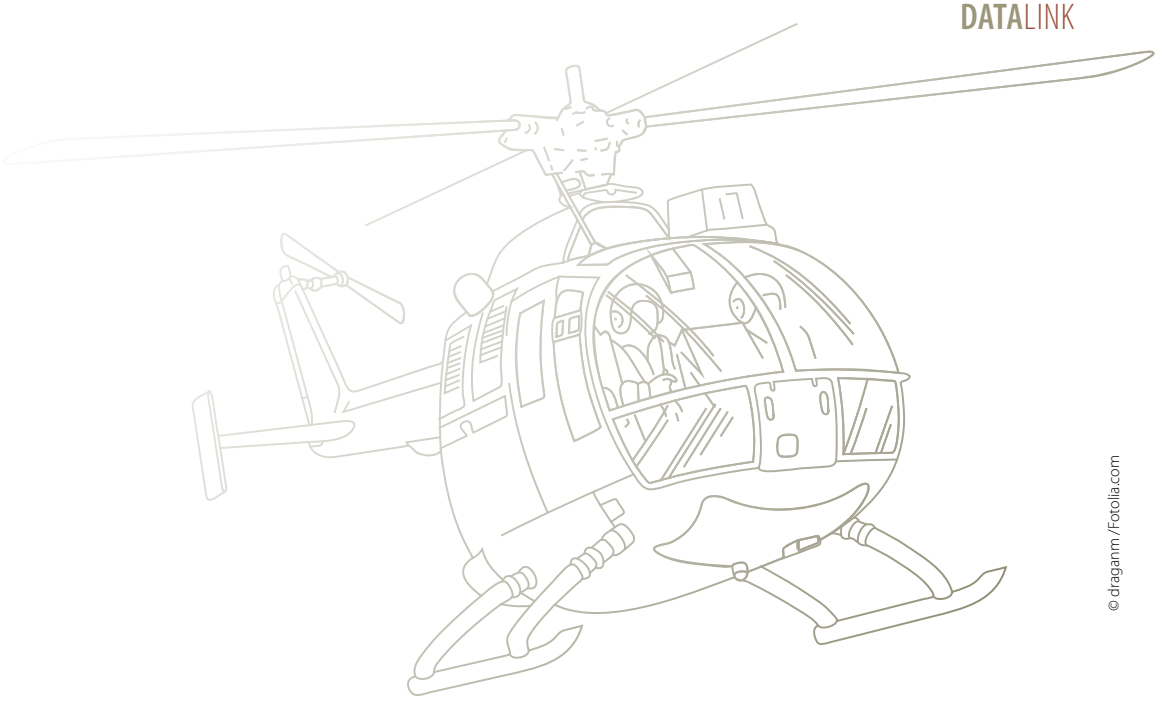


Route Causes

For helicopters, the journey — not the destination — holds the greatest risk.

BY RICK DARBY

The largest percentage of European helicopter accidents in 2000–2005 studied by the European Helicopter Safety Analysis Team (EHSAT) occurred in the en route phase of flight.[1] That contrasts with fixed-wing commercial air transport operations, where the most recent European Aviation Safety Agency (EASA) annual safety review reported that approach and landing accidents represented the highest percentage.[2]

EHSAT is a component of the International Helicopter Safety Team and part of the European Strategic Safety Initiative, a 10-year program involving EASA, some national civil aviation authorities and many other aviation organizations. "Analysis of occurrence data, coordination with other safety initiatives and implementation of cost-effective action plans are carried out to achieve fixed safety goals," the report says.

It was estimated that about 6,860 helicopters were registered in EASA member states for civil use in 2007.[3] A total of 16 fatal civil helicopter accidents occurred in 2007, compared with 14 in 2006, the report says.

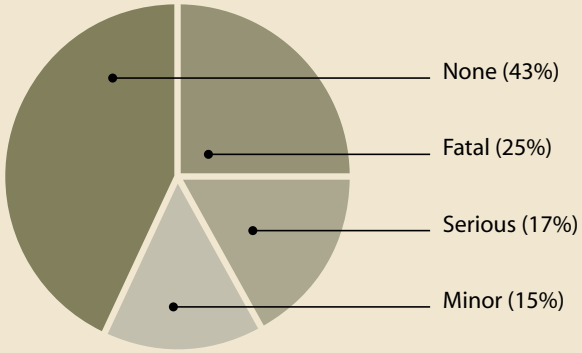
EHSAT regional teams familiar with the languages of the accident reports and the local context analyzed the accidents. The teams' judgments were based on, but not identical with, the official reports by accident investigation authorities.

