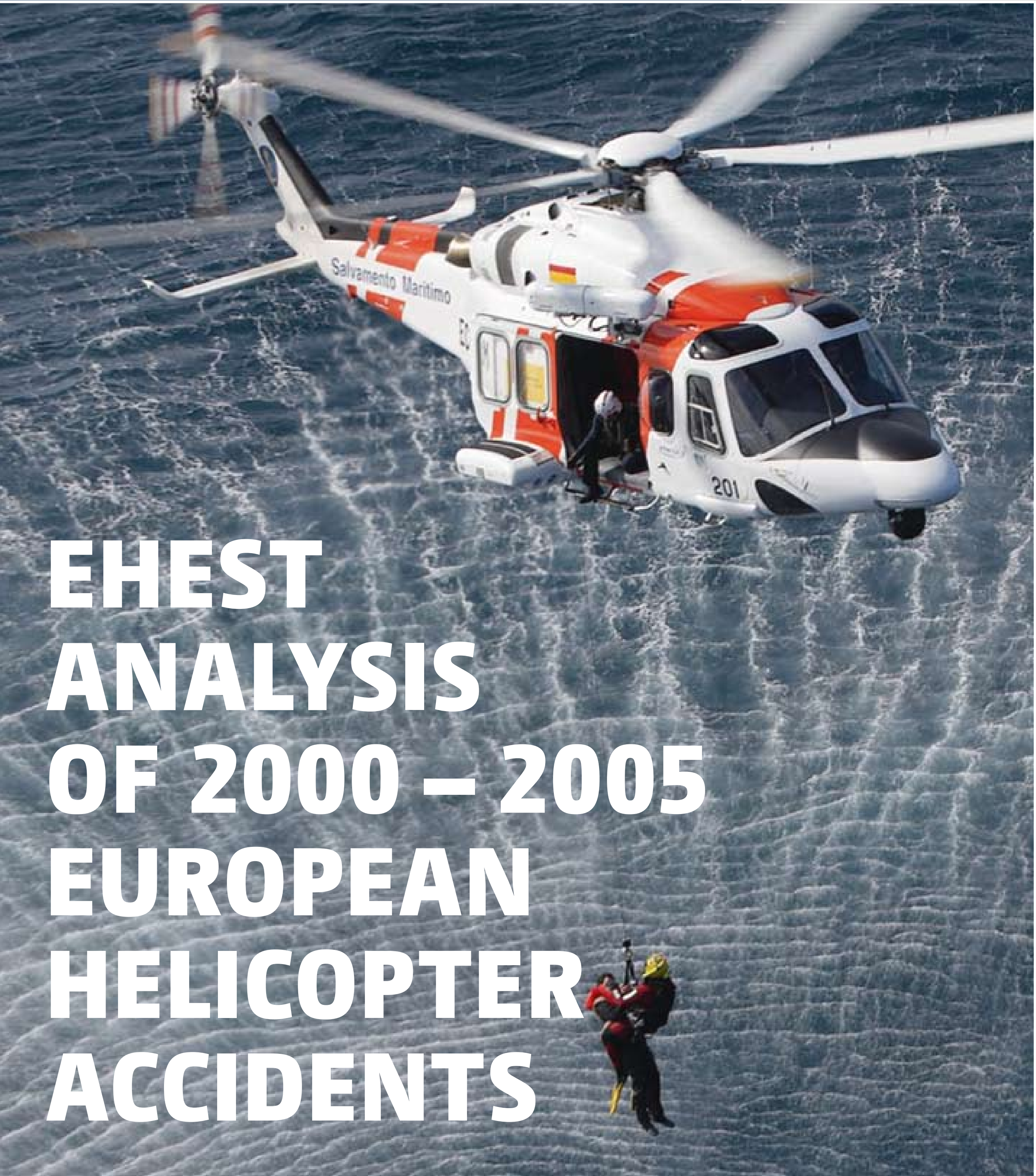
EHEST
Component of ESSI

FINAL REPORT 2010



EHEST ANALYSIS OF 2000 – 2005 EUROPEAN HELICOPTER ACCIDENTS

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EXECUTIVE SUMMARY

The **EUROPEAN STRATEGIC SAFETY INITIATIVE (ESSI)** is a ten year program launched in 2006 to enhance aviation safety in Europe and for the European citizen worldwide. ESSI is a voluntary partnership between the European Aviation Safety Agency (EASA), European national aviation authorities, manufacturers, operators, professional unions, research organisations and the General Aviation community. More than 150 organisations have participated to date.

The basic principle is to improve aviation safety by complementing regulatory action by voluntarily encouraging and committing to cost-effective safety enhancements. Analysis of occurrence data, coordination with other safety initiatives and implementation of cost-effective action plans are carried out to achieve specific safety goals.

The ESSI has three components: the European Commercial Aviation Safety Team (ECAST) – the European equivalent to CAST in the United States; the European General Aviation Safety Team (EGAST); and the **EUROPEAN HELICOPTER SAFETY TEAM (EHEST)**.

EHEST is also the European component of the **INTERNATIONAL HELICOPTER SAFETY TEAM (IHST)**. IHST was formed as a major initiative to improve helicopter safety worldwide. It is a combined government and industry effort to reduce the civil helicopter accident rate by 80 percent over the 10 years to 2016. EHEST has adopted this IHST objective for Europe.

To achieve this goal IHST has adopted and adapted a process originally developed by the United States Commercial Aviation Safety Team (US CAST). The CAST strategy is to significantly increase public safety by adopting an integrated, data-driven methodology to reduce the fatality risk in fixed wing commercial air travel. The process involves the development of safety enhancements and action plans based on the review of occurrence data. Substantial safety benefits have been obtained from applying this process in the fixed wing community.

Within the IHST/EHEST structure, two main working groups were created to deal with the different process steps: an analysis team (for Europe the EHSAT) and an implementation team (for Europe the EHSIT).

The European Helicopter Safety Analysis Team (EHSAT) analyses accident investigation reports and, from this analysis, identifies suggestions for safety enhancement. EHSAT regional teams have been formed in Finland, France, Germany, Hungary, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom. It is estimated that these States account for more than 90% of the helicopters registered in Europe. The analysis results of the different regional teams are consolidated on a European level. This initiative is unique in its efforts to prepare a European wide accident analysis of helicopter accidents.

The EHSAT analysis consolidates analysis of European wide helicopter accident data. The analysis methodology is described in **CHAPTER 3**. **CHAPTER 4** presents the results based on the 311 helicopter accidents in the timeframe 2000–2005 analysed so far. The scope of the data set is accidents[1] that occurred within an EASA Members State where a final investigation report from the Accident Investigation Board (AIB) has been issued.

Of the accidents analysed: 140 accidents involve General Aviation operations; 103 accidents involve Aerial Work operations; 59 were Commercial Air Transport operations; and 9 involved State Flights. Most accidents analysed by the EHSAT occurred during the en route phase of flight.

The accident analysis aims at identifying all factors, causal or contributory, that played a role in the accident. Factors are coded using two taxonomies: Standard Problem Statements (SPS) and Human Factors Analysis and Classification System (HFACS) codes.

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[1] as defined by ICAO Annex 13 Aircraft Accident and Incident Investigation.

The top three Standard Problem Statements identified were:

- **Pilot judgment & actions**
- **Safety Culture/Management**
- **Ground duties**

The use of the HFACS taxonomy by the EHSAT provided a complementary perspective on human factors. In 78 % of the accidents, at least one HFACS factor was identified. In most accidents unsafe acts or preconditions for unsafe acts were identified. In fewer accident reports supervisory or organisational influences were identified. The potential to identify such factors is very much dependent on the depth of the accident investigation performed and the accident data available.

For both the SPS and HFACS taxonomies, different patterns were observed for Commercial Air Transport, Aerial Work and General Aviation. **SECTION 4.4** provides an overview of the factors for the different type of operations identified at the lowest level of the taxonomy.

Most Intervention Recommendations (IRs) were identified in the three areas of:

- **Flight Operations & Safety Management/Culture**
- **Training/Instructional**
- **Regulatory/Standards/Guidelines**

The European Helicopter Safety Implementation Team (EHSIT) was launched in February 2009. This team uses the accident analysis and the intervention recommendations produced by the EHSAT to develop safety enhancement strategies and action plans.

In 2009 the EHSIT defined a process to aggregate, consolidate, and prioritise the intervention recommendations produced by the EHSAT and also defined safety strategies and action plans. To address the top intervention recommendation categories identified by the EHSAT, the EHSIT has launched three Specialist Teams on Operations and SMS, Training, and Regulation. These EHSIT teams are in the process of developing detailed action plans with a view to producing guidance material and toolkits that can be used to help drive down the accident rate in Europe.

The EHSAT will continue analysing accidents in order to monitor possible changes in accident scenarios. The team will also be involved in the measuring of results and effectiveness of safety improvements.

