Introduction To err is human, that is how the saying goes.This is especially true if the number of witnesses is high, as the interviewer may tent to focus on "interesting" information from certain point on and omit the facts that are being repeated by the other witnesses. single interview is preferrable to a group session. Firstly, in a group activity, one (or some) person could influence the others and secondly, some people prefer not to talk in public. interruptions are likely to cause the witness to lose their train of thought and crucial information may be missed. The best option is to listen to the whole story and ask for clarification later. it is important to make a person feel comfortable during the interview. This would make them more likely to contact the investigator again if they remember something they missed during the interview. 3.2 Equipment 3.2.1 Flight Simulators If used properly, flight simulators can help investigators gain a better understanding of what happened during the occurrence through the eyes of the participants. It should be noted, however, that the use of simulators is subject to certain limitations. Some situations can be simulated better than others. The investigator needs to be fully aware of the limitations and use other appropriate methods to supplement the simulator results. Simulators are very useful for: recreating aircraft behaviour in most situations (i.e. within the flight envelope). recreating certain equipment malfunctions (e.g. engine failure, hydraulic failure). recreating events that are related to visibility (e.g. runway incursions, fog, etc.). Examples of situations where simulators are of limited value are: situations where high g forces are experienced. assessment of the impact of the event on a person (except for the visuals, as stated above). some equipment malfucnctions that are not well documented (and therefore not fully simulated). events that happen outside the boundaries of the flight envelope (e.g. prolonged high angle of attack stall). 3.2.2 Drones Unmanned aerial vehicles (UAVs), popularly refered to as drones, provide investigators with a number of options and advantages, e.g.: quick deployment. Unlike e.g. police or SAR helicopters, drones are deployable in a matter of minutes after reaching the accident site. Also, the pictures are immediately available. full control. The operator (investigator) has a control over the flight path and the viewing angle therefore can position the camera at the optimal position. high quality. Modern drones offer high quality cameras with image stabilization. easy relaunch, if necessary, to take additional footage. can be flown closely to trees and wreckage to obtain close-up images without disturbing them with rotor downwash. can be easily programed to take a series of geo-tagged and overlapping overhead shots for photogrammetry purposes. can operate in low-visibility and low-cloud conditions that would prevent an airplane or helicopter being operated. low cost, when compared to other options (e.g. helicopters) One of the most useful features of drone pictures is the ability to combine them into an orthomosaic image (corrected for both perspective and scale, which has the same lack of distortion as a map) or a 3-d model of the site. Conclusions and Recommendations During an investigation, it is common to come across hazards that have not been addressed but are not directly related to the occurrence. The conclusions however, should focus on the factors that are related to the event in some way and other channels should be used to rectify the other hazards. Once the list of factors and contributors is complete, a list of reccomendations needs to be made. Reccommendations should: be tied to a specific factor or contributor. address each and every factor and contributor. only address the factors and contributors that caused or are related to the event. be focused on the prevention of similar events from happening again. avoid punitive actions; these are unlikely to prevent future occurrences but are very likely to limit cooperation in future investigations. preferably offer short, medium and long-term solutions. be as specific as posssible and avoid generalizations (e.g. procedures for XXX need to be reviewed). 4 Investigation – Final Report 4.1 In accordance with International Civil Aviation Organisation (ICAO) Standards and Recommended Practices (SARPS) provided in Annex 13, when a State accident investigation body conducts an investigation to an aircraft accident/serious incident, the progress and result of the investigation is to be published, including any safety recommendation(s), via the release of a Preliminary Report and a Final Report. The purpose of the preliminary report is to communicate promptly the data obtained during the early stages of the investigation. The Preliminary and the Final reports, along with any safety recommendations are sent to the relevant parties to the investigation, States and organisations. Requirements and guidance regarding the notification of accidents are provided in Annex 13. In practice, not all State Investigation Agencies automatically issue Preliminary Reports but many do issue Interim Reports if significant matters, which it is judged deserve prompt disclosure, come to light during a major investigation. 