The EHSAT preliminary report database included accidents occurring within EASA member states, and defined according to the International Civil Aviation Authority (ICAO) Annex 13, *Aircraft Accident and Incident Investigation*. Only accidents for which a final investigation report had been issued were included.

The database included 186 accidents. Of those, 40, or 22 percent, involved commercial air transport. General aviation represented the largest percentage, 39 percent, followed

Regional teams familiar with the languages of the accident reports and the local context analyzed the accidents.

Injury Levels, European Helicopter Accidents, 2000–2005

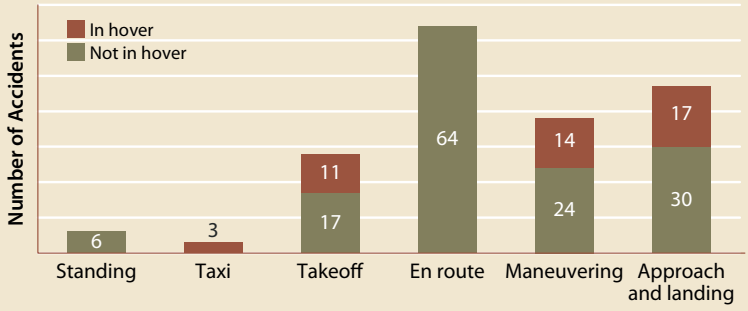


Note: Data are based on 186 civil aviation helicopter accidents analyzed by regional teams of the European Helicopter Safety Analysis Team. Accidents occurred in European Aviation Safety Agency member states.

Source: European Helicopter Safety Analysis Team

Figure 1

European Helicopter Accidents, by Phase of Flight, 2000–2005



Note: Data are based on 186 civil aviation helicopter accidents.

Source: European Helicopter Safety Analysis Team

Figure 2

by aerial work, 35 percent. Nearly a third of accidents resulted in some degree of injury, and one in four involved at least one fatality (Figure 1).

Most accidents — 64, or 34 percent — occurred in the en route phase of flight (Figure 2). Among the fatal accidents, 68 percent occurred in the en route phase (Figure 3). The helicopter was hovering in 24 percent of accidents in all phases.

Pilot experience in the accident helicopter type was weighted toward low time (Figure 4). In 14 percent of commercial air transport accidents and 9 percent of aerial work operations accidents, the pilot-in-command had fewer than 100 hours in type, the report says.

So that its work will be comparable to that performed by other teams worldwide, EHSAT uses standardized codes for factors judged to have been involved in the accidents. The codes are derived from two models:

- The standard problem statements (SPS) taxonomy was inherited from the International Helicopter Safety Team and the U.S. Joint Helicopter Safety Analysis Team. The report says, "The structure consists of three levels: The first level identifies the main area of the SPS, and the second and third levels go into more detail."
- The Human Factors Analysis and Classification System (HFACS), developed to encourage cross-study compatibility, was developed from James Reason's theories of latent and active failures. The report says, "The HFACS model describes human error at four levels: organizational influences, unsafe supervision, preconditions for unsafe acts and the unsafe acts of operators."

Level 1 SPS categories were tabulated for the 186 accidents in the database (Figure 5, p. 50). "Pilot judgment and actions" topped the list of categories, identified in 68 percent of the accidents. "Safety culture/management" was next most frequent, in 48 percent, followed by "pilot situation awareness" in 38 percent.

"Pilot judgment and actions" includes decision making, "unsafe flight profile," procedure implementation, crew resource management and human factors. "Safety culture/management" concerns safety management systems (SMSs), training, pilot disregard of a known safety risk, self-induced pressure and pilot experience. "Pilot situation awareness" covers in-flight factors such as reduced visibility and external obstacle or hazard awareness.

"The highest level of SPS, Level 1, only provides information on a general level," the report

says. "To better understand what kind of factors played a role in the accident data set, one must look at a deeper level in the taxonomy" — Level 2 (Figure 6, p. 50).