1. EUROPEAN HELICOPTER SAFETY TEAM

1.1 The broader picture: ESSI and IHST

The **EUROPEAN STRATEGIC SAFETY INITIATIVE (ESSI)** is a ten year program launched in 2006 to enhance aviation safety for European citizens. The ESSI is a partnership between the European Aviation Safety Agency (EASA), European national aviation authorities, manufacturers, operators, professional unions, research organisations, military operators and the General Aviation community. Currently, more than 150 organisations are participating.

The basic principle is to improve aviation safety by complementing regulatory action through voluntarily encouraging and committing to cost-effective safety enhancements. Analysis of occurrence data, coordination with other safety initiatives and implementation of cost-effective action plans are carried out to achieve specific safety goals.

The ESSI has three components: the European Commercial Aviation Safety Team (ECAST) – the European equivalent to CAST in the United States, the European General Aviation Safety Team (EGAST), and the **EUROPEAN HELICOPTER SAFETY TEAM (EHEST)**.

The EHEST brings together a range of civil stakeholders and a few military operators from across Europe [Ref.1-5]. EHEST comprises more than 75 participating organisations. A listing of participants is provided on the ESSI/EHEST website[2]. The team addresses the whole spectrum of civil helicopter operations across Europe, from commercial air transport to General Aviation.

EHEST is also the European component of the **INTERNATIONAL HELICOPTER SAFETY TEAM (IHST)**[3]. The IHST was formed as a major initiative to improve helicopter safety worldwide. It is a combined government and industry effort to reduce the helicopter accident rate by 80 percent by the year 2016. EHEST is committed to the IHST goal, with emphasis on European safety.

The IHST has an Executive Committee composed of representatives of the United States Federal Aviation Administration (FAA), Helicopter Association International (HAI), American Helicopter Society International (AHS), Transport Canada (TCCA), the Helicopter Association of Canada (HAC), European Aviation Safety Agency (EASA), new European Helicopter Association (new EHA) and several industry partners.

So far, regional teams have been established in the United States, Europe, Canada,

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[2] http://www.easa.europa.eu/essi/ehestEN.html

[3] http://www.ihst.org/

India, Brazil, the Gulf Cooperation Council (GCC) states and Australia. At the same time the IHST is seeking to further expand on an international level.

1.2 Process description

In order to pursue the 80% civil helicopter accident rate reduction goal, the IHST adopted and adapted a process originally developed by the United States Commercial Aviation Safety Team (US CAST). The CAST strategy is to significantly increase public safety by adopting an integrated, data-driven methodology aimed to reduce the fatality risk in fixed wing aircraft commercial air travel.

The process involves a data-driven methodology, where based on the review of occurrence data, safety enhancements and action plans are developed, **SEE FIGURE 1**. These enhancements may address both regulators and industry and should be implemented by the participating organisations. Both the level of the actual implementation and the effects need to be measured in order to ensure that effective actions were put in place.

Within the IHST/EHEST structure, two main working groups were created to deal with the different process steps: an **ANALYSIS TEAM** (for Europe the EHSAT) and an **IMPLEMENTATION TEAM** (for Europe the EHSIT).

1.3 European Helicopter Safety Analysis Team

The **EUROPEAN HELICOPTER SAFETY ANALYSIS TEAM (EHSAT)** analyses accident investigation reports and, from this analysis, identifies suggestions for safety enhancement. To tackle the variety of languages in the accident reports and account for regional characteristics, EHSAT Regional Teams have been formed in Finland, France, Germany, Hungary, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom. A preliminary EHSAT report of helicopter accident analysis was published by the EU Publications Office and was based on data originally presented to an EHEST conference held in Portugal in October 2008. [Ref.6]

It is estimated that these States account for more than 90% of the helicopters registered in Europe. The analysis of the different regional teams is consolidated at European level by the EHSAT Core Team composed of all Regional Team leaders and EASA. This initiative is unique in its efforts to prepare a Europe-wide analysis of helicopter accidents. The EHSAT will ultimately also be involved in the measuring of results and effectiveness of safety improvements developed within the initiative.

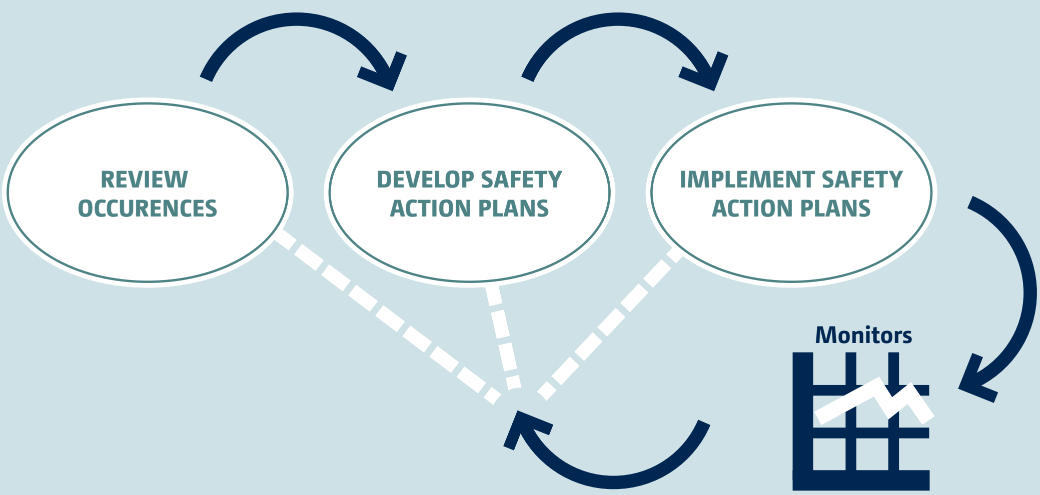
Details on the analysis results of the EHSAT can be found in **CHAPTER 4**.

A few State organisations, such as the military, were involved in some of the EHSAT regional teams or are doing an individual analysis using the EHSAT methodology. The involvement of these organisations in EHEST is warmly welcomed, since the issues relating to helicopter flight safety can to some degree be similar.

1.4 European Helicopter Safety Implementation Team

The **EUROPEAN HELICOPTER SAFETY IMPLEMENTATION TEAM** (EHSIT) was launched in February 2009. The team uses the accident analysis and the Intervention Recommendations produced by the EHSAT to develop safety enhancement strategies and action plans. As well as creating Specialist Teams for important topics, the EHSIT also exploits the same regional organisation as the EHSAT because: relations between partners are already established; teams are aware of local context; and action plans will eventually be implemented at a local level to account for language and other differences. Details on the EHSIT activities are presented in **CHAPTER 5**.

FIGURE 1 **DATA-DRIVEN PROCESS ADAPTED FROM US CAST**



2. BACKGROUND DATA FOR EUROPE

In Europe[4], helicopters are used in a wide variety of operations and regions — from North Sea off shore operations to mountain flying, from Emergency Medical Services to fire-fighting operations, and from training to pleasure flights.

For 2008, it was estimated that approximately 6800 helicopters were registered in Europe for civil use[5]. No reliable flight hour data is available for all registered helicopters across Europe. However, for the year 2008 a total of 1.7 million flight hours and 4.7 million landings was estimated for turbine powered helicopters, involved in civil use, registered in Europe[6].

Data collected for the EASA annual safety review [Ref. 7] provide an indication of the number of helicopter accidents within Europe. **FIGURE 2** presents the number of heavy helicopters fatal accidents worldwide in commercial air transport for helicopters operated by EASA Member State operators and third country operators. Data on light helicopter accidents is presented in **TABLES 1** and **2**.

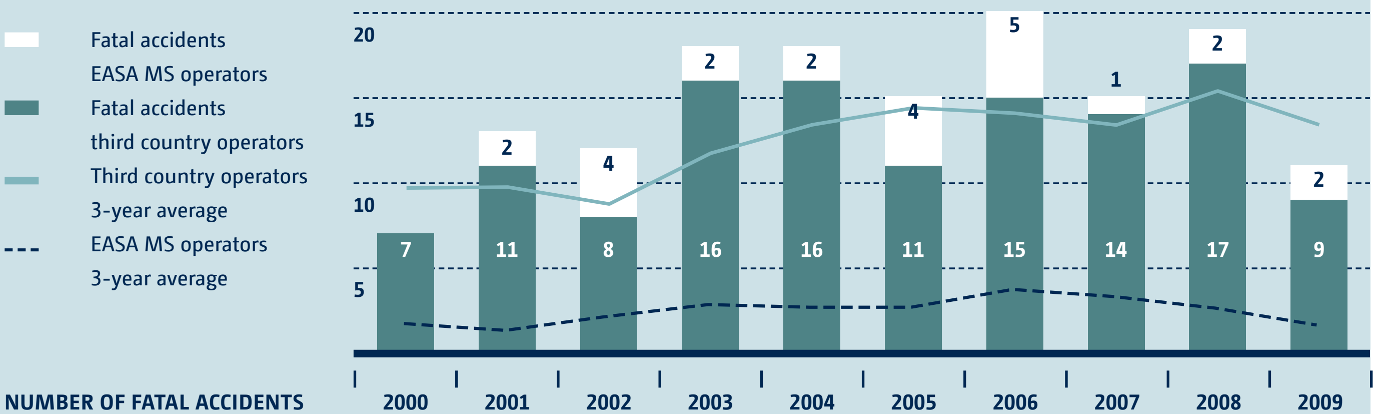
[4] For this report, Europe (referred later as EASA Member States) is considered to be the 27 European Union Member States plus Iceland, Liechtenstein, Norway and Switzerland

