs)[1] may also wish to allocate priorities within training programmes to ensure that high risks are managed first. The following topics are worth considering:

1.2.1. Training in extreme environments

Some SIAs have established training programmes to give investigators the opportunity to experience the deployment to extreme hot or cold climates. Such programmes are a valuable source of experience for investigators and will assist in confirming capabilities of investigation teams, in particular with regard to the appropriateness and use of equipment and clothing.

1.2.2. Physical and psychological preparation

Identify hazards associated with deployment to particular locations or situations and establishing the physical and psychological safety requirements of go-team members.

1.2.3. First aid training

It is important to be able to respond to injuries/illness occurring on site to both yourself and others, and to have the know-how to observe and take care of persons in a team. In addition, it is necessary to be aware of the hygiene/healthcare requirements, in order to maintain fitness and health in a range of environmental and weather conditions.

1.2.4. Investigating under different situations and conditions

Know how to collect and preserve evidence under varying constraints generated by location, weather, time limitations, etc.

1.2.5. Specialised training

Specialised training could include subjects such as:

a. Training using specialised equipment and clothing for use in jungle/arctic/mountains/desert environments. For example, this could include campfires, preparation/consumption of

1 This guidance uses the generic term of Safety Investigation Authorities (SIAs) to describe an accident investigation body.

operational rations, setting up tents, hammocks and improvised shelters;

b. Training for protection against bloodborne pathogens;

c. Identification, use and disposal of Personal Protection Equipment (PPE) for extreme environments;

d. Helicopter awareness training, including entering and leaving helicopters and use of the winch;

e. Helicopter Underwater Escape Training – if flight is required over areas of water;

f. Offshore safety training, evacuation drills, use of life jacket and life raft.

1.2.6. Training reviews

Conduct annual reviews of deployments, share lessons learned (good and bad), identify and review recommendations.

1.3. Preparation

1.3.1. Personal health

Accident investigation tasks can place great physical and mental pressures on investigators and their support teams, and it is likely that these pressures will increase significantly where the investigation is undertaken in extreme environments. It is very important that investigators look after their fitness and health at all times and also give it further consideration to deploy to extreme and challenging environments. Investigators should consider completing an annual medical or fitness check to confirm their fitness and identify medical conditions that could possibly present a problem during a deployment. Aircrew aviation medicals may be a good standard of clinical assessment, and some further physical tests could be added to these to help the investigator understand his/her physical fitness.

Information about health hazards, particular diseases, hygiene issues and physical requirements, can be investigated when considering the possibility of deployments to hazardous regions of the world. Further information can be confirmed prior to deployment. Issues to consider include the following:

a. Use as wide a range of sources of information as possible. Consider State Embassies and (national) travel authorities, World Health Organisation (WHO) and similar websites, SIAs and personal medical advisors, and perhaps also colleagues in the State of Occurrence;

b. Ensure that you have vaccinations required for the country/region you are travelling to. A medical practitioner in tropical disease may assist in determining the required vaccinations for the particular deployment;

c. Before departure, take the appropriate medication (prophylaxis/preventive) and repellent to protect yourself against insect borne diseases; and

d. Have a first aid kit with items **suitable for the location.**

1.3.2. Risk assessment

A risk assessment is considered critical when travelling to challenging and extreme environments and it is recommended that at least one senior member of the team should be tasked to undertake this role. The risk assessment should identify the hazards associated with the deployment, and should establish mitigation measures to maintain risk at a level that is as low as reasonably practical.

The risk assessment may take into account the following:

a. Information about the accident/deployment from the SIA/Investigator-In-Charge (IIC), or, if there is no contact with the IIC before leaving your country, from your Ministry of foreign affairs, Embassy in the State of Occurrence or any other appropriate source.

Information should include at least the following:

- Precise location of the accident site (remoteness and distance to nearest town)
- Climate and weather
- Access to/from site and wreckage
- Factual information about the event, location of aircraft parts/components
- Local capabilities for equipment cleaning and disinfection
- Investigation capabilities and assistance available from the State of Occurrence
- Wreckage recovery options;

b. Available accommodation;

c. Transport/travel in the country, including an evaluation of alternate means of transportation if unforeseen changes appear, for instance worsening weather;

d. Local circumstances (water/food quality and suitability, availability and quality of medical services, hygiene, etc.). Obtain information on the political and security situation in the country;

e. Preparations for unknown and unexpected situations, including medical evacuation and the possible need to stay overnight at the accident site;

f. Considerations of the benefits of sharing and travelling with other investigation teams.