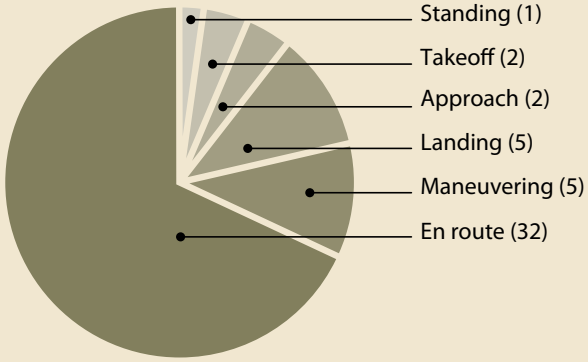
From Level 2 SPS, it appears that the main factors identified lie in the human factors domain. "Pilot's decision making," "mission planning" and "external environment awareness" were identified most frequently by EHSAT in the accident data set.

The prevalence of human factors findings led EHSAT researchers to adopt the HFACS model for further understanding, the report says. For the 186 accidents in the database, a total of 445 HFACS factors were counted, and in 78 percent of the accidents, at least one HFACS factor was found.

"In most accidents, unsafe acts or preconditions were identified," the report says (Figure 7, p. 51). "For the lowest level in the model [the results of latent causal factors], the unsafe acts, 84 percent of the identified factors concerned errors: activities that failed to achieve their intended outcome. Most errors were identified as … judgment and decision making errors, such as poorly executed procedures, improper choices or misinterpretation of information. These errors represent conscious and goal-intended behavior.

"Skill-based errors, on the other hand, are errors that occur with little or no conscious thought, such as inadvertent operation of switches and forgotten items in a checklist. These errors were identified in 28 percent of the errors. … Violations, willful disregard of rules and regulations, were identified in 16 percent of unsafe acts."

European Helicopter Fatal Accidents, by Phase of Flight, 2000–2005

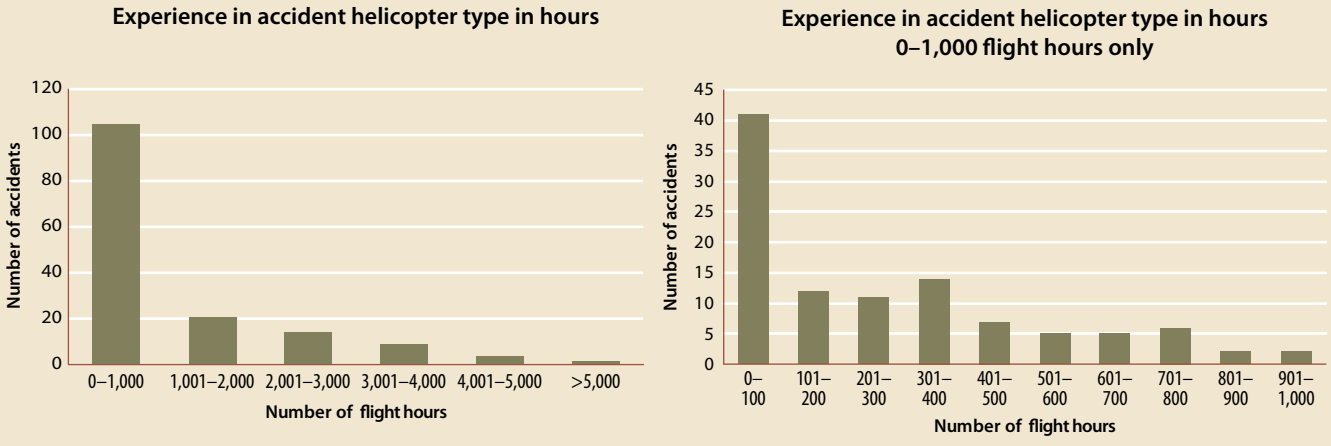


Note: Data are based on 186 civil aviation helicopter accidents.