[5] *Source:* HeliCAS and EASA data warehouse

[6] *Source:* NLR and EASA data warehouse

FIGURE 2

FATAL ACCIDENTS IN COMMERCIAL AIR TRANSPORT WORLDWIDE — EASA MS AND THIRD COUNTRY OPERATED HELICOPTERS, MAXIMUM TAKE-OFF MASS OVER 2250 KG



NUMBER OF FATAL ACCIDENTS

TABLE 1 HELICOPTER ACCIDENTS AND FATALITIES, EASA MEMBER STATES, MAXIMUM TAKE-OFF MASS OVER 2250 KG

Overview of total number of helicopter accidents and fatal accidents for Europe
Maximum take-off mass over 2250 kg *(Source EASA Annual Safety Review 2009)*

Operation type	Period	Number of accidents	Fatal accidents	Fatalities on board
Commercial Air Transport	1998 – 2007 (average)	8	3	11
	2008 (total)	10	2	4
	2009 (total)	5	2	18
General Aviation	1998 – 2007 (average)	5	2	3
	2008 (total)	1	0	0
	2009 (total)	2	2	3
Aerial Work	1998 – 2007 (average)	6	2	3
	2008 (total)	5	1	2
	2009 (total)	1	1	4

Note: Numbers for Commercial Air Transport based on EASA Member State operated helicopters, numbers for General Aviation and Aerial Work based on EASA Member State registered.

TABLE 2 LIGHT HELICOPTER ACCIDENTS AND FATALITIES, EASA MEMBER STATES, MAXIMUM TAKE-OFF MASS BELOW 2250 KG

Overview of total number of helicopter accidents and fatal accidents for Europe
Maximum take-off mass below 2250 kg *(Source EASA Annual Safety Review 2009)*

Operation type	Period	Number of accidents	Fatal accidents	Fatalities on board
All	2006 – 2008 (average)	79	8	18
	2009 (total)	95	15	28

3. ANALYSIS METHODOLOGY

EHSAT committed to ensuring that the analysis carried out in Europe is compatible with the work performed by other analysis teams worldwide, so that the analysis results could be collated at a worldwide level. The methodology therefore was basically inherited from the Joint Helicopter Safety Analysis Team in the United States (US JHSAT) [Ref.8], which itself adapted to helicopters the methodology originally developed in the late 1990s by US CAST for the analysis of fixed wing commercial air transport accidents.

3.1 Introduction

The EHSAT accident analysis, performed by the EHSAT Regional Teams, is based on a standardised method, featuring the use of defined taxonomies and expert judgement. The analysis aimed at identifying all factors, causal or contributory, that played a role in the accident.

In order not to interfere with ongoing accident investigations and to ensure the data analysed was to the same ICAO Annex 13 standard only those accidents where a final investigation report issued by AIBs were analysed.

Analysing an accident on all aspects requires a diverse and balanced set of competences. It was therefore agreed that each EHSAT analysis team should include members with a balanced range of competences, bringing together representatives with different backgrounds.

The first step in the EHSAT analysis is the collection of factual information on the accident, such as occurrence date, state of occurrence, aircraft registration, helicopter make and model, operation type, aircraft damage, injury level, phase of flight, meteorological conditions, and flight crew flight experience. EHSAT introduced the ICAO ADREP 2000 taxonomy to collect this information, for standardisation purposes and allowing exchange of information with the ECCAIRS[7] system.

Next the analysis team identifies all the factors that played a role in the accident. This process focuses on identifying all factors, not only the primary cause. It also includes

[7] ECCAIRS stands for European Coordination Centre for Accident and Incident Reporting Systems. The ECCAIRS Reporting System is composed of various applications forming together a suite of products allowing organisations to create, maintain and deploy a repository of accident and incident reports. ECCAIRS is used by many NAAs and AIBs in Europe and elsewhere.

factors that could have initiated hours, days or even weeks before the accident. These factors are then coded using standardised taxonomies. The use of standardised codes supports accident aggregation and statistical analysis. Two complementary taxonomies were used: Standard Problem Statements and the HFACS model, described in the following sections.

3.2 Standard Problem Statements

The **STANDARD PROBLEM STATEMENTS** (SPS) taxonomy inherited from IHST/US JHSAT has over 400 codes in 14 different areas. The structure consists of three levels: the first level identifies the main area of the SPS. Level 1 categories are: Ground duties, Safety Management, Maintenance, Infrastructure, Pilot judgement and actions, Communications, Pilot situation awareness, Part/system failure, Mission risk, Post-crash survival, Data issues, Ground personnel, Regulatory and Aircraft design. The second and third levels go into more detail. **FIGURE 3** presents an example of the translation of the analysis into a three-level SPS code. A single factor identified in the accident can be coded using multiple SPSs if appropriate.

FIGURE 3 **EXAMPLE OF STANDARD PROBLEM STATEMENT**

Analysis / Whg / Contributing factors	SPS nr.	level 1	level 2	level 3
The commander inadvertently entered IMC and probably became spatially disoriented	701005	Pilot situation awareness	Visibility/ Weather	Inadvertent entry into IMC

3.3 HFACS

To address human factors in a structured manner, EHSAT also introduced a second taxonomy and classification system: The **HUMAN FACTORS ANALYSIS AND CLASSIFICATION SYSTEM (HFACS)**. HFACS was developed from Reason's concept of latent and active failures [Ref.9-10]. The HFACS model describes human error at four levels: organisational influences, unsafe supervision, preconditions for unsafe acts and the unsafe acts of operators (e.g. flight crew, maintainers, air traffic controllers etc.), **SEE FIGURE 4**. The classification system contains over 170 codes in these four main areas. In addition to providing more detail on human factors, it also encourages the analysis to not only identify the human error on an operator level, but to also search for underlying management and organisational factors. An example of HFACS coding is provided in **FIGURE 5**.

Additionally, the HFACS Maintenance Extension (HFACS ME) was introduced to code maintenance related human factors. HFACS ME is an adapted HFACS coding system for maintenance developed by the US Naval Safety Center. The system features the following main categories (from local to remote): Maintainer Acts, Maintainer Conditions, Working Conditions, and Management Conditions.

3.4 Intervention recommendations

The final analysis step consists of identifying Intervention Recommendations (IRs) for all the factors (SPS and HFACS) identified in the previous steps. IRs are aimed at preventing those factors, directly or remotely involved, from reoccurring. One or several IRs can be formulated for each SPS or HFACS factor.

IRs are freely generated and formatted in free text, using the diverse expertise in the analysis team and supporting creativity. A special support table was created to invite the analysis teams to go through all flight phases and to target various aspects within the IRs such as regulations, design and other technical factors (e.g. weight and balance), certification, operations; procedures, staffing, qualification, licensing and training, weather, winds, turbulences and other environment factors, working environment factors, workload, fatigue, attitudes, national, regional, company and professional culture and other human factors, production, commercial and market factors, management, Safety Management Systems (SMS) and safety culture, and accident investigation aspects.

FIGURE 4 **HFACS MODEL STRUCTURE**

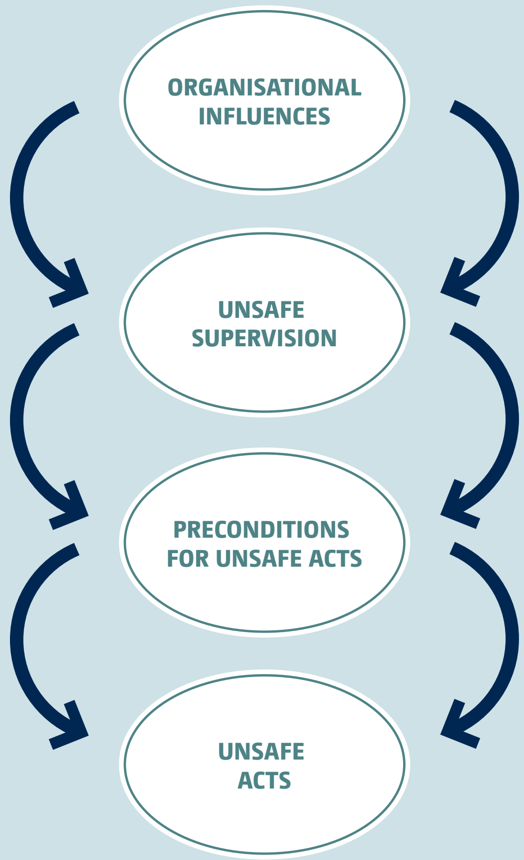


FIGURE 5 **EXAMPLE OF APPLICATION OF HFACS CODE**

Analysis / Whg / Contributing factors	HF ACS nr.	level 1	level 2	level 3
The commander inadvertently entered IMC and probably became spatially disoriented	5305100	Preconditions – Condition of Individuals	Perceptual Factors	Spactial Disorientation 3 Incapacitating
	5001040	Unsafe Acts – Errors	Skill-based Errors	Overcontrol/ Undercontrol
	5501030	Supervision	Inadequate Supervision	Local Training Issue/Programs
	5603020	Organizational Influences	Organizational Process	Program and Policy Risk Assessment

Finally, the IRs are categorised to allow consolidation of results. **FIGURE 6** presents an example of an Intervention Recommendation.