Ask the question:

Does the level of risk outweigh the benefit of deploying?

Answering this question can be a challenge to the investigator. While the hazards can be identified and the risks assessed in advance of deployment, often the benefit of deploying can only be accurately assessed in hindsight. Therefore it is the judgement of the investigator by virtue of his or her experience and that of the investigation team that will be fundamental to addressing this issue.

1.3.3. Equipment

Does your team have all of the equipment it will need? Check your equipment against the expected environment and the risk assessment made. Checking the list against the Investigation Field Kit list (ICAO Doc 9756 Part 1) will reveal whether items are applicable and whether additional equipment will be needed.

Use checklists for materials, clothes and other equipment depending on circumstances (see ***Section 2: Extreme and challenging environments***).

Take necessary documentation with you, such as ICAO Circular 315, operational and administrative manuals, including technical documentation (see, e.g., *Airbus Accident Investigation Booklet*)[1].

In a remote area where cell phone coverage is a problem, satellite phone would become essential for maintaining communication in case of an emergency.

1.3.4. Transport

Effective transport management is vital to a successful deployment, both in travelling to the State of Occurrence and in daily travel to and from the accident site.

When travelling to the State of Occurrence, make sure that you travel comfortably and rest whenever possible. This is important during long flights, as it is not unusual to be expected to start work upon arrival.

Local transport to the accident site could include a variety of methods including by air, water and/or road. It should be remembered that transport may not always be available, may be cancelled at short notice or the accident site may not be accessible other than by foot.

Some accident sites may require travel over long distances and for long periods each day. There may be benefits in splitting the team up to ensure that fatigue is well-managed.

Be aware of possible restrictions on transporting people and equipment to and from the accident site. Do not forget, situations may require ***you*** to carry equipment for long distances and across difficult terrains.

While there are advantages in having access to self-drive vehicles, it is important to confirm that it is safe and suitable for members of the team to drive in the country you are visiting.

1.3.5. Security

The local political situation and local media reporting should be monitored to ensure that the risk assessment is regularly updated. Where threats to security are considered a significant risk, consideration should be given to using a specialist to look after the security of the team. Ideally, one person should deal with issues such as:

- Embassy contacts and security debrief and advice;
- Team transportation;
- Permanent escort on site;
- Local situation monitoring;
- Communications.

1.3.6. Advance arrangements

1.3.6.1. Home deployments

For accidents in your home State, good national advance arrangements with the emergency services and emergency planning authorities are important. Liaison with external bodies, through Memorandums of Understanding (MoUs) with the police, prosecution authorities, Ministry of Defence (MoD) and other emergency services will have a positive benefit for SIAs.

1. See ECAC/ACC website.

1.3.6.2. Foreign deployments

Consider the benefits of developing MoUs or advanced arrangements with foreign States. These advanced arrangements will facilitate coordination and cooperation between States by establishing procedures for sharing knowledge, information and working practices for accident investigation. There are benefits in having a dedicated person/ team for the management of logistics, travel, accommodation, visa and notifications. This allows the go-team to focus on preparing themselves for the mission itself, rather than having the additional stress and fatigue of making travelling arrangements.

1.4. Organisation

1.4.1. Before deployment

Specialist advice may be required for some parts of the deployment (possibly including: guides, security/protection, translators/ interpretors, drivers, mountain rescue teams, etc.). These could be personnel who have assisted with training and preparation of the team for such deployments. It is important to try and identify the need for specialist assistance at an early stage to ensure that it is available when required. Keep in mind to check visa requirements. The physical and mental well-being of investigators can be determined during the job selection process and periodic health assessment. However, for deployment on exceptional missions, additional considerations may be required to ensure that the investigator's fitness is adequate for the specific mission.

1.4.2. During deployment

Be prepared to start working immediately upon arrival, even after a long flight. Adapt travel and work schedules to the environmental and social conditions experienced at site. Review your mission-specific equipment to ensure that only the important equipment is carried. Each day confirm what is "**essential**" as opposed to what would be "**nice**" to have before loading it into backpacks.

If time is likely to be restricted for site operations, recovery and evidence management tasks should be planned as far as possible to be undertaken concurrently. Here too, a lot of pressure is placed on investigators to complete their site work as quickly as possible and ensure that perishable evidence is protected.

Keep distances in mind. Travelling to and from the briefing venue can add significantly to your working day. Locate briefing rooms as close as possible to the accident site.