Source: European Helicopter Safety Analysis Team

Figure 3

Pilot-in-Command Flight Experience, European Helicopter Accidents, 2000–2005

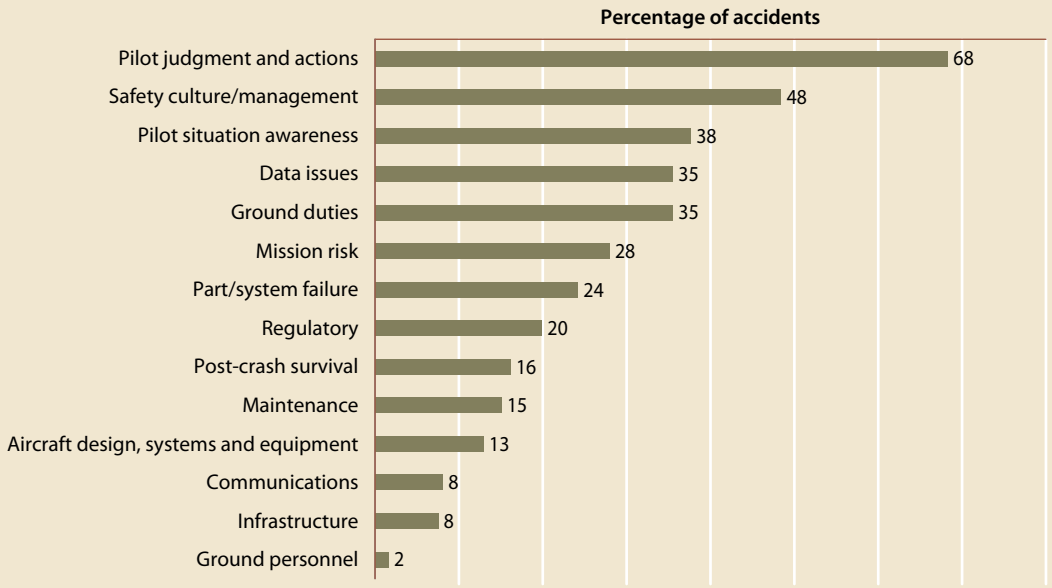


Note: Data are based on 155 civil aviation helicopter accidents, a subset of 186 such accidents.

Source: European Helicopter Safety Analysis Team

Figure 4

Level 1 SPS Categories Identified in European Helicopter Accidents, 2000–2005



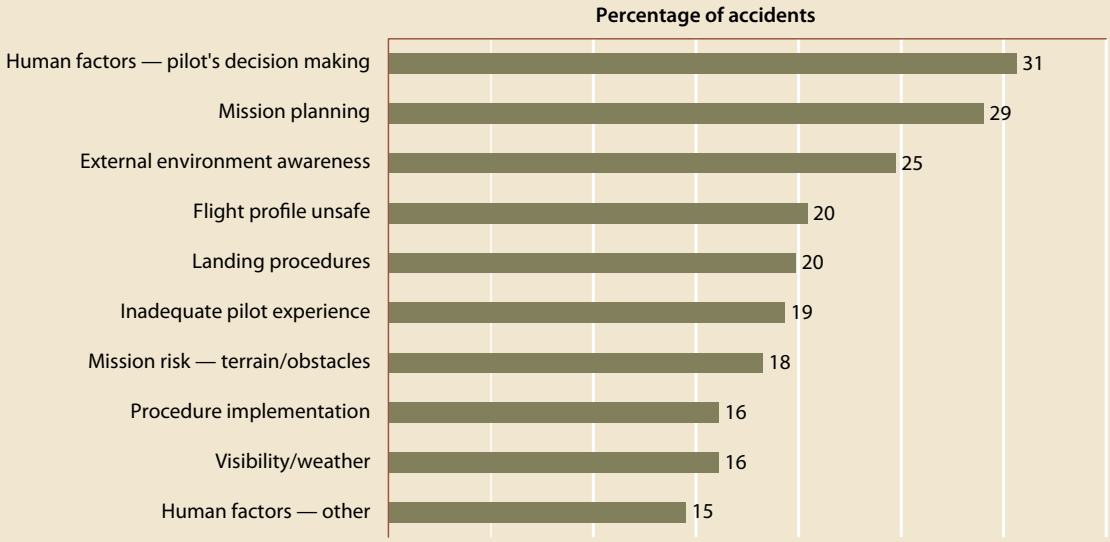
SPS = standard problem statements, a taxonomy

Note: SPS Level 1 is the most general level. Data are based on 186 civil aviation helicopter accidents.

Source: European Helicopter Safety Analysis Team

Figure 5

Level 2 SPS Categories Identified in European Helicopter Accidents, 2000–2005



SPS = standard problem statements, a taxonomy

Note: Data show the top 10 SPS Level 2 categories. SPS Level 2 is more specific than Level 1. Data are based on 186 civil aviation helicopter accidents.