To assist the implementation team, and ultimately the industry and authorities, to determine best action course, all the coded factors (SPS and HFACS) are scored on Validity and Importance and the IRs on Ability and Usage. Validity is dependent on the level, quality and credibility of data and information available in the event report. Factors associated with hypothetical events not supported by documented evidence in the accident reports are scored low on validity. Importance is the measure of the identified factor importance in the event's chain of causal factors. Ability is the measure of how well an IR can mitigate an event's problem or contributing factor, assuming it performs exactly as intended. Usage is the measure of how confident we are that this intervention will be utilised and will perform as expected given this particular accident scenario.

Accident analysis provided by all Regional Teams are then consolidated to present a European picture. Finally, the analysis results are passed on to the implementation team, the EHSIT. Economic and other considerations are introduced in the EHSIT process to decide on best course of action and develop suitable and effective safety enhancement action plans.

FIGURE 6 **EXAMPLE OF INTERVENTION RECOMMENDATIONS**

Intervention recommendation	Intervention recommendation
[free text]	**[coded on Category level]**
All periodic base check flying tests carried out by the Operator should include the pilot's capability to fly by sole reference to flight instruments.	Training/Instructional
Regulations should address the hazards of flight in a Degraded Visual Environment (DVE).	Regulatory

4. ANALYSIS RESULTS

This chapter presents the analysis results of the EHSAT.

4.1 Scope

The EHSAT analysis scope has been initially limited to:

- **Accidents (definition ICAO Annex 13) reported by accident investigation boards (AIB), where a final report is available,**
- **Date of occurrence between 01 January 2000 – 31 December 2005,**
- **State of occurrence located in Europe.**

The final dataset analysed by the EHSAT consists of 311 accidents involving 312 helicopters (status 31 March 2010).

Additional accidents outside of the 2000 to 2005 time frame have been analysed by some States. Although not included in the analysis presented in **SECTIONS 4.2** through **4.4**, this data has been included in the Intervention recommendation consolidation exercises being performed by the Specialist Teams and presented in **SECTION 4.5**.

4.2 Factual data

In the accident dataset, the largest category was General Aviation accidents, **SEE FIGURE 7**. A relatively large proportion of fatal accidents have been analysed, **SEE FIGURE 8**. This is most probably the result of good availability of accident

FIGURE 7

Distribution of type of operation in the accident dataset

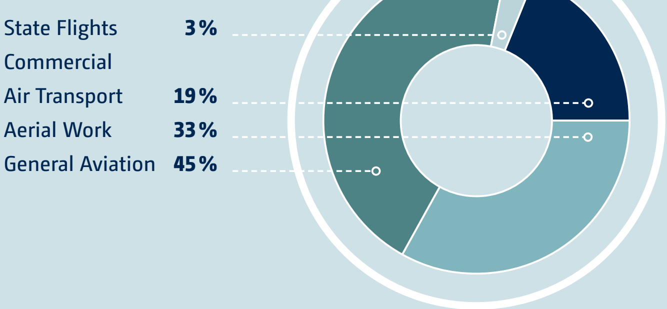
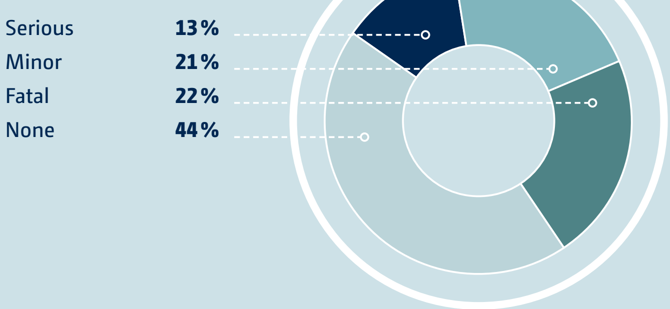


FIGURE 8

Distribution of injury level in the accident dataset



reports for fatal accidents. Because of the limited number of State Flights analysed, in this report these will not be dealt with separately.

Most accidents, 28 %, occurred during the en route phase of flight, **SEE FIGURE 9**. When looking only at fatal accidents, 67 % of the fatal accidents occurred during the en route phase. In general, during the en route phase more time is spent at high speed and therefore the energy available is higher.

4.3 Factor identification – all accidents

The accident analysis aims at identifying all factors, causal or contributory, that played a role in the accident. Factors are coded using the two taxonomies described in **SECTIONS 3.2** and **3.3**: Standard Problem Statements (SPS) and Human Factors Analysis and Classification System (HFACS) codes.

4.3.1 Standard Problem Statements

For the accidents in the dataset, a total of 1836 Standard Problem Statement counts were recorded.

The order of the SPS categories is globally consistent with the number of fatalities too (not presented in the figure).

The area that was identified in almost 70 % of the accidents in the dataset is **Pilot Judgment & Actions, SEE FIGURE 10**. This includes factors related to pilot decision making, unsafe flight profile, landing procedures, procedure implementation, Crew Resource Management and Human Factors such as diverted attention and perceptual judgment errors. The second most identified area (52 % of the accidents) is **Safety Culture / Management**. This includes identified issues related to (weaknesses in or lack of) Safety Management Systems, flight procedure training, disregard of known safety risk and self-induced pressure, pilot experience and training programme management. The area **Ground Duties**, identified in 40 % of the accidents, includes factors such as (poor or incomplete) mission planning and aircraft pre- and post-flight duties.

The area **Data Issues** is a specific area to code factors related to the lack of information in the accident report. It was found by the teams that in almost 40 % of the analysed accident reports there was insufficient information available to fully analyse and understand the accident. One of the reasons for insufficient information being available is the absence of a flight data recording capability in many helicopters. In addition, some accidents reports did not include the level of detail for a subsequent EHSAT analysis to be fully comprehensive.