1.4.3. Psychological aspects

When working under extreme conditions, implement peer support within the investigation team. It is important that you maintain a level of concern for each other. Monitor your colleagues on their physical and psychological condition. Look out for any change in behaviour (based on your knowledge of how they usually behave). Work in pairs and, where this would be an advantage, complete work in shifts. Plan your day to ensure that you have adequate rest. During and after the mission, members should talk with colleagues within the team.

The team leader should ensure that each day, there is an opportunity for the team to discuss and review/debrief events experienced. Do not hesitate to speak up to say that you are unwell or need a break. Consider the need for individuals to call home on a regular basis.

Create good relationships with the local population. They are the ones who have the local knowledge and can help you in these challenging circumstances. They can be a valuable resource in gaining access to equipment, facilities, and manpower and can inform you about possible social or even religious issues that may play a part in the accident that you are investigating.

1.4.4. After deployment

Conducting an operational debrief is important to capture the experiences of the team and improve arrangements for the future. This is particularly so with extreme and challenging environments. Medical, travel, safety and logistic arrangements can be discussed with good and bad experiences fed into management systems.

All individuals should monitor their medical condition for a suitable period after returning from deployments. It is not unusual for symptoms of illness or medical conditions to appear sometime after return, and it would be important to seek medical advice as soon as possible.

SIAs and the investigators themselves should also consider the need for including a formal and perhaps even mandatory confidential psychological debrief for critical incident stress management using professional support services.

1.5. Management

During the investigation, it is good practice to separate management of the investigation itself from the overall support management of your organisation.

It is important to have a good communications link (preferably on a daily basis) with senior management at home to ensure that they are well-informed and that appropriate resources are made available to the investigation. It is advisable that the investigation team has administrative support on site that organises and takes care of things like:

- Rental cars (keys, rental contracts, location information, etc.);
- Flight reservation, hotel rooms;
- Conference/meeting rooms;
- Recording of all the documents/photographs/evidence during the investigation;
- Contractual arrangements with different suppliers;
- Purchases of equipment;
- Interpreters/translation services.

Where possible, the team could have IT support available that organises:

- Telephones, cellular telephones, satellite phones, computers, photocopiers, printers;;
- Databases, accurate phone lists and email addresses;
- Image processing (manage images in various formats);
- Internet access and IT problems resolution.

1.6. Dealing with people

The team will often be dealing with a variety of people during an investigation, sometimes under stressful conditions and with different languages and cultures. This could present significant challenges to the team.

The following aspects may play a role:

a. Communication:
   - Verbal;
   - Written;
   - Non-verbal (implicit).

b. Customs:
   - Authority structure;
   - Accepted behaviour.

c. Cultural:
   - Understanding the local culture in its various forms will reduce the possibility of offending the local population and help with gaining assistance in and around the accident site.

Keep the local population in mind along with their feelings/social sensitivities. Be aware that attitudes can change very quickly and without prior warning. It is important to have good links to the local population, and to keep them informed of activities and plans (where the investigation permits).

1.7. Dealing with the media

Although it can be difficult to agree and keep to a media strategy that suits all organisations involved, it is strongly advisable for the investigation team to have one in mind prior to the deployment.

Be aware that dealing with the media may take a lot of time and energy, but there may be benefits from releasing agreed statements with regard to the process and progress of the investigation.

Once the parties involved in the safety investigation arrive at the accident site, a meeting should be set up to define various aspects related to media communication.

Consider the following:

- The SIA's Information Policy;
- Specifics such as frequency of press briefings and press releases, participants, location, time;
- The contact information of the SIA's Head of Communication and/or spokesperson; and
- The contact information of the person in charge of relaying information to the victims' families.

It is recommended that the investigation team has a press spokesperson at the site to:

- Write press releases to inform the media at specific times;
- Prepare press conferences and receive the media's requests for pictures, interviews;
- Liaise with media representatives from the other organisations on site;
- Plan and prepare for possible media interviews; and
- Organise regular meetings with the media.

Positioning the press briefing away from the investigation team/hotel/HQ or debrief room will alleviate part of this pressure from the team.

Be aware of being overlooked and overheard by the media/public. It is likely that on some accident sites, cordons will not be positioned very far from the main evidence and/or the site may be overlooked from adjacent buildings or other high places. This places additional pressures upon the investigation/ recovery team to conduct all tasks effectively and respectfully.

Also keep in mind that when in foreign States, accident investigation communication is usually the responsibility of the State of Occurrence. As such it is very important to seek permission from the IIC before releasing any information relevant to the investigation.