4.2 Format of the Final Report The recommended format presented below has been extracted from Annex 13, Appendix to Chapter 6. Additional guidance for completing each section of the Final Report can be found in ICAO Doc 6920 – Manual of Aircraft Accident Investigation. One notable area where the recommended format is widely ignored, even by otherwise reputable agencies, is that 'Personnel Information' is rarely given for any directly involved person except flight crew even when their actions have been found to have had much more bearing on the outcome of the event investigated than those of the flight crew. 4.3 Title The Final Report begins with a title comprising: Name of the operator; manufacturer, model, nationality and registration marks of the aircraft; place and date of the accident or incident. 4.4 Synopsis Following the title is a synopsis describing briefly all relevant information regarding: Notification of accident to national and foreign authorities; Identification of the accident investigation authority and accredited representation: organization of the investigation; Authority releasing the report and date of publication; A brief resume of the circumstances leading to the accident. 4.5 Body The body of the Final Report comprises the following main headings: 4.5.1 Factual information History of the flight. A brief narrative giving the following information: Flight number, type of operation, last point of departure, time of departure (local time or UTC), point of intended landing. Flight preparation, description of the flight and events leading to the accident, including reconstruction of the significant portion of the flight path, if appropriate. Location (latitude, longitude, elevation), time of the accident (local time or UTC whether day or night). 4.5.2 Injurie to persons Completion of the following (in numbers): 4.5.3 Damage to aircraft Brief statement of the damage sustained by aircraft in the accident (destroyed, substantially damaged, slightly damaged, no damage). 4.5.4 Other damage Brief description of damage sustained by objects other than the aircraft. 4.5.5 Personnel information Pertinent information concerning each of the flight crew members including: age, validity of licences, ratings, mandatory checks, flying experience (total and on type) and relevant information on duty time. Brief statement of qualifications and experience of other crew members. Pertinent information regarding other personnel, such as air traffic services, maintenance. etc., when relevant. 4.5.6 Aircraft information Brief statement on airworthiness and maintenance of the aircraft (indication of deficiencies known prior to and during the flight to be included if having any bearing on the accident). Brief statement on performance, if relevant, and whether the mass and centre of gravity were within the prescribed limits during the phase of operation related to the accident. (If not and if of any bearing on the accident give details.) Type of fuel used. 4.5.7 Meteorological information a) Brief statement on the meteorological conditions appropriate to the circumstances including both forecast and actual conditions, and the availability of meteorological information to the crew. b) Natural light conditions at the time of the accident (sunlight, moonlight, twilight, etc.). Aids to navigation. Pertinent information on navigation aids available, including landing aids such as Instrument Landing System (ILS), MLS, Non-Directional Beacon, PAR. VHF Omnidirectional Radio Range (VOR), visual ground aids, etc., and their effectiveness at the time. 4.5.8 Communications Pertinent information on aeronautical mobile and fixed service communications and their effectiveness. Aerodrome information. Pertinent information associated with the aerodrome, its facilities and condition, or with the take-off or landing area if other than an aerodrome. 4.5.9 Flight recorders Location of the flight recorder installations in the aircraft, their condition on recovery and pertinent data available therefrom. 4.5.10 Wreckage and impact information General information on the site of the accident and the distribution pattern of the wreckage; detected material failures or component malfunctions. Details concerning the location and state of the different pieces of the wreckage are not normally required unless it is necessary to indicate a break-up of the aircraft prior to impact. Diagrams, charts and photographs may be included in this section or attached in the Appendices. 4.5.11 Medical and pathological information Brief description of the results of the investigation undertaken and pertinent data available therefrom. Note. - Medical information related to flight crew licences should be included in Personnel information. 4.5.12 Fire If fire occurred, information on the nature of the occurrence, and of the fire fighting equipment used and its effectiveness. 4.5.13 Survival aspects Brief description of search, evacuation and rescue, location of crew and passengers in relation to injuries sustained, failure of structures such as seats and seat-belt attachments. 4.5.14 Tests and research Brief statements regarding the results of tests and research. 4.5.15 Organisational and management information Pertinent information concerning the organizations and their management involved in influencing the operation of the aircraft. The organizations include, for example, the operator. the air traffic services, airway. aerodrome and weather service agencies: and the regulatory authority. The information could include, but not be limited to, organizational structure and functions, resources, economic status, management policies and practices. and regulatory framework. 4.5.16 Additional information Relevant information not already included in History of the Flight to Organisational and Management Information above. 4.5.17 Useful or effective investigation techniques When useful or effective investigation techniques have been used during the investigation, briefly indicate the reason for using these techniques and refer here to the main features as well as describing the results under the appropriate sub-headings from History of the Flight to Additional Information. 4.6 Analysis Analyse, as appropriate, only the information documented in section "Factual information" and which is relevant to the determination of conclusions and causes.The system as a whole produces failures when holes in all of the slices momentarily align, permitting "a trajectory of accident opportunity", so that a hazard passes through holes in all of the defences, leading to an accident. Figure ?2 1 Swiss Cheese model of accident causation 2 PEAR Model 2.1 Description