FIGURE 9 DISTRIBUTION OF ACCIDENTS OVER THE PHASE OF FLIGHT

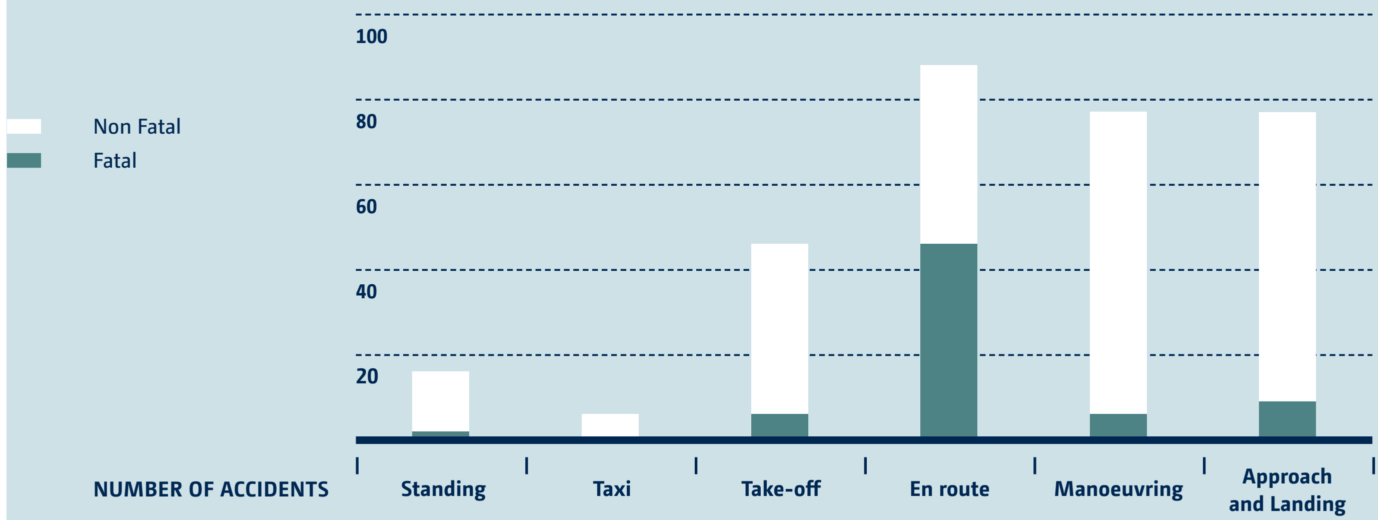
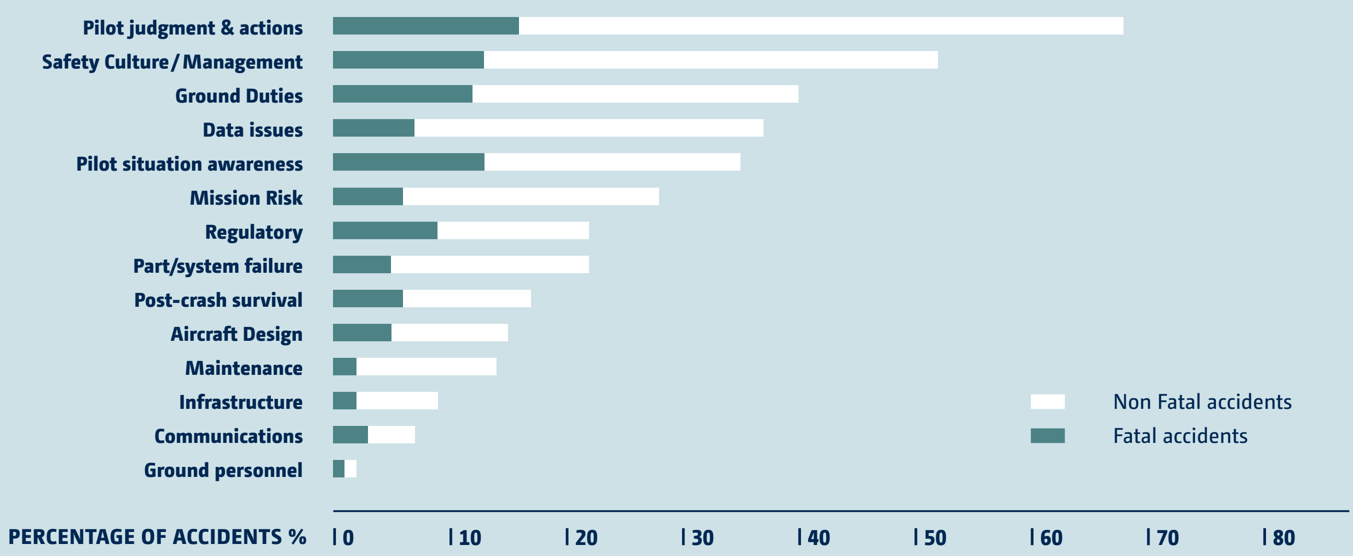


FIGURE 10 PERCENTAGE OF ACCIDENTS IN DATASET IN WHICH SPS CATEGORY (LEVEL 1, HIGHEST LEVEL) WAS IDENTIFIED AT LEAST ONCE



The area **Pilot Situation Awareness**, identified in 35% of the accidents, covers in-flight factors such as external environment awareness and visibility and weather issues.

Technical issues are spread over the several SPS Level 1 categories including Part/system failure, Aircraft design and Maintenance (however simply adding up the three SPS categories isn't possible because multiple codes may have been used for the same accident). Due to their nature helicopters are complex vehicles featuring much bespoke technology resulting in many airworthiness challenges. These challenges need to be addressed beside, and in relation with, operational issues. Some airworthiness issues are helicopter type and model specific and are therefore addressed through the existing initial certification and continuing airworthiness processes. The EHSIT Specialist Teams (**SEE SECTION 5**) will address generic design /airworthiness interventions relating to their area and consider technical and system solutions for possible interventions.

The highest level of Standard Problem Statements, level 1, only provides information on a general level. To better understand what kind of factors played a role in the accident data set it is required to look at a deeper level in the taxonomy. Looking at the level 2 Standard Problem Statements, pilot's decision making, mission planning and external environment awareness are the three most relevant factors, identified in respectively 35, 33 and 23% of the accidents in the data set, **SEE FIGURE 11**.

FIGURE 11

PERCENTAGE OF ACCIDENTS IN DATASET IN WHICH SPS CATEGORY (LEVEL 2) WAS IDENTIFIED AT LEAST ONCE (TOP 10, EXCLUDING FACTORS RELATED TO DATA ISSUES)

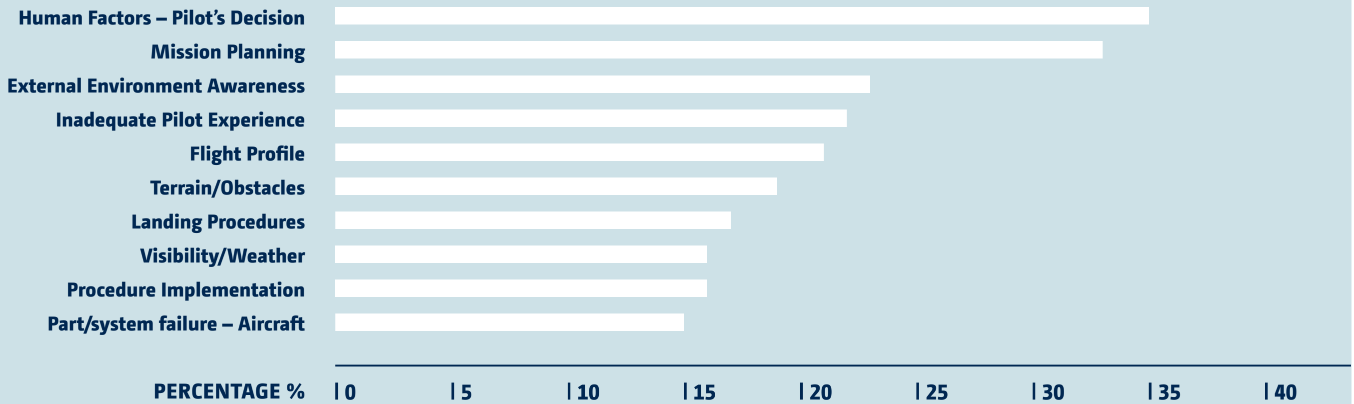
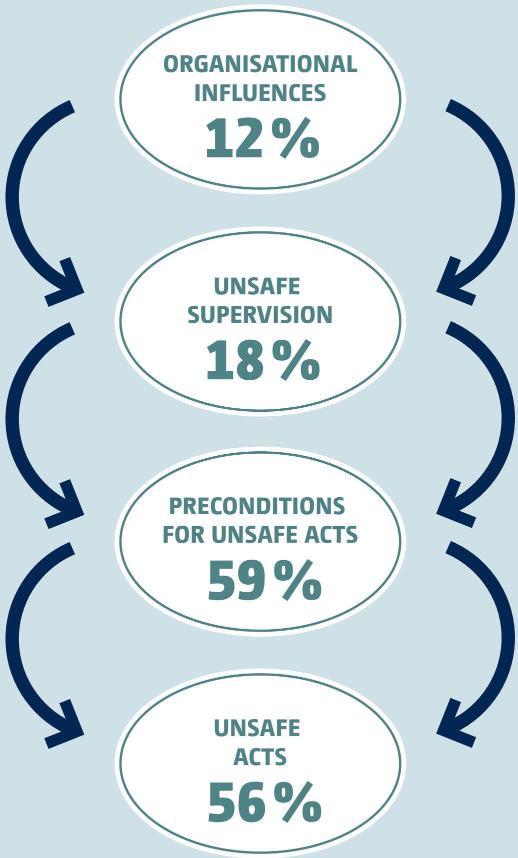


FIGURE 12 **PERCENTAGE OF ACCIDENTS WHERE HFACS LEVEL WAS IDENTIFIED AT LEAST ONCE**



4.3.2 Human Factors Analysis and Classification System

Human Factors must be addressed in order to meet the IHST objective of achieving an 80% reduction in helicopter accident rates by 2016. HFACS address HF in a detailed and structured manner. The system is well documented and has been used with success in other studies. It is based on a well known theoretical framework [Ref.10, 12-14], and the analysis instructions are clear and relatively easy to apply. See also the introduction on HFACS in **CHAPTER 3**.

For the accidents in the data set a total of 754 HFACS factor counts were recorded. In 78% of the accidents, at least one HFACS factor was identified. In most accidents unsafe acts or preconditions for unsafe acts were identified, **SEE FIGURE 12**. In a fewer number of accidents issues related to supervision or organisational influences were captured.

The possibility of identifying those factors is however very much depending on the depth of the accident investigation performed: if the accident investigator did not look into managerial or organisational aspects related to the accident or if the report does not contain the information available on human factors, the EHSAT analysis team could not assign factors in those areas.

Unsafe Acts

For the lowest level in the model, the unsafe acts, in 50 % of accidents errors were identified: activities that failed to achieve their intended outcome. Most errors were identified as being judgment & decision making errors, such as poorly executed procedures, improper choices, or misinterpretation of information. These errors represent conscious and goal-intended behaviour. Skill-based errors on the other hand are errors that occur sub-consciously, such as inadvertent operation of switches and forgotten items in a checklist. Finally, perceptual errors are related to a degraded sensory input. Violations, wilful disregard of rules and regulations, were identified in 13 % of the accidents.