1.8. Family liaison

According to European and ICAO provisions, an update on the progress of the safety investigation must be provided to victims' families prior to public release. Consideration should be given to appointing a '*Point of Contact*', outside the investigation team, for that purpose.

SECTION 2: Extreme and challenging environments

2.1. Introduction

This Section presents the characteristics of specific environments and has been developed from the personal experience of investigators operating in such environments. It is particularly adapted to investigators going on missions abroad, usually as accredited representatives, sometimes far from home, and in unknown or little known countries and environments.

It is not the intention of this Section to provide a definitive list of advice, practices or all equipment to be carried on foreign deployments, but rather suggestions that may assist you in operating safely in the different specific environments that are considered to be extreme and challenging.

2.2. General considerations and advice

a. Identify the organisations/people present on the accident site;

b. Adapt yourself to local conditions and plan your work time on site accordingly (implement work schedules, shifts within the team);

c. Create a good contact and atmosphere with the local population. They can be a source of information and good advice on the local situation, local hazards, availability of equipment, etc.;

d. The language can be an issue, adapt your vocabulary and your flow of speech to your hosts;

e. In a State of Occurrence where limited investigation knowledge and capabilities exist, do not hesitate to make suggestions about the investigation management and work practices;

f. Be ready to consider suggestions from other parties, from local SIAs and other accident investigation bodies;

g. Be prepared to consider, in consultation with your management and the IIC, aborting or reorganising the on-site investigation phase if the safety/health risks are too high or are uncontrollable;

h. Working on an extreme and challenging site can be physically and mentally demanding. Take your time and watch out for the safety of your colleagues;

i. Climatic conditions can adversely affect human performance and particular attention should be given to monitoring the well-being of colleagues throughout the investigation;

j. Be mindful of the effects of jet lag, time differences and fatigue;

k. Make sure to have appropriate levels and stocks of Personal Protective Equipment (PPE);

l. Communications out in the open in remote locations often present problems, as there may be few landlines and little or no mobile or internet coverage. In these situations, satellite telephones are considered essential equipment for the investigation team;

m. For an accident site involving a large area, consideration should be given for the use of a walkie-talkie radio system. It is important to remember that most commercial communication devices are not secure and can be listened to by third parties. Suitable caution and discretion should be used by investigators in this knowledge;

n. Political and social instability can be a feature of extreme and challenging environments and increased consideration should be given to the security of the investigation team.

2.3. Guidelines for particular environments

2.3.1. Arctic – Cold – Snow

Under arctic conditions, work with nature, not against it. Conditions change very quickly – for example, you may be confronted with a fall of three meters of fresh snow overnight. The weather, including high winds and low visibility, can cause icing conditions overnight; on the other hand, you may be confronted with swamp-like, muddy environment at first that freezes over in a few days. The cold presents some significant danger in the form of:

- Frostbite/Wind chill (can lower the temperature significantly);
- Dehydration - although you will likely not feel thirst;
- Fatigue - heat generation, exertion;
- Materials change, for example metals and plastics become brittle;
- Perspiration may refreeze, which may then cause frostbite.

These and other factors will lead to everything taking twice as much time and energy than expected.

Accommodation can also be limited and sparse. Investigation tasks, including wreckage recovery, may sometimes have to be completed very quickly. There is wildlife too in the arctic. Take care of your rations and colleagues on site.

Your equipment will have to be adjusted to your circumstances. In particular, your clothing needs to take account of the specific temperatures that will be experienced. Advice should be sought to ensure that you have the correct temperature protection and that your clothing is suitable for the location in question. Make sure that you carry a minimum of the following items in your go-bag:

- Polar clothing – parka and pants, appropriate head-dress to protect head (most heat escapes from the head);
- Dress in layers – remove or add as appropriate:
  - Insulating and transpiration transmitting layer closest to the skin (preferably fine wool)
  - One or two insulating and warming intermediate layers (typically thick wool or fleece)
  - Wind and water proof outer-layer (typically Gore-Tex);
- Boots – sturdy and warm footwear is essential;
- Gloves – 'finger' gloves do not work when it is really cold, only thick mittens. Consider use of fine inner gloves under mittens;
- Socks – matched with your boot specification;
- Sun block (especially in spring or autumn);
- Sunglasses, after-sun, moisturizer;
- Hot pockets/catalytic heaters.

Cover exposed skin on all places including ankle, wrist, neck and head as 40-45% of body heat is lost from there. Keep toes free to move (in socks).