The mnemonic PEAR is used to recall the four considerations for assessing and mitigating human factors in aviation maintenance: People who do the job; Environment in which they work; Actions they perform; and Resources necessary to complete the job. 2.2 People Physical Factors Physical Size Gender Age Strength Sensory Limitations Physiological Factors Nutritional factors Health Lifestyle Fatigue Chemical dependancy Psychological Factors Workload Experience Knowledge Training Attitude Mental or emotional state Psychosocial Factors Interpersonal conflicts Personal loss Financial hardships Recent divorce 2.3 Environment Physical Weather Location inside/outside Workspace Shift Lighting Sound level Safety Organisational Personnel Supervision Labour-management relations Pressures Crew structure Size of company Profitability Morale Corporate culture 2.4 Actions Steps to perform task Sequence of activity Number of people involved Communication requirements Information control requirements Knowledge requirements Skill requirements Attitude requirements Certification requirements Inspection requirements 2.5 Resources Procedures/work cards Technical manuals Other people Test equipment Tools Computers/software Paperwork/signoffs Ground handling equipment Work stands and lifts Fixtures Materials Task lighting Training Quality systems 1 Objective The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability. (ICAO Annex 13, Aircraft Accident and Incident Investigation) 2 Accident classification Accident: International Civil Aviation Organisation (ICAO) defines an accident as an occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked in which: A person is fatally or seriously injured The aircraft sustains damage or structural failure The aircraft is missing or is completely inaccessible Note: The following are not considered accidents: experimental test flights, sabotage, hijacking, terrorism, or direct military action There are several ways to classify an accident. These include classification by the level of damage incurred, by the extent of injuries caused, or by the cost of the damage to the aircraft. The following definitions are used in various classification taxonomies: Damage Destroyed: The aircraft is not repairable, or, if repairable, the cost of repairs exceeds 50% of the cost of the aircraft when it was new Substantial: Damage or failure that adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Not considered in substantial damage are; engine failure or damage limited to an engine only, bent or dented skin, damage to landing gear (to include wheels and tires), flaps, or wingtips. Minor: Damage that neither destroys the aircraft nor causes substantial damage. Injury Fatal: An injury that results in death in the accident itself, or up to 30 days after the accident Serious: An injury 1that requires more than 2 days of hospitalization up to 7 days after the accident. Fracture of any bone (except simple fractures of the toes, fingers, or nose). Serious also includes injury to an internal organ, any muscle or tendon damage, any second- or third-degree burn, or any burn covering more than 5 percent of the body. Minor: An injury that requires less than 2 days of hospitalization up to 7 days after the accident. 3 Techniques and Best Practices the best practices used in aviation occurrence investigation. It also describes the use of some specific equipment, like UAVs and flight simulators, in the process, along with their benefits and limitations. As a general rule, the investigation should be unbiased (i.e. find out what has happened as opposed to proving one's assumptions) based on a Just Culture approach (i.e. focus on the lessons to be learned rather than on the person to be punished) Specific techniques (and relevant rationale) for conducting certain parts of the investigation are provided in the following sections. The advice given is derived from shared experience and common sense and is therefore not intended to supplement or supersede relevant local instructions and procedures. 3.1 Evidence Gathering and Examination The stages of gathering evidence and their subsequent examination are very important for conducting an objective investigation. The following practices can prove very helpful: examination of evidence should start only after all of it has been gathered and categorized. categorization of evidence is critical for the later stages of the investigation. a systematic approach is essential to the success of the investigation. No conclusions should be drawn until all evidence has been examined and compared. existing evidence should not be "tailored" to fit the conclusions and contradicting evidence should not be neglected just because it does not fit.ICAO SHELL Model, as described in ICAO Doc 9859, Safety Management Manual, is a The concept (the name being derived from the initial letters of its components, Software, Hardware, Environment, Liveware) was first developed by Edwards in 1972, with a modified diagram to illustrate the model developed by Hawkins in 1975.Supervisory Violation: Refers to those instances when