Preconditions for Unsafe Acts

Only focussing on unsafe acts, however, is “like focussing on a patient’s symptoms without understanding the underlying disease state that caused it.” [Ref.10]. Therefore, one must look deeper into preconditions to identify why the unsafe acts took place. In 46 % of the accident, preconditions related to the condition of the individual could be identified. These conditions include overconfidence, channelised attention, ‘press-on-itis', inattention, distraction, misperception of operational condition, and excessive motivation. Personnel factors, in 21 % of the accidents, mostly concerned mission planning and briefing. Also cross-monitoring performance and mission briefing were identified. For the Environmental factors, in 15 % of the accidents, factors such as restricted vision by meteorological conditions, windblast, and brownout/whiteout were identified.

Unsafe Supervision

In 18 % of the accidents, latent failures on middle management level were identified. Under Planned Inappropriate Operations the factors limited experience and inadequate formal risk assessment, in case a supervisor does not adequately evaluate mission risks or risk assessment programs, were identified. In addition, cases were identified under Inadequate Supervision relating to inadequate leadership/supervision or oversight and lack of policy or guidance.

Organisational Influences

In 12 % of the accidents latent failures on the higher management level or organisational level were identified. Items identified under Organisational Process included issues related to procedural guidelines and publications, and doctrine. Under Organisational Climate organisational values/culture and organisational structure were identified.

General remarks

HFACS and SPS complement each other well: SPS codes are technically more adapted to helicopter operations while HFACS adds a valuable, theory-driven human factor analysis system. The real benefit comes from jointly considering SPS and HFACS results in a single shell. When used in combination, HFACS and SPS provide a basis for richer analyses and recommendations.

HFACS made the analysis teams think about the psychological state of the crew, such as overconfidence. HFACS encourages not only the identification of the underlying management and organisational factors that influence behaviour. HFACS also distinguishes between errors and violations, i.e. between unintentional and wilful deviations. The prevention and management of errors and violations require different interventions.

Human Factors can only be addressed as far as they were reported in the accident investigation report. This concerns especially the managerial and organisational issues. We therefore encourage investigators to include factors remote in time and space from the accident scene in accident reports. Recommendations targeting the remote layers can help to prevent reoccurrence not only of the accident investigated but also of a whole set of potential accidents in which such factors can play a role.

4.4 Factor identification – per type of operation

The results presented so far were consolidated for all types of operations. At a detailed level, differences can be observed between the different types of operation. **TABLES 3** to **5** present example results of the top issues identified for Commercial Air Transport, Aerial Work and General Aviation operations. The issues are presented on the lowest level of the used taxonomies[8]. The data in the tables provides an understanding of a ‘typical’ accident scenario for the different types of operation. Differences and similarities between the three can be observed from the tables below.

4.4.1 Commercial Air Transport

ICAO defines Commercial Air Transport as “an aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire”.

The domain of commercial air transport operations for helicopters includes passenger transportation onshore and to offshore installations, ferry and positioning flights, emergency medical services and training performed by the operator. A total of 59 helicopter accidents in the dataset (involving 60 helicopters) concerned Commercial Air Transport operations.

A typical scenario of a Commercial Air Transport accident is the following: “Once the patient was boarded, the helicopter took off despite the degraded weather condition because an ambulance was waiting to bring the patient to the hospital. The helicopter

[8] The top 25 % for SPS and top 50 % of HFACS factors are being presented in the tables

TABLE 3

TOP ISSUES FOR HELICOPTER COMMERCIAL AIR TRANSPORT OPERATIONS (EXCLUDING FACTORS RELATED TO DATA ISSUES)

Top issues Standard Problem Statements	Top issues HFACS
• Pilot decision making	• Inattention
• Pilot-in-Command self induced pressure	• Decision-making during operation
• Inadequate oversight by the Authority	• Channelized attention
• Failed to follow procedures	• Brownout/whiteout
• Selection of inappropriate landing site	• Risk assessment – during operation
• Reduced visibility – whiteout, brownout	• Overcontrol/Undercontrol
• Pilot's flight profile unsafe for conditions	• Procedural Guidelines/Publications
• Inadequate government/industry standards and regulations	• Communication Critical Information
	• Mission Briefing
• Disregarded cues that should have led to termination of current course of action or manoeuvre	• Error due to misperception
	• Technical/Procedural knowledge
• Aircraft position and hazards	• Pressing
• Pilot inexperienced with area and/or mission	• Cognitive task oversaturation
• Mission involves operations at high density altitudes	• Misperception of operational condition
• Management disregard of known safety risk	• Distraction
• Inadequate consideration of obstacles	• Excessive motivation to succeed

hit the ground (snowed-covered surface) with the right skid and nosed over just after take-off in poor visibility due to falling and blowing snow".

The main factors identified in this scenario are loss of visual reference, inadequate in-flight decisions, and the fact that the pilot felt pressure to take-off and transport the patient.

When looking at all the accident data, the top three level 2 issues identified in most Commercial Air Transport accidents are:

- Human Factors - Pilot's decision
- Mission Planning
- External Environment Awareness

Looking at the factors presented on the lowest level of the taxonomy (level 3), this provides an understanding of a 'typical' accident scenario, **SEE TABLE 3**.

TABLE 4

TOP ISSUES FOR HELICOPTER AERIAL WORK OPERATIONS (EXCLUDING FACTORS RELATED TO DATA ISSUES)

Top issues Standard Problem Statements	Top issues HFACS
• Mission involves flying near hazards, obstacles, wires	• Risk assessment – during operation
• Mission requires low/slow flight	• Mission planning
• Pilot decision making	• Channelized attention
• Inadequate consideration of obstacles	• Inattention
• Diverted attention, distraction	• Procedural error
• Selection of inappropriate landing site	• Misperception of Operational Condition
• Low flight near wires	• Decision-making during operation
• Pilot inexperienced with area and/or mission	• Error due to misperception
• Helicopter inadequately equipped for mission	• Overconfidence
• Customer/Company pressure	• Fatigue – physiological/Mental
• Inadequate post vortex ring state (settling with power) or LTE avoidance, recognition and recovery training	• Violation – Routine/Widespread
	• Overcontrol/Undercontrol
	• Limited total experience
	• Excessive motivation to succeed

4.4.2 Aerial Work

ICAO defines Aerial Work as "an aircraft operation in which an aircraft is used for specialised services such as agriculture, construction, photography, surveying, observation and patrol, search and rescue, aerial advertisement, etc. Using a helicopter for such purposes can result in pushing the helicopter and pilot towards the limits of their capabilities. In addition, aerial work operations often involve operating close to terrain or obstacles.

A total of 103 accidents analysed occurred while performing aerial operations. A typical scenario of an Aerial Work accident: "During vertical take-off with external cargo from a confined landing area in the forest, the helicopter started to rotate to the left after having cleared the tree tops. The helicopter lost altitude, contacted the surrounding trees and crashed".

The main factors in this scenario are that the helicopter was operated near Maximum Take-Off Mass, that it had to operate close to obstacles, that the task was pilot intensive, and that there was a tailwind. It all resulted in a Loss of Tail rotor Effectiveness, and the pilot failed to release the cargo, **SEE TABLE 4**.

The top three of level 2 issues identified in most aerial work accidents are:

- Mission Risk - Terrain/Obstacles
- Mission Planning
- Human Factors - Pilot's decision

4.4.3 General Aviation

ICAO defines General Aviation as "an aircraft operation other than a commercial air transport operation or an aerial work operation" and includes private flight, basic flight training and so on.

A total of 140 accidents in the dataset involved helicopters performing General Aviation operations. Significantly, as shown previously in Figure 7, this represents around 45% of all of the accidents analysed by the EHSAT. The General Aviation community therefore provides a particular area of focus for the IHST/EHEST initiative.

TABLE 5

TOP ISSUES FOR HELICOPTER GENERAL AVIATION OPERATIONS (EXCLUDING FACTORS RELATED TO DATA ISSUES)

Top issues Standard Problem Statements	Top issues HFACS
• Pilot decision making	• Risk assessment – during operation
• Mission Planning	• Overconfidence
• Pilot misjudged own limitations/capabilities	• Mission Planning
• Pilot inexperienced	• Overcontrol/Undercontrol
• Inadequate consideration of weather/wind	• Violation – Lack of discipline
• Failed to follow procedures	• Procedural Error
• Pilot control/ handling deficiencies	• Decision-making during operation
• Failed to recognise cues to terminate current course of action or manoeuvre	• Vision restricted by meteorological conditions
• Wilful disregard for rules and SOPs	
• Inadvertent entry into IMC	

A typical General Aviation accident scenario could look as follows: “The helicopter was on a Visual Flight Rules flight. En route, it entered an area of rising terrain and low cloud base. Radar tracking indicates that the helicopter slowed down, and then made a sharp turn before disappearing off the screen. The helicopter then suffered an in-flight collision with terrain directly after the loss of radar contact”.