Keep your equipment on your body as much as possible; water in a bottle on your body and sloshing prevents freezing. When making drinks, keep in mind that ice holds more water than snow and melts quicker.

Remember, hot pockets/catalytic heaters cannot be trusted as the primary means of staying warm; they must rather be seen as emergency equipment to

prevent local frostbite. Keep in motion to avoid getting too cold. Always bring a small shovel. You can survive a snow gale by digging into the snow and take cover (snow is a good insulator).

Arctic winters are relatively dark, even during daytime – lights will be required, so bring torches and a supply of batteries. Remember much of your equipment is battery powered and the battery life can be shortened by the low temperatures.

Put a small notebook in a pocket and take notes with an ordinary pencil (ballpoint pens do not work in low temperatures).

Wreckage recovery can be difficult in these conditions. Changes in wind or weather phenomena may lead to snowstorm or blizzard conditions. Aerial wreckage recovery by helicopter requires careful planning, as there is the potential for a 'white-out' situation resulting in a loss of visibility for the flight crew near the ground.

2.3.2. Tropical areas - Jungle

There are typical challenges to meet when working in tropical/jungle areas.

2.3.2.1. General considerations

The heat and humidity poses a threat of medical conditions – heat can create stress and discomfort and can lead to dehydration, therefore it is important to keep hydrated. Furthermore, there are likely to be a range of skin conditions resulting from a constant high level of humidity.

Constant moisture and rain also poses a threat technically. This environment is a significant hazard to electronic equipment. It is advisable not to take notebooks and tablets into the jungle. However, if this cannot be avoided, cover devices in protective plastic bags to protect them from moisture.

The dense vegetation in the jungle makes it difficult to walk and carry/extract things. It can be particularly difficult to access the accident site and, where river and lakes are involved, the recovery of wreckage can be highly challenging due to wildlife, currents and a lack of visibility underwater. Wildlife such as ants, bees, mosquitoes, scorpions, spiders and snakes will constantly be present and may threaten your health, if not your life.

Beware of fatigue - heat and humidity saps your energy, as well as physical and material hazards, as you may have to work on unstable or slippery ground/wreckage. Communication is crucial, make sure you can stay in permanent contact with each other.

2.3.2.2. During the mission

- Protect yourself against heat and humidity;
- Be sure to have enough water with you and make sure that the local authorities provide an appropriate amount of water and food on site as high temperatures and long stays may lead to dehydration and fatigue;
- Adapt your protective equipment with regard to the heat and humidity encountered;
- Use refreshing towels, hat and sunblock;
- Appropriate footwear for jungle environment – e.g., high ankle protection;

2.3.3. Desert – Dry heat

Hot desert is characterised as a sandy environment with very high summertime temperature and significant temperature differences between day and night – nights can be extremely cold.

2.3.3.1. General considerations

Insulation and body water evaporation are the most relevant issue for people operating in desert area.

The sun is a natural hazard, and the use of long trousers, long sleeve shirts, head protection (wide brimmed hat), sunglasses and sunscreen can help alleviate the effects of the sun.

Age, weight, degree of physical fitness, degree of acclimatisation, metabolism, use of alcohol or drugs and a variety of medical conditions such as hypertension, all affect a person's sensitivity to heat. Even the type of clothing worn should be considered. Hot conditions also predispose an individual to additional stress.

It is difficult to predict just who will be affected and when, because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction and relative humidity, all affect an individual's response to heat.

Accident site should be equipped, where possible, to provide a heat safe area – shaded cover.

Adequate changes of clothes are necessary in case of a prolonged heat exposure period.

Local wildlife such as spiders, scorpions or snakes will attempt to find warm, secluded locations to sleep at night. This can include hats, boots or the interior of 'go-bags'. Investigators should be cognisant of the possibility injury from such creatures, and secure their personal belongings when being stored at night. Water availability at all times is mandatory for heat environment activity – confirm arrangements with local authorities or IIC.

2.3.3.2. Heat Exposure Physiological Conditions

Rashes

- Manifested as red papules and usually appears in areas where the clothing is restrictive as result of sweating increase;
- In most cases, heat rashes disappear when back in cool environment;
- Loose and comfortable clothes could prevent symptoms.

Sunburn

- Is commonly caused by over-exposure of the skin to ultra-violet (UV) radiation;
- Uncovering of the skin should be avoided and in any case protected with high degree sunshades lotions (factor +50).

Cramps

- Over-sweating and fatigue typically result in heat cramps;
- Water consumption with mineral salts will restore normal physical performance.