existing rules and regulations are willfully disregarded by supervisors (e.g., enforcement of rules and regulations, authorized unnecessary hazard, inadequate documentation).Supervisory Violation: Refers to those instances when existing rules and regulations are willfully disregarded by supervisors (e.g., enforcement of rules and regulations, authorized unnecessary hazard, inadequate documentation).The appropriate matching of the liveware - environmental interactions involve a wide array of disparate disciplines, from environmental studies, physiology, psychology through to physics and engineering.Errors Skill-Based Errors: Errors which occur in the operator's execution of a routine, highly practiced task relating to procedure, training or proficiency and result in an unsafe situation (e.g., fail to prioritise attention, checklist error, negative habit).Technological Environment: Refers to factors that include a variety of design and automation issues including the design of equipment and controls, display/interface characteristics, checklist layouts, task factors and automation.Inadequate Supervision: The role of any supervisor is to provide their staff with the opportunity to succeed, and they must provide guidance, training, leadership, oversight, or incentives to ensure the task is performed safely and efficiently.Errors Skill-Based Errors: Errors which occur in the operator's execution of a routine, highly practiced task relating to procedure, training or proficiency and result in an unsafe a situation (e.g., fail to prioritize attention, checklist error, negative habit).Technological Environment: Refers to factors that include a variety of design and automation issues including the design of equipment and controls, display/interface characteristics, checklist layouts, task factors and automation.Inadequate Supervision: The role of any supervisor is to provide their staff with the opportunity to succeed, and they must provide guidance, training, leadership, oversight, or incentives to ensure the task is performed safely and efficiently.human factors include such attributes as: human physiology (including perception, cognition, memory, social interaction, error); work place design; environmental conditions; human-machine interface; anthropometrics (the scientific study of measurements of the human body).Similarly, switches should have been positioned in locations that can be easily accessed by controllers in various situations and the manipulation of equipment should not impede the reading of displayed information or other devices which might need to be used at the same time.Swiss Cheese Model 1.5 Description The Swiss Cheese model of accident causation, originally proposed by James Reason, likens human system defences to a series of slices of randomly-holed Swiss Cheese arranged vertically and parallel to each other with gaps in-between each slice.5.1 The HFACS Framework The HFACS framework (Figure 1) describes human error at each of four levels of failure: Unsafe acts of operators (e.g., aircrew), Preconditions for unsafe acts, Unsafe supervision, and Organisational influences.Once this trend was identified, the Navy was able to implement interventions that not only reduced the percentage of accident associated with violations, but sustained this reduction over time.1.2 Liveware-Software (The interface between people and software) Software is the collective term which refers to all the laws, rules, regulations, orders, standard operating procedures, customs and conventions and the normal way in which things are done.This interface is the one most commonly considered when speaking of human-machine systems: design of seats to fit the sitting characteristics of the human body, of displays to match the sensory and information processing characteristics of the user, of controls with proper movement, coding and location.Environmental Factors Physical Environment: Refers to factors that include both the operational setting (e.g., weather, altitude, terrain) and the ambient environment (e.g., heat, vibration, lighting, toxins).Physical/Mental Limitations: Refers to the circumstance when an operator lacks the physical or mental capabilities to cope with a situation, and this affects performance (e.g., visual limitations, insufficient reaction time).Fail to Correct Known Problem: Refers to those instances when deficiencies are known to the supervisor, yet are allowed to continue unabated (e.g, report unsafe tendencies, initiate corrective action, correct a safety hazard).The HFACS framework may also be useful as a tool for guiding future accident investigations in the field and for developing better accident databases, both of which would improve the overall quality and accessibility of human factors accident data.By using HFACS, an organisation can identify where hazards have arisen historically and implement procedures to prevent these hazards which will result in improved human performance and decreased accident and injury rates.Environmental Factors Physical Environment: Refers to factors that include both the operational setting (e.g., weather, altitude, terrain) and the ambient environment (e.g., heat, vibration, lighting, toxins).Physical/Mental Limitation: Refers to when an operator lacks the physical or mental capabilities to cope with a situation, and this affects performance (e.g., visual limitations, insufficient reaction time).Fail to Correct Known Problem: Refers to those instances when deficiencies are known to the supervisor, yet are allowed to continue unabated (e.g, report unsafe tendencies, initiate corrective action, correct a safety hazard).This building block diagram does not cover the interfaces which