The main factors in this case are that the pilot was inexperienced, did not obtain a weather forecast, did not establish contact with ATC, and inadvertently entered Instrument Meteorological Conditions (IMC), **SEE TABLE 5**.

The top three level 2 issues are

- Human Factors - Pilot’s decision
- Mission Planning
- Inadequate Pilot Experience

4.5 Intervention recommendations

The regional EHSAT teams were also asked to develop Intervention Recommendations (IRs) that could possibly prevent similar accident factors from reoccurring. These IRs are free text and have been assigned to one of 11 categories. **FIGURE 13** shows that most recommendations fall into the following categories:

- Flight Ops & Safety Management/Culture
- Training/Instructional,
- Regulatory/Standards/Guidelines.

To allow further processing by the EHSIT the free text IRs were consolidated into groups. **TABLES 6** to **8** present an overview of the top six of these consolidated IRs for the Operations & SMS Management/Culture, Training/Instructional and Regulatory categories.

FIGURE 13 **DISTRIBUTION OF INTERVENTION RECOMMENDATION CATEGORIES FOR ALL ANALYSED ACCIDENTS**

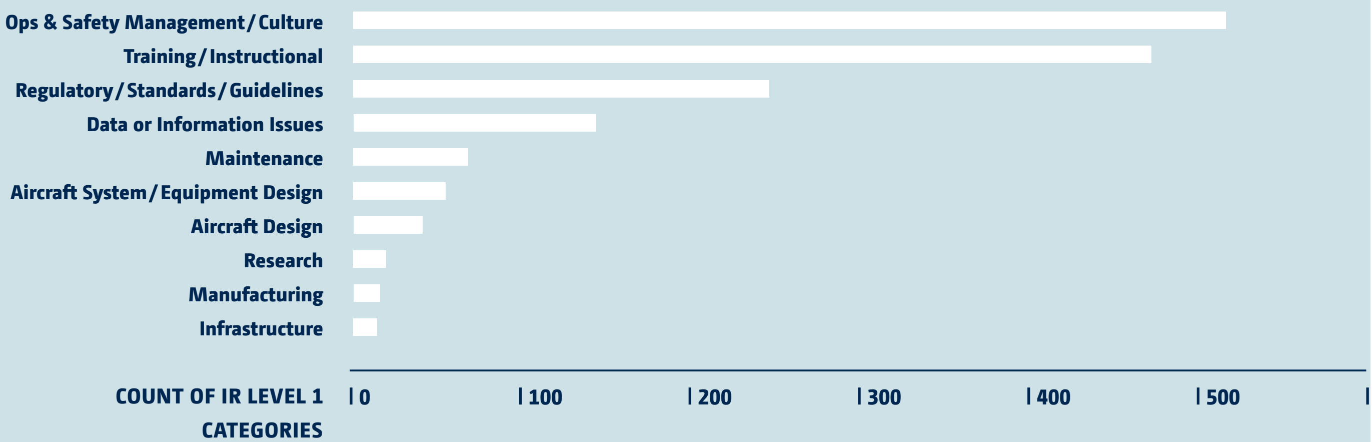


TABLE 6 TOP CONSOLIDATED IRS FOR THE CATEGORY FLIGHT OPERATIONS & SAFETY MANAGEMENT/CULTURE

Operations & Safety Management / Culture

Standard Operating Procedures	Operators should be encouraged to establish and apply effective SOPs for all activities that they undertake (ground and in-flight fuel management, define the role of crew and personnel during flight, etc.).
Safety Culture	Develop an engagement/communication plan (with a variety of passive, active and pro-active measures such as videos, meetings, surveys, internet etc.) for all levels of aviation to promote of the development of a Safety Culture and encourage application of sound safety principles (e.g. basic airmanship), risk assessment and rule compliance.
SMS	Encourage the implementation of effective safety management systems including risk management, safety assurance, emergency response plan and codes of practice. Refine procedures based on risk assessment and service experience. Make personnel more aware of hazard of inattention due to repetitive or unusual tasks. Make sure that the SMS is adhered to.
Mission Preparation and Execution	Produce guidance material and check lists for mission preparation and execution (to include weight & balance). Propose recurrent training including theoretical and practical test for airmanship. Ensure that passengers/crew members receive thorough pre-flight and in-flight briefing. Assess means to make people read and follow the produced guidance.
Risk Assessment – Implementation	Introduce the principle of Risk Assessment (with Control Measures) into pre-flight preparation. Highlight the importance when conducting operations over unfamiliar terrain or for unusual missions. In addition, the experience level of the crew will influence the associated risk and the need for Risk Assessment for inexperienced crews should be emphasised.
Risk Assessment – Divulgation	Increase general awareness of the principles and benefits of Risk Assessments (especially for smaller operators) and provide training and standard templates to make the process accessible and user friendly.

TABLE 7 TOP CONSOLIDATED IRS FOR THE CATEGORY TRAINING/INSTRUCTIONAL

Training/Instructional	
Ab Initio Training Syllabi	The flying training syllabus for ab initio helicopter pilots should be expanded to give more time for: A) Mission planning B) Demonstration of Vortex Ring and Loss of Tail Rotor Effectiveness C) Flight into deteriorating weather D) Static & Dynamic Rollover E) Quick stop F) Quick power variation G) Low rotor RPM management H) Awareness of Height and Velocity diagram
Recurrent Training	Expand recurrent training for inexperienced PPL pilots and experienced professional pilots, to include additional emphasis on: A) Recovery from unusual attitudes/loss of airspeed by sole reference to instruments B) Vortex ring C) Loss of Tail Rotor Effectiveness D) Conduct of High Risk missions (mountain flying, HEMS etc.). E) Autorotation; making the best use of Synthetic Training Devices.
CRM - Training Syllabi	Consider developing and introducing minimum standards for training syllabi. Ensure that these minimum standards include all issues reviewed by the EHSAT accident analysis, especially CRM. CRM training should be extended to all types of operation on all types of aircraft.
External Environment Awareness	Pilots should be made aware of the need to familiarise themselves with both the area in which they intend to operate (terrain, obstacles, hazards etc.) and any local meteorological phenomena that may occur, including whiteout.
Flying Skill	The training for and demonstration of flying skills must emphasise that the pilot is responsible for the aircraft's safety in both normal and emergency conditions and that he/she understands their responsibility for maintaining these proficiencies. Consider developing and introducing objective criteria for covering flying and A/C management skills for ab initio and recurrent training/proficiency checks.
Adherence to Limits	Training should stress adherence to Rotorcraft Flight Manual Procedures and limitations, including the use of focused examinations to emphasise known problem areas.
Checklists and Briefing	Reinforce, through awareness campaign, the need for crews to use checklists / Flight Manual and to ensure that passengers/ crew members receive thorough pre-flight and in-flight briefing.
Inadvertent Entry into IMC/DVE	Review training and testing syllabus to address initial actions to recover from unusual attitudes and inadvertent entry to IMC.

TABLE 8 **TOP CONSOLIDATED IRS FOR THE CATEGORY REGULATORY**

Regulatory/Standards/Guidelines	
Data recording	Improve the data recording capability of all helicopters, to assist in future occurrence investigation.
Authority oversight	Authority oversight, audits and inspections need to be improved. There is a need for the Authorities to be able to enforce more sanctions (fines, license withdrawal etc.) against license holders and operators who break the rules.
Flotation, markings and exits	Regulations must specify the safety characteristics of and a demonstration of airframe buoyancy, flotation devices, high visibility paint schemes, emergency exits, liferaft stowage/tethering and the readability of all associated labelling by day and night, for all helicopters licensed for over-water Public Transport operation.
Safety equipment requirements	The regulations concerning the requirements of carrying and usage of emergency equipment (seatbelt, helmet, life jacket etc.) need to be improved and properly enforced.
DVE/Inadvertent entry into IMC	Review training and testing syllabus to address initial actions to recover from unusual attitudes and inadvertent entry to IMC. This might be done by introducing a few mandatory flight hours (or simulator hours) in marginal /degraded visibility conditions.
Seat and harness design	Seat and harness design, mounting, static and dynamic testing specifications should be improved.

5. ACTION PLANS AND BEYOND

In 2009 the EHSIT defined a process to aggregate, consolidate, and prioritise the intervention recommendations produced by the EHSAT and also defined safety strategies and action plans. To address the top intervention recommendation categories identified by the EHSAT, the EHSIT has launched three Specialist Teams (ST) on: Operations and SMS; Training; and Regulation.

5.1 EHSIT Specialist Team on operations and SMS

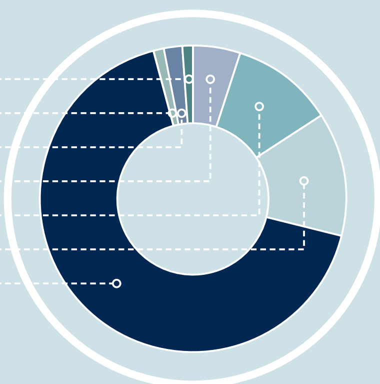
This Specialist Team is tasked to process the Intervention Recommendations related to Operations, SMS, and Safety Culture produced by the EHSAT. Throughout 2009 the Team's terms of reference have been developed and approved, membership has been consolidated, and a global strategy and work plan have been initiated.