Source: European Helicopter Safety Analysis Team

Figure 6

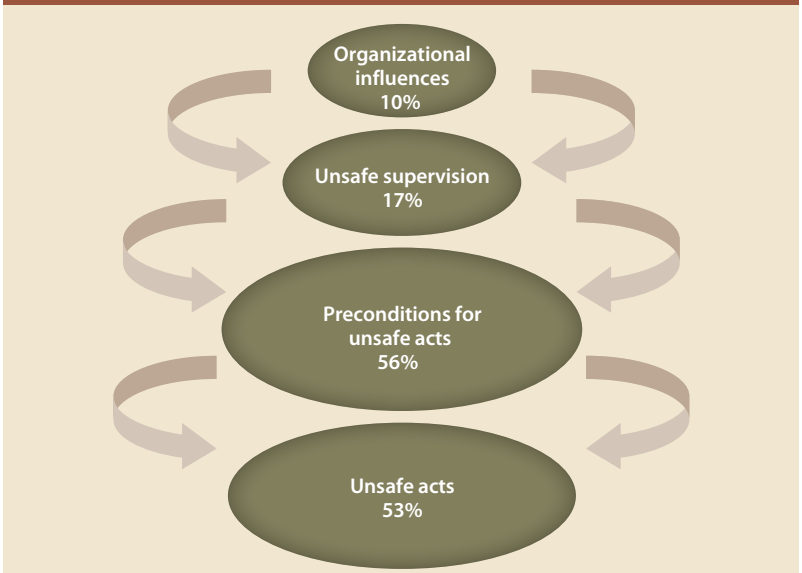
"Preconditions for unsafe acts," the next higher HFACS level, represent latent factors that enable or encourage unsafe acts. The report says that 60 percent of the preconditions in the accident database were individual rather than institutional. They included "overconfidence, channelized [narrowly focused] attention, 'press-on-itis,' inattention, distraction, misperception of operational condition and excessive motivation." Personnel-related factors, such as mission planning, accounted for 23 percent of preconditions. Environmental factors, such as restricted visibility, represented 17 percent of preconditions.

"Latent failures of middle management" were found in 17 percent of the accidents in the database — the next higher HFACS level, called "unsafe supervision." Of these supervision problems, 59 percent were labeled "planned inappropriate operations," such as failure to adequately evaluate mission risks or inadequate risk assessment programs. The other 41 percent came under the heading of "inadequate supervision," consisting of factors such as inadequate oversight and lack of policy or guidance. No cases were identified of "failure to correct known problem" or "supervisory violations," which if they had occurred would have been categorized as "inadequate supervision."

In 10 percent of the accidents, "organizational influences," the top level, were identified. Of these, 64 percent were classified as "organizational process," which included issues related to procedural guidelines and publications, as well as doctrine. A further 24 percent were classified as "organizational climate," and the remaining 12 percent came under the heading of "resource management."

EHSAT regional teams were asked to develop intervention recommendations to reduce the kinds of accident factors found in the study. The report says, "Examples of intervention recommendations are better training for specific missions — for example, mountain operations; better training for specific operating environments, such as inadvertent entry into instrument meteorological conditions; risk assessment training; promoting safety culture and introduction of [SMSs]; increase of obstacles awareness; requirements for flight data recording; [and] establishment of training requirements for aerial work operational crew other than flight crew."

HFACS Levels Identified, European Helicopter Accidents, 2000–2005



HFACS = Human factors analysis and classification system

Notes: HFACS levels range from the most remote causal factors (top level) to the most immediate (bottom level). Percentages represent the proportion of accidents where the HFACS level was identified at least once.

Data are based on 186 civil aviation helicopter accidents.

Source: European Helicopter Safety Analysis Team

Figure 7

Notes

1. EHSAT. "Preliminary Results of Helicopter Accident Analysis." April 20, 2009. Available via the Internet at <www.easa.europa.eu/essi/EHSAT2.htm>.
2. EASA. "Annual Safety Review 2007." Available via the Internet at <www.easa.europa.eu/essi/documents/AnnualSafetyReview2007_EN_001.pdf>.
3. *Ibid.*