are outside Human Factors (hardware-hardware; hardware-environment; software-hardware) and is only intended as a basic aid to understanding Human Factors: Software - the rules, procedures, written documents etc., which are part of the standard operating procedures.However, of all the dimensions in the model, this is the one which is least predictable and most susceptible to the effects of internal (hunger, fatigue, motivation, etc.) and external (temperature, light, noise, workload, etc.) changes.It includes programmes like Crew Resource Management (CRM), the ATC equivalent - TRM (TRM), Line Oriented Flight Training (LOFT) etc.Reason hypothesizes that most accidents can be traced to one or more of four levels of failure: Organisational influences, Unsafe supervision, Preconditions for unsafe acts, and The unsafe acts themselves. Decision Errors: Errors which occur when the behaviors or actions of the operators proceed as intended yet the chosen plan proves inadequate to achieve the desired end-state and results in an unsafe situation (e.g, exceeded ability, rule-based error, inappropriate procedure). Condition of operators refers to the adverse mental state, adverse physiological state, and physical/mental limitations factors that affect practices, conditions or actions of individuals and result in human error or an unsafe situation. Operational Process: Refers to organisational decisions and rules that govern the everyday activities within an organisation (e.g., operations, procedures, oversight). Both of these methods will allow organisations to identify weak areas and implement targeted, data-driven interventions that will ultimately reduce accident and injury rates. 5.7 Application of HFACS While the first use of the HFACS framework occurred in the US Navy where it originated, the system has spread to a variety of industries and organizations (e.g. mining, construction, rail and healthcare). Organizations such as the Federal Aviation Administration (FAA) and National Aeronautics and Space Administration have explored the use of HFACS as a complement to pre-existing systems. Decision Errors: Errors which occur when the behaviours or actions of the operators proceed as intended yet the chosen plan proves inadequate to achieve the desired end-state and results in an unsafe situation (e.g, exceeded ability, rule-based error, inappropriate procedure). 5.10 HFACS Level 2: Preconditions for Unsafe Acts The Preconditions for Unsafe Acts level is divided into three categories – environmental factors, condition of operators, and personnel factors – and these two categories are then divided into subcategories. Condition of operators refer to the adverse mental state, adverse physiological state, and physical/mental limitations factors that affect practices, conditions or actions of individuals and result in human error or an unsafe situation. Operational Process: Refers to organisational decisions and rules that govern the everyday activities within an organisation (e.g., operations, procedures, oversight). Liveware – the human beings – the controller with other controllers, flight crews, engineers and maintenance personnel, management and administration people – within in the system. Sometimes, two simplistic alternatives are proposed in addressing error: there is no point in trying to remove errors from human performance, they are independent of training; or, humans are error prone systems, therefore they should be removed from decision making in risky situations and replaced by computer controlled devices. It is a broad human error framework that was originally used by the U.S. Navy to investigate and analyse human factors aspects of aviation. Figure ?0 1The HFACS framework 5.2 HFACS Level 1: Unsafe Acts The Unsafe Acts level is divided into two categories – errors and violations – and these two categories are then divided into subcategories. Perceptual Errors: Errors which occur when an operator's sensory input is degraded and a decision is made based upon faulty information. 5.3 HFACS Level 2: Preconditions for Unsafe Acts The Preconditions for Unsafe Acts level is divided into three categories: environmental factors, condition of operators, and personnel factors. Personal Readiness: Refers to off-duty activities required to perform optimally on the job such as adhering to crew rest requirements, alcohol restrictions, and other off-duty mandates. Plan Inappropriate Operation: Refers to those operations that can be acceptable and different during emergencies, but unacceptable during normal operation (e.g., risk management, crew pairing, operational tempo).Resource Management: Refers to the organisational-level decision-making regarding the allocation and maintenance of organisational assets (e.g., human resources, monetary/budget resources, equipment/facility recourse).Common trends within an organisation can be derived from comparisons of psychological origins of the unsafe acts, or from the latent conditions that allowed these acts within the organisation.Perceptual Errors: Errors which occur when an operator's sensory input is degraded and a decision is made based upon faulty information.Personnel factors refer to the crew resource management or TRM and personal readiness factors that affect practices, conditions or actions of individuals, and result in human error or an unsafe situation.Personal Readiness: Refers to off-duty activities required to perform optimally on the job such as adhering to crew rest requirements, alcohol restrictions, and other off-duty mandates.Plan Inappropriate Operation: Refers to those operations that can be acceptable and different during emergencies, but unacceptable during normal operation (e.g., risk management, crew pairing, operational tempo).Resource Management: Refers to the organisational-level decision-making regarding the allocation and maintenance of organisational assets (e.g., human resources, monetary/budget resources, equipment/facility recourse).Over the past 40 years, over 80% of accidents and incidents were related to the human element and were largely preventable through the proper application of Human Factors principles.1.ICAO SHELL Model conceptual tool used to analyse the interaction of multiple system components.Hardware - the Air Traffic Control suites, their configuration, controls and surfaces, displays and functional systems.1.4 Liveware - Environment (The interface between people and the environment) The liveware - environment interface refers to those interactions which may be out of the direct control of humans, namely the physical environment - temperature, weather, etc., but within which aircraft operate.In the Swiss Cheese model, an organisation's defences against failure are modelled as a series of barriers, represented as slices of the cheese.5 1 Definition The Human Factors Analysis and Classification System (HFACS) was developed by Dr Scott Shappell and Dr Doug Wiegmann.Investigators are able to systematically identify active and latent failures within an organisation that culminated in an accident.Within each level of HFACS, causal categories were developed that identify the active and latent failures that occur.Errors are unintentional behaviors, while violations are a willful disregard of the rules and regulations.Environmental factors refer to the physical and technological factors that affect practices, conditions and actions of individual and which result in human error or an unsafe situation.Personnel factors refer to the crew resource management and personal readiness factors that affect practices, conditions or actions of individuals, and result in human error or an unsafe situation.HFACS can also be used proactively by analyzing historical events to identify reoccurring trends in human performance and system deficiencies.By breaking down the human contribution to performance, it enables the analyst to identify the underlying factors that are associated with an unsafe act.Identifying those common trends supports the identification and prioritization of where intervention is needed within an organisation.5.9 HFACS Level 1: Unsafe Acts The Unsafe Acts level is divided into two categories - errors and violations - and these two categories are then divided into subcategories.Errors are unintentional behaviours, while violations are a willful disregard of the rules and regulations.Environmental factors refer to the physical and technological factors that affect practices, conditions and actions of individual and result in human error or an unsafe situation.In order to achieve a safe, effective operation between the liveware and software it is important to ensure that the software, particularly if it concerns rules and procedures, is capable of being implemented.1.3 Liveware-hardware (The interface between people and hardware) Another interactive component of the SHELL model is the interface between liveware and hardware.Hardware, for example in Air Traffic Control, refers to the physical features within the controlling environment, especially those relating to the work stations.The HFACS framework provides a tool to assist in the investigation process and target training and prevention efforts.Exceptional Violations: Violations which are an isolated departure from authority, neither typical of the individual nor condoned by management.Condition of Operators Adverse Mental State: Refers to factors that include those mental conditions that affect performance (e.g., stress, mental fatigue, motivation).Adverse Physiological State: Refers to factors that include those medical or physiological conditions that affect performance (e.g, medical illness, physical fatigue, hypoxia).Personnel Factors Crew Resource Management: Refers to factors that include communication, coordination, planning, and teamwork issues.Organisational Climate: Refers to the working atmosphere within the organisation (e.g., structure, policies, culture).The US Navy was experiencing a high percentage of aviation accidents associated with human performance issues.Using the HFACS framework, the Navy was able to identify that nearly one-third of all accidents were associated with routine violations.Exceptional Violations: Violations which are an isolated departure from authority, neither typical of the individual nor condoned by management.Condition of Operators Adverse Mental State: Refers to factors that include those mental conditions that affect performance (e.g., stress, mental fatigue, motivation).Adverse Physiological State: Refers to factors that include those medical or physiological conditions that affect performance (e.g, medical illness, physical fatigue, hypoxia).Personnel Factors Crew Resource Management: Refers to factors that include communication, coordination, planning, and teamwork issues.Organisational Climate: Refers to the working atmosphere within the organisation (e.g., structure, policies, culture).This does not imply that human factors issues were not present before these dates nor that human error did not contribute to other incidents; merely that it took an accident to draw attention to human factors problems and potential solutions."Human factors" refers to the study of human capabilities and limitations in the workplace.One practical diagram to illustrate this conceptual model uses blocks to represent the different components of Human Factors.According to the SHELL