Fatigue

- The signs and symptoms of heat fatigue include impaired performance of skilled sensorimotor, mental, or vigilance jobs;
- There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

Dehydration

- Results in severely impaired performance of an individual;
- When exposed to heat for a long period, constant consumption of water is mandatory;
- Fluid replacement can be assured by consuming a litre of water every hour;
- The consequences of dehydration can be very severe and can lead to:
  - Collapse
  - Exhaustion
  - Stroke
  - Death.

2.3.3.3. Soft sand walking

As walking on soft sand is tiring, taking small steps is advised. Walk as a team, do not chase but keep in pace. Consider your own and the team members' stamina and keep team members in sight. This requires looking forward, not down, which is good to keep orientation. Be aware that it is easy to veer off course due to the different strength in your legs, which will make you walk in circles. Also, rest by plan, not casually. There should preferably be two to decide on the route and two that keep an eye on possible stragglers. It is advisable to have people of average fitness walk up front and the most fit in the back.

When walking up dunes, do not try to walk up in a straight line; walk at an angle up the slope or avoid the dune altogether. Keep in mind that the upwind side of the dune consists of more compact sand than the downwind side.

Try walking in the twilight of the morning and evening, rest midday when the sun is high. Drink small amounts of water, but do it regularly and keep the last bottle, if possible, until the destination has been reached.

Make sure to protect your equipment from sand as sand gets into all small openings. Protect your camera in a special bag. Keep all equipment out of the heat and covered.

2.3.3.4. Wreckage recovery

Do not underestimate time constraints for wreckage recovery. Possible wind condition variation may lead to sandstorm phenomena. Sandstorms are poorly predictable and depending on the intensity could compromise site visibility and could actually bury the wreckage.

Although GPS track coverage may suggest an easy accident site location, a route has to be carefully planned. Ground transportation - though preferred - is not always possible due to distance and soil consistency.

Aerial wreckage recovery by helicopter must be planned and performed carefully, particularly so when considering the risks associated with brown out (an in-flight visibility condition that restricts visibility due to dust or sand in the air) during sling load operation.

Brown out during landing or taking off in a sandy/dusty environment is a frequent cause of accident, but it is also a frequent issue during wreckage recovery. Heavy wreckage recovery needs powerful helicopters that generate huge rotor downwash during low hover condition, leading to a more critical brown out condition. The risk is typically mitigated by the adoption of long sling lines capable of increasing hover height. However, these may adversely affect the load stability during transportation.

2.3.4. Mountains

2.3.4.1. General considerations

Working in high mountains poses challenging conditions that you must be aware of before starting the mission.

The main challenges encountered will include:

- Difficult wreckage location, aerial recognition and the long time required to reach the accident site, where helicopter access is not available;
- The effective custody of wreckage and accident site, including the wreckage recovery will be difficult;
- Localised weather constantly plays an important role as it may change often and very quickly during the investigation;
- Considerable occupational safety issues that demand your attention, e.g., unstable terrain and rock fall;
- The need to be in good personal physical shape;
- Completing the on-site investigation in one visit is often not possible due to weather conditions, access and terrain. Provisions need to be made to make repeated visits to the site.

2.3.4.2. Altitude sickness characteristics

Hypoxia is a condition that the human body experiences when it is deprived of oxygen to the blood. During high altitude conditions, the partial pressure of the oxygen in the air is lower than what it is at sea level conditions, where atmospheric pressure close to standard prevails.

With the oxygen partial pressure lower than standard, the human body is unable to saturate the blood with enough oxygen. This causes hypoxia, of which some symptoms are as follows:

- Loss of concentration and a state of euphoria;
- Dizziness;

- Headaches and other pains;
- Loss of appetite;
- Pale complexion;
- Dehydration (may lead to thirst, lack of appetite, slow reactions, nausea, drowsiness and high body temperature);
- Difficulty in sleeping;
- Loss of energy;
- Fatigue.

2.3.4.3. Other symptoms

Additional symptoms may include: sunburn, red/hot/dry skin, high body temperature, rapid pulse, slow and noisy breathing, confusion or unconsciousness. The following **precautions** are recommended when your mission leads you to high mountains:

- Limit physical exertion above 8,000 feet above sea level;
- Keep hands free on steep climbs;
- Rest frequently;
- Have oxygen available at high altitudes;
- Drink water or juice often to avoid dehydration;
- Wear sunblock, sunglasses and a hat;
- Seek advice from the local guides who should, ideally, be accompanying the investigation team.