In 2010 – 2012 the team will finalise consolidation of the EHSAT Intervention Recommendations, consolidate its strategy, and develop detailed action plans targeting the industry, the authorities and the operators including private individuals in the GA community.

The team will focus their efforts on the three most important areas (according to the IRs): Risk Management, Safety Management System (SMS) and Standard Operating Procedures (SOPs).

FIGURE 14 **WESTERN & EASTERN EUROPEAN OPERATORS FLEET SIZE (SOURCE NEW EHA)**

Fleet > 50 Helicopters	1 %
Fleet from 21 to 50 Helicopters	1 %
Fleet from 11 to 20 Helicopters	2 %
Fleet from 6 to 10 Helicopters	5 %
Fleet from 3 to 5 Helicopters	11 %
Fleet of 2 Helicopters	13 %
Fleet of 1 Helicopters	67 %



The team will make the best possible use of materials and actions plans produced by other groups such as the JHSIT and the ECAST SMS working group, and will coordinate with European and international partners.

The Ops & SMS Specialist Team will also develop new tools such as pre-flight risk assessment checklists and example lists of hazards per operations, useable for risk assessment in the context of SMS.

EHEST has recently decided to promote the use in Europe of The International Standard for Business Aviation (IS-BAO), created by the International Business Aviation Council (IBAC) which has been granted in August 2009 European recognition through a CEN Workshop Agreement, in addition to the existing IHST SMS Toolkit. IS-BAO covers more than just SMS and provides an accreditation scheme. To better serve the needs of the wide range helicopter operators, helicopter edition of IS-BAO will be developed in 2010 with the support of new EHA, BHA and HAI.

A section will be created on the EHEST website to provide a selection of links, products, and references that promote the understanding and implementation of SMS, Safety Culture, Risk Assessment, and Operations. This section will primarily be developed for the *small operators*, who constitute the great majority of operators in Europe, as can be seen from **FIGURE 14**. More than 90 % of European operators have a fleet of 5 or less Helicopters."

5.2 EHSIT Specialist Team on training

This Specialist Team will process the intervention recommendations produced by the EHSAT addressing training.

In 2009, terms of reference have been adopted, a training action strategy has been drafted, and the team has been formed. The strategy consists of identifying the main objectives and suitable actions according to forces in place and anticipating as far as possible the helicopter world evolution by 2016 or later. A road map has been proposed as part of the strategy.

In 2010 – 2012 the team will develop detailed action plan targeting major stakeholders in Europe: helicopter manufacturers and suppliers; Flight Training Organisations (TRTOs & FTOs); Synthetic Training Devices (STD) manufacturers; authorities (ICAO, EASA, and NAAs); helicopter and instructors associations; and operators and private individuals in the General Aviation community.

The team is developing safety leaflets and videos on subjects such as Vortex Ring, Loss of Tail rotor Effectiveness (LTE), Dynamic and static rollover, Loss of visual references, RPM Management, Airmanship and mission preparation, and Helicopter modern cockpit and training. In the longer term, the Training Specialist Team will also develop an up to date Helicopter Training Manual, in cooperation with the academia.

5.3 EHSIT Specialist Team on regulation

A third Specialist Team was launched end of 2009. This team will identify potential areas for rulemaking. The Team will not deal with helicopter regulation in general but will process those intervention recommendations of a regulatory nature derived from the EHSAT analysis. The work of this Specialist Team could result in rulemaking proposals being submitted to the competent authorities (ICAO, EASA, or NAAs), using standard rulemaking processes.

The team has aggregated and consolidated the intervention recommendations produced by the EHSAT, terms of reference have been drafted and a work program defined. In 2010, the Specialist Team on Regulation was also tasked by the EHEST to draft comments to the draft EASA Opinion on a Commission Regulation establishing the Implementing Rules for the Licensing of pilots (Part FCL).

5.4 EHEST Communication Sub-Group

Having completed the analysis, and having a clear picture of the issues that have contributed to accidents, the key is to communicate that information to those who need to know and who have a role to play in reducing the accident rate.

To that end, a Communications Sub Group has been created to ensure that the European team is connected with its IHST counterparts around the globe and also to develop a communications network that can reach as many of the European helicopter community as possible.

Regular Press Releases are provided to keep the ‘story’ in the headlines wherever possible. More importantly, the communications network uses existing distribution opportunities wherever possible to monopolise the popularity and broad reach of helicopter websites, magazines, association newsletters, national aviation authorities, SKYbrary, conferences, forums, etc.

The EHEST Communications Sub Group has also embedded a communication representative into each of the Specialist Teams to stay close to the emerging intervention strategies and to provide advice on using the communications network to best effect.

5.5 IHST toolkits

In parallel to EHEST work, IHST has developed a series of toolkits freely accessible on the IHST website. Four toolkits, created by the US JHSIT, are now available covering: SMS; Training; Risk Assessment; and Helicopter Flight Data Monitoring. A fifth toolkit addressing Maintenance is being developed by EHSIT.

6. CONCLUDING REMARKS AND WAY FORWARD

The EHSAT analysis consolidates analyses of European wide helicopter accident data. This report presents the results of this analysis so far. The accident dataset consists of 311 helicopter accidents analysed by the regional EHSAT teams up to 31 March 2010.

The top 3 identified areas for the Standard Problem Statements are

- Pilot judgment & actions
- Safety Culture/Management
- Ground duties

The use of the HFACS taxonomy by the EHSAT provided a complementary perspective on human factors. In 78% of the accidents, at least one HFACS factor was identified. In most accidents unsafe acts or preconditions for unsafe acts were identified. In fewer accidents reports issues related to supervision or organisational influences were captured. The possibility of identifying those factors is very much dependent on the depth of the accident investigation performed and the accident data available.

For both the Standard Problem Statements and HFACS taxonomies, different patterns were observed for Commercial Air Transport, Aerial Work and General Aviation. **SECTION 4.4** provides an overview of the factors for the different type of operations identified at the lowest level of the taxonomy.

Most Intervention Recommendations (IRs) were identified in the areas of Operations & Safety Management/Culture, Training/Instructional, and Regulatory/Standards/Guidelines.

The European Helicopter Safety Implementation Team (EHSIT) was launched in February 2009. The team uses the accident analyses and the intervention recommendations produced by the EHSAT to develop safety enhancement strategies and action plans. In 2009 the EHSIT defined a process to aggregate, consolidate, and prioritise the intervention recommendations produced by the EHSAT and also defined safety strategies and action plans.

To address the top intervention recommendation categories identified by the EHSAT, the EHSIT has launched three Specialist Teams on Operations and SMS, Training, and Regulation. These EHSIT Specialist Teams are in the process of developing detailed action plans and delivering safety promotion material and tools of benefit for the industry, in particular for small operators and General Aviation. EHSIT results will be communicated to the helicopter community via the Communications Sub-Group.

Also the EHSAT will continue analysing accidents in order to monitor possible changes in accident scenarios over time. The team will also be involved in the measuring of results and effectiveness of safety improvements.

ANNEX 1: REFERENCES

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Websites

EHEST	http://www.easa.europa.eu/essi/ehestEN.html
IHST	http://www.ihst.org

ANNEX 2: ACRONYMS

AIB	Accident Investigation Board
EASA	European Aviation Safety Agency
ECAST	European Commercial Aviation Safety Team
ECCAIRS	European Coordination Centre for Accident and Incident Reporting Systems
EGAST	European General Aviation Safety Team
EHEST	European Helicopter Safety Team
EHSAT	European Helicopter Safety Analysis Team
EHSIT	European Helicopter Safety Implementation Team
ESSI	European Strategic Safety Initiative
HFACS	Human Factors Analysis and Classification System
ICAO	International Civil Aviation Organisation
IHST	International Helicopter Safety Team
IR	Intervention Recommendation
NAA	National Aviation Authority
SMS	Safety Management System
SPS	Standard Problem Statement
ST	EHSIT Specialist Team
US JHSAT	United States Joint Helicopter Safety Analysis Team
US CAST	United States Commercial Aviation Safety Team

ANNEX 3: LIST OF FIGURES AND TABLES

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A3-2: List of tables

IMPRINT

Disclaimer:

The safety improvement analyses and recommendations produced by EHEST are based on expert judgement and are supplementary to the official reports of the Accident Investigation Boards (AIB). Such recommendations, and the safety improvement actions that may follow, are solely aimed at improving helicopter safety, are not binding and under no circumstances should be considered to take precedence over the official AIB reports. The adoption of such safety improvement recommendations is subject to voluntary commitment, and engages only the responsibility of those who endorse these actions. The EHEST accepts no responsibility or liability whatsoever with regard to the content or for any actions resulting from the use of the information contained in these recommendations.

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