Model, a mismatch between the Liveware and other four components contributes to human error.Thus, these interactions must be assessed and considered in all sectors of the aviation system.The edges of this block are not simple and straight, and so the other components of the system must be carefully matched to them if stress in the system and eventual breakdown are to be avoided.Increasingly, software also refers to the computer-based programmes developed to operate the automated systems.The holes in the cheese slices represent individual weaknesses in individual parts of the system, and are continually varying in size and position in all slices.This is especially true for the positions of gauges and switches whose position can be unintentionally changed when moved away from the scene.The following practices generally give a better chance for obtaining the most (and most useful) information: statements need to be taken shortly after the event, otherwise memories may fade.4.8 Safety Recommendations As appropriate, briefly state any recommendations made for the purpose of accident prevention and any resultant corrective action.The goal of HFACS is not to attribute blame; it is to understand the underlying causal factors that lead to an accident.Violations Routine Violations: Violations which are a habitual action on the part of the operator and are tolerated by the governing authority.5.4 HFACS Level 3: Unsafe Supervision The Unsafe Supervision level is divided into four categories.5.5 HFACS Level 4: Organisational Influences The Organisational Influences level is divided into three categories.5.6 Use of HFACS By using the HFACS framework for accident investigation, organisations are able to identify the breakdowns within the entire system that allowed an accident to occur.5.8 HFACS Taxonomy The HFACS taxonomy describes four levels within Reason's model and are described below.Violations Routine Violations: Violations which are a habitual action on the part of the operator and are tolerated by the governing authority.5.11 HFACS Level 3: Unsafe Supervision The Unsafe Supervision level is divided into four categories.5.12 HFACS Level 4: Organisational Influences The Organisational Influences level is divided into three categories.Creativity, adaptability, and flexibility are our strengths.Continual alertness and precision in action or memory are our weaknesses.o If the accident or incident rate is to be decreased, human factors must be better understood and the knowledge more broadly applied.It also refers to a framework proposed in ICAO Circular 216-AN31.Liveware The critical focus of the model is the human participant, or liveware, the most critical as well as the most flexible component in the system.Human Error is often seen as the negative consequence of the liveware dimension in this interactive system.In this interface, we are concerned with leadership, co-operation, teamwork and personality interactions.More intangible are difficulties in symbology and the conceptual design of systems.As an example the press to talk switch is a hardware component which interfaces with liveware.The switch will have been designed to meet a number of expectations, including the probability that when it is pressed the controller has a live line to talk.Much of the human factor development in this area has been concerned with designing ways in which people or equipment can be protected, developing protective systems for lights, noise, and radiation.Interviews Most investigations use witness statements to help reconstruct the events.If at any time leading up to the adverse event, one of the failures is corrected, the adverse event will be prevented.HFACS provides a structure to review and analyze historical accident and safety data.People are not precision machinery designed for accuracy.Neither of these alternatives are particularly helpful in managing errors.1.1 Liveware-Liveware (the intertface between people and other people) This is the interface between people.creating a sketch of the scene takes little time but can be very useful, especially in the first days of the investigation when computer models are not yet ready.recording the interview (with the person's consent) is preferable to taking notes.HFACS is heavily based upon James Reason's Swiss cheese model (Reason 1990).These three categories are further divided into subcategories.We are amazingly error tolerant.1 introduction in June 1990 brought the need to address human factors issues in this environment into sharp focus.Human factors researchers study system performance.Environment - the situation in which the L-H-S system must function, the social and economic climate as well as the natural environment.Also attention needs to be shown with phraseologies which are error prone, confusing or too complex.taking a lot of photos is essential for preserving the scene.oral form is preferable to written.Most people do not like writing, and will generally tend to summarize instead of giving as much detail as possible.4.7 Conclusions List the findings and causes established in the investigation.4.9 Appendices Include, as appropriate, any other pertinent information considered necessary for the understanding of the report.In theory, at least one failure will occur at each level leading to an adverse event.We are extremely flexible.no statement should be discarded out of hand.A statement from a witness experienced in aviation is not necessarily the most valuable.The list of causes should include both the immediate and the deeper systemic causes.Over the years, the application reached civil and general aviation.It is a fact of life.In fact, we humans are a different kind of device entirely.