When you have to move through mountainous areas, a walking stick is useful while taking small steps and landing on your fore foot instead of heel. Tighten your shoelaces when descending. Breathe slowly and deeply. Finally, take extra clothing, including gaiters and two layers of socks as protection around your lower pants.

2.3.5. Urban

2.3.5.1. General considerations

Accidents within urban locations, particularly in city centres, are likely to present major pressures for emergency response agencies and SIAs, particularly where infrastructure and utility supplies are affected. Fatalities among the local population also add to the pressure and as a result, produce additional challenges for the investigation.

The ICAO Manual of Accident Investigation identifies the potential benefits of effective 'prior arrangements' with Police and other emergency services. This has proved to be extremely important when responding to urban air accidents. Having the trust and confidence of the Police and Fire Services is essential in enabling investigators to have the desired level of access and control of investigation activities.

For investigators, having an understanding of how national and local emergency plans are formed and applied helps considerably, especially for 'major incident' events.

It is important to know how the investigation team fits into this national response planning, and beneficial also for others to see how the investigation itself fits into these 'Integrated Emergency Response Plans' as well.

2.3.5.2. Agreeing priorities

Agreeing and continually stating the key priorities for site operations is considered a major benefit in these major accidents. Key priorities, such as the safety of personnel, dignified recovery of the deceased and effective evidence recovery can be re-stated at the outset of each major accident meeting to reinforce the site operational needs. This also helps to reinforce the importance of the investigators' roles within the major accident response group.

2.3.5.3. Investigation tasks

Getting some form of SIA representation to site as quickly as possible can be very useful to establish a 'presence' and generate site-operational contacts. Getting a member of the investigation or support team to the accident site as quickly as possible will help identify suitable locations and rendez-vous points (RVPs) for the travelling investigation team.

These personnel can also begin a site safety assessment prior to the arrival of the main team. Understanding the time pressures for site operations is important. It is possible that the investigation and recovery of wreckage will be done in the public and media eye, so additional energy may have to be applied to resource management and planning activities to ensure that time constraints are met.

Accident site investigation activities are normally conducted in daylight hours, and investigation teams are often resourced only for this extent of work. However, there may be occasions where pressure will be applied to have an SIA presence over the full 24 hours, either from external sources, or from within the SIA. It is worth considering the potential and the implications of such a situation.

2.3.5.4. Resources

Urban accidents may require more investigation resources than would normally be deployed to accidents involving similar sized aircraft in non-urban locations. This can be particularly noticeable where the accident is considered a 'major incident' by the responding authorities.

There is likely to be SIA representation requested at strategic, tactical and at operational levels of progress and planning meetings. This requirement is likely to be coupled with the difficulties of accomplishing investigation tasks in the remains of damaged buildings and infrastructure, and in a compressed timescale.

Such events can generate an increased resource requirement, which would normally be considered disproportionate to the scale of the accident.

2.3.5.5. Accommodation

Normally hotel and office accommodation will be available locally. In foreign States, the host SIA or embassy representatives should be asked to assist as early as possible, with an understanding of the need to find accommodation as close as possible to the site.

Time pressures are often significant, and the investigation team cannot afford to lose time in travelling to and from the accident site each day.

2.3.5.6. Recovery

Recovery operations also present a different challenge within urban environments. Wreckage may be difficult to locate due to buildings and other structures. The assistance of the emergency services may be required to gain access to and search high buildings or secure areas. It is not unusual for wreckage to be located within partially collapsed buildings where access poses a severe safety issue for investigation teams. Damage to utilities may also present additional safety risks or possible loss of evidence if not dealt with quickly. Recovery vehicles may have difficulty getting in to RVPs and the site itself.

2.3.5.7. In the public eye

When accidents occur in urban areas, the likelihood is that there will be a high presence of media and the public in close proximity to the accident site, with some even located in elevated areas.

Live media broadcasts may be taking place during the course of the site examination and wreckage recovery, so it is important to be mindful that you are being watched and your behaviour on-site needs to be adapted accordingly.

2.3.6. Politically sensitive environment

2.3.6.1. General considerations

You may be required to go into a conflict zone or occupied area. The help and support of the military and your Ministry of foreign affairs will be essential in this regard.

Most of the time when you are in a politically sensitive area, the experience of the local investigation team is low. The IIC may never have conducted any type of investigation at all.

There are always the general hazards, but in a warzone there may be extra ones, including old mine fields or unexploded ordnance and, most importantly, risks of personal attack.

There is a very special sensitivity in the release of bodies under some circumstances, depending on political, religious or other issues.

