

Reasons for using flight helmets during medical emergency missions in helicopters

Justificación del casco de vuelo en misiones de helicópteros de emergencias médicas

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The cabin of a medical helicopter is full of electromedical equipment essential for patient care. These devices must be firmly attached to the helicopter's structure to prevent them from becoming projectiles in the event of turbulence or accidents. In any case, these devices stick out from the walls and, given the limited space available in the cabin, are relatively close to the occupants. In addition, they are positioned so that they are accessible from the seats of the medical personnel.

During the flights, there may be gusty winds, sharp turns and even aeronautical emergency situations

that force the pilot to perform abrupt maneuvers or even an emergency landing. When there are head impact risks, in any type of work, measures must be taken to protect workers, i.e., personal protective equipment (PPE) that adequately protects them from those risks to their health or safety that cannot be avoided¹. However, in most emergency medical helicopters (EMH), medical personnel do not wear flight helmets, but only headsets. To date, no law has made it mandatory for helicopter occupants to wear helmets, which is clearly dangerous, given the characteristics of EMHS

missions. In this paper we present the existing evidence that would justify, in the authors' opinion, that all occupants of a medical helicopter, regardless of whether they are flight or medical personnel, should always be equipped with protective helmets during their aerial missions.

All helicopter accidents that occurred in the period from 2002 to 2016, in the database of the Ministry of Public Works, were reviewed in the annual reports of the Civil Aviation Accident and Incident Investigation Commission (CIAIAC)^{4,5}, both EMHs and non-EMHs mission flights, as well as those in which reference was made to the flight helmet in

Table 1. List of accidents with helmet recommendation and summary of the technical report

Date of the accident	Helicopter/Registration	Location	Investigation
15/09/2002	Bell UH-1M/CC-CNI	León-Spain	The report concludes that the sustained forces on the helicopter structures and occupants were not severe. However, injuries occurred because some occupants were not wearing helmets and this could have been the cause of unconsciousness. After this accident, several recommendations were published, among them 14/03 states: it would be a requirement to keep the helmet and seat belt on during all phases of the flight.
5/08/2003	SA 319B Alouette/EC-HEA	Spain	The occupants were not wearing helmets. The subsequent report refers to Rec 14/3 and further reiterates the recommendation of helmet and buckled seat belt.
10/07/2004	SA Lama 315B/HB-XFX	Switzerland	The pilot was wearing a helmet and this protected him from more serious head injuries.
5/03/2006	AS 365 Dauphin/HB-XQS	Swiss Alps	The investigation found that the co-pilot suffered a mild traumatic brain injury, lost consciousness and suffocated from aspiration of vomit. His life would have been saved if he had been wearing a helmet. The SESE (Swiss Investigative Service) recommended that helmets be imposed on all persons in the cockpit.
25/04/2006	SA 316 B/F-GPJF	Lleida-Spain	The result was 4 deaths. The safety recommendations indicate that all personnel should wear protective helmets and fireproof coveralls, among others, as PPE.
30/05/2006	EC 135/EC-ION	Salamanca-Spain	Impact of a stork that grazed the shoulder of the only pilot and crashed alongside the nurse. In the opinion of COPAC (Official College of Pilots) it should be guaranteed that all team members should wear PPE, including the protective helmet. They also emphasize the need for the co-pilot.
17/07/2006	Bell 212/EC-HOY	León-Spain	Firefighting helicopter. All occupants minor injuries, all wearing helmets.
10/08/2006	AS 350 B3/LN-ODK	Norway	None of the occupants were wearing helmets. The SHT (Norwegian Transport Accident Investigation Team) recommended the use of protective helmets for all personnel.
17/08/2008	AS 350/F-GTTB	Argentier-France	The use of the helmet was vital to the pilot's survival in the emergency landing.
12/03/2009	Sikorsky S-92/C-G2CH	Canada	The pilots were not wearing helmets and were seriously injured by the impact of their heads on the equipment. The TSB (Transportation Safety Board of Canada) began a program on the importance of protective helmets, even approving financial assistance for the purchase of helmets.
27/05/2009	AS 350 B3/F-GVCE	Montferrier-Francia	The pilot suffered serious head injuries as he was not wearing a helmet. The BEA recommended to EASA the "mandatory" use of helmets for helicopter crews.
21/07/2009	Bell 47 G2/F-BTGR	Champagne-Francia	The report states that the helmet was instrumental in reducing the pilot's injuries during the emergency landing.
20/05/2011	Bel 212/C-FJVR	Canada	Pilot without a helmet contributing to the aggravation of head injuries. The report refers to a U.S. Army study showing that without a helmet there is a 6 times greater risk of fatal head injuries.
13/05/2014	350 BA/C-FHPC	Canada	Pilot wearing protective helmet. After a significant impact, he was conscious and was able to shut off the engine and help the other occupant who was seriously injured to get out. The TSB (Transportation Safety Board) states in the report that not wearing a helmet increases the risk of head injuries and loss of consciousness.
23/06/2014	AS 350 B3/LN-OSY	Norway	The pilot was not wearing a helmet. According to the SHT (Transportation Accident Investigation Commission) report, this clearly increases the risk of loss of consciousness and therefore compromises the pilot's ability to assist.
27/11/2014	R 22/VH-HRX	Australia	The pilot was not wearing a helmet and was injured in the head and neck. The ATSB (Australian Transport Safety Bureau) recommended that the benefits of wearing a helmet in terms of reducing head injuries be considered.
12/11/2015	R 22/VH-HWJ	Australia	The protective helmet mitigated the rider's injuries. This accident led to the mandatory use of helmets.
12/05/2016	R 22/VH-WGB	Australia	The use of the helmet limited the severity of the rider's injuries, ATSB highlighted the value of wearing a helmet in this accident.

the final report were selected. Accidents recorded in other countries were also included, through the reports of the following organizations: AIBN (Accident Investigation Board Norway), ATSB (Australian Transport Safety Bureau), BEA (Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile), TSB (Transportation Safety Board of Canada) and SESE (Service suisse d'enquête de sécurité)⁶.

Out of 82 accidents reviewed, 18 were selected in which helmet use was referred to in the technical report. In these 18 accidents, there

were 22 fatalities and 10 serious injuries. Table 1 presents these 18 accidents with a summary of the technical report, where the helmet recommendation is mentioned. The accident investigations do not reflect the medical cause of death, although when safety recommendations are made, in practically all cases helmets are mentioned as a factor in reducing head injuries or maintaining consciousness after impact.

In the Air Navigation Requirements Regulation 965/2012⁹, the use of helmets is exclusively

mentioned in the annexes relating to "special operations": SPO. IDE.H.205 Personal Protective Equipment, which refers only to the fact that all persons on board should wear appropriate protective equipment. Personal Protective Equipment (PPE) may include flight suits, gloves, helmets, protective shoes, etcetera, but does not oblige pilots or occupants to wear them.

Safety in the aeronautical world is usually a pioneer in this field. In spite of this, it seems unwise to leave safety elements that have been shown to

be useful in the event of an accident to the field of recommendations, and not to include them in mandatory regulations. Spanish aeronautical regulations lack regulation and obligatory nature of PPE in aerial work⁷. As far as we are aware, there is only one ruling from an administrative court in Madrid in 2012, in which SUMMA was ordered to purchase fireproof flight suits and flight helmets with communications for medical personnel working in its medical helicopters⁸. However, and based on the safety recommendations of the post-accident reports, there is no doubt, as evidenced by the data, that the need for all aircraft occupants to wear flight helmets during all phases of flight in EMHs missions should be regulated.

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