When you have left the State of Occurrence, the communication with the IIC and the transfer of data may be difficult. You will not normally be able to revisit the wreckage. And, as you are not the lead investigator, it is likely that on-going cooperation may be hampered severely.

2.3.6.2. Military operational areas and restricted/conflict zones

Military operational areas and restricted areas can present themselves anywhere across the globe and to that end, accident investigators must be prepared to operate

in any of the environmental/climatic conditions described elsewhere in this guide. In addition to these considerations however, military operational areas and restricted/conflict zones will often present the investigator with extra, unique hazards and challenges.

It is imperative that the appropriate embassy and/or defence attaché are contacted as soon as possible after the event. These will be key to obtaining access into the area as well as being able to provide in-country points of contact. Transportation into and within a military/conflict zone will usually only be possible by military or official means.

The only way to obtain passage on such transportation is through liaison with the military or government officials. Your embassy or defence attaché is the initial route into those organisations. They will also be able to provide guidance on any particular procedures and protocols that may be required for a particular region.

Liaise with your military accident investigation branch (or equivalent) to obtain information that may be relevant to operations in the area concerned. Consider requesting a military investigator to accompany your deployment. Militaries worldwide understand each other and can often gain access and obtain information that civilians and civilian organisations cannot.

If it is imperative to deploy to the accident site, consideration must be given to self-protection. Depending on the activity in the area, it may be appropriate to deploy with military style hard hats and protective vests. If used, however, these must be easily discernible from those worn by the military, i.e., akin to those worn by journalists in conflict zones. Likewise, all personal clothing should be easily identifiable as being non-military – do not wear military camouflage.

In any accident, rapid collection of perishable evidence is crucial. In a military/conflict zone however, the personal risk increases as time goes by. Early access to the scene is therefore even more crucial as any delay may mean not only losing essential evidence, but also an increase in the risk to investigative personnel. This risk can be mitigated to a degree with support of the military providing force protection, but cannot be relied upon as the accident may have occurred in an area that is inaccessible to friendly forces.

The 'enemy' may not always be another recognised State – some States and terrorist factions are unlikely to observe the Geneva Convention. Support may not always be forthcoming, even within States that have previously been considered friendly.

A military/conflict zone, by its very nature, is quite likely to be 'contaminated' with unexploded ordnance and improvised explosive devices. Unless the area has been declared free of these hazards, access should not be attempted.

Consideration needs to be given to accommodation and subsistence. Whilst hotels and restaurants are usually still available in surrounding areas, there will be no home comforts within a military/conflict zone. Whilst most militaries will provide food and water, it is advisable to deploy with sleeping systems and tents.

SIAs should have a plan for carrying out an investigation without any physical evidences. War and conflict are unlikely to pause in the event of an aircraft accident and more often than not, access to a crash site will not be possible, at least not for a considerable time after the event.

List of Speakers

Workshop on Investigations in Extreme and Challenging Environments, Lucerne, 14 and 15 May 2014

- Chow Wah Chong, AAIB Singapore: *Training for extreme environments*

- Nicolas Bardou/Ania Bellagh, Airbus: *Investigation logistics & investigation in Pakistan*

- Sid Hawkins, AAIB UK: *Urban - London/Glasgow helicopter accidents*

- André De Kock, ICAO: *High Altitude/Wild Life - Mount Kenya*

- Mario Colavita, ANSV: *ANSV experience in high-mountain accident investigation*

- Brad Vardy, TSB Canada: *Snow and Arctic*

- Agne Widholm, Swedish (SHK): *Cold Mountain – C130 Accident*

- Tim LeBaron, NTSB, United States: *Investigations in Afghanistan*

- Julien Bravet, BEA, France: *Investigation in Mekong River - Laos*

- Fernando Camargo, CENIPA, Brazil: *Jungle/Dense Forest*

- Emmanuel Delbarre, BEA, France: *Investigation in hot and humid environment – Venezuela*

- Luigi Candiani and Marco Terzi, AgustaWestland: *Hostile Desert environment – Instances of helicopter accident investigation*

- W/Comdr Neil Bishop MilAAIB, UK: *Material provided for Investigations in war zones*

The individual presentations are available on the restricted pages of the ECAC/ ACC website.

European Civil Aviation Conference
3 bis, Villa Emile Bergerat
F-92522 Neuilly-sur-Seine

Tel.: +33 1 46 41 85 44
Fax: +33 1 76 73 98 57
secretariat@ecac-ceac.org
www.ecac-ceac.org