Cir 338
AN/196

Helicopter Medical Transport (HMT) Safety Circular

Approved by the Secretary General
and published under his authority

International Civil Aviation Organization

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GLOSSARY

ABBREVIATIONS

ACAS	Airborne collision avoidance system
AGL	Above ground level
AMC	Air medical crew
AMPA	Air Medical Physician Association
AMRM	Air medical resource management (CRM for the entire crew and support staff)
ATC	Air traffic control
CFIT	Controlled flight into terrain
CRM	Crew resource management
CTOL	Collision with obstacle(s) during take-off and landing
EASA	European Aviation Safety Agency
EGPWS	Enhanced ground proximity warning system
FSM	Flight support member
FTDS	Flight training devices
GPS	Global positioning system
HAI	Helicopter Association International
HEMS	Helicopter emergency medical service
HMT	Helicopter medical transport
HMTSG	Helicopter Medical Transport Sub-Group
HOGE	Hover-out-of-ground effect
IFR	Instrument flight rules
IHST	International Helicopter Safety Team
IIMC	Inadvertent instrument meteorological conditions
IMC	Instrument meteorological conditions
LOC-I	Loss of control in flight
LOFT	Line-oriented flight training
LZ	Landing zone
NVG	Night vision goggles
NVIS	Night vision imaging system
ODP	Operational decision point
PinS	Point-in-space
QM	Quality management
RNP AR	Required navigation performance authorization required
SARPs	Standards and Recommended Practices
SBAS	Satellite-based augmentation system
sm	Statute mile
SMS	Safety management system
SOPs	Standard operating procedures
TCAS	Traffic alert and collision avoidance system
TT	Total flight experience
US NTSB	United States National Transportation Safety Board
VFR	Visual flight rules
VMC	Visual meteorological conditions

TERMINOLOGY

For the purpose of this document the following terms are used:

Air medical crew (AMC) member. A medically qualified person (e.g. paramedic, nurse, or physician) assigned to an HMT flight team who has received flight safety and emergency procedures training specific to aircraft type, operational environment, and crew composition. That person may be assigned limited flight safety duties including passenger briefing and supervision, company radio communications, loading/unloading, etc.

*Note.— The terms **Air medical crew member** and F**light medical crew member** are used synonymously around the world.*

Cultural lighting. Artificial, human-made lighting which increases the overall illumination of the night envrironment and helps define physical features and spatial relationships when viewed through night vision goggles (NVG). Cultural lighting includes street, vehicle, obstruction, and building lights.

Facility. A hospital or other health care facility with a certified or pre-surveyed, designated landing site for the pick-up and delivery of patients.

***Flight support member* (FSM)**. An HMT crew member (e.g. AMC or other crew member) assigned by the operator to support the pilot in selected flight tasks in addition to his or her normal flight safety duties.

***Flight-following*.** The recording in real time of departure and arrival messages by operational personnel to ensure that a flight is operating and has arrived at the destination aerodrome.

Helicopter medical transport (HMT). A dedicated helicopter air medical operation which transports patients from scene landing zones to certified or pre-surveyed landing sites at health care facilities (scene response), and between such facilities (inter-facility).

Note.— For the purposes of this circular, an HMT flight includes all legs associated with a patient dispatch request, including the non-patient outbound response and repositioning legs of an HMT flight. It is intended that the following flight legs be regarded as integral parts of the HMT flight:

a) to and from the scene landing zone;

b) to and from a heliport for the delivery or pick-up of medical supplies and/or persons required for the completion of the HMT flight; and

c) to and from a heliport for refuelling which is required for the continuation of the HMT flight or for its return to flight-ready status for the next HMT dispatch.

Landing zone (LZ). A commonly used term within the HMT industry for a helicopter landing site , particularly when referring to the landing and manoeuvring area at an ad hoc, unprepared landing site.

Look under. Visually “looking under” helmet-mounted night vision goggles (NVG) to scan the cockpit and external environment unaided (i.e. without looking through the NVG image intensification tubes).

Operational decision point* (ODP*). A point that has been reached in an HMT operation where the pilot-in-command is required to alter the flight to resolve a real or perceived increase in the risk of the mission.

Note.— An ODP can occur on the ground as well as in flight.

Scene. An accident or incident site or other emergency response location where medical assistance is required.

Scene LZ selection. The process of ranking and selecting the various options for the most appropriate landing site at, or near, a scene location. The lowest risk LZ which meets the patient transport medical care objectives on a case-by-case basis should be selected. Appropriate mitigation measures should be applied as LZ risk increases. *(See scene LZ risk mitigation hierarchy in 3.2.)*

Specified operational area. An area defined by the operator in the operations manual to the satisfaction of the authority, taking into account the following:

a) adequate ground reference;

b) flight-following system for the duration of the HMT flight;

c) reliability of meteorological conditions reporting facilities;

d) the helicopter minimum equipment list;

e) meteorological minima;

f) any additional considerations due to specific local conditions; and

g) appropriate navigation equipment/infrastructure.

EXPLANATORY NOTES ON TERMINOLOGY

Flight support member (FSM). The flight duties assigned to the FSM should improve flight safety and reduce pilot workload. Examples of appropriate duties include, but are not limited to, detection of obstacles, selection of landing sites, collision avoidance, reading checklists, monitoring flight parameters, company communication and navigation assistance, monitoring and assisting in ODP compliance, and shared flight safety decision-making. To provide assistance with ATC communications, the FSM should have a certificate (e.g. pilot licence) issued in accordance with Annex 1 — *Personnel Licensing*. The FSM should receive sufficient and appropriate ground-, flight- and scenario-based approved training to effectively carry out his or her flight support tasks and responsibilities. The FSM should demonstrate competency and currency on a regular basis.

Helicopter medical transport (HMT). HMT includes a pre- and inter-healthcare facility, emergency time-critical response, and transport of non-emergency patients between facilities. Regardless of the patient's condition and level of care, all HMT operations are considered to be routine from an aviation flight safety perspective. HMT operations should conform to best aviation safety practices and decision-making. In this sense, the term HMT includes, expands upon and qualifies the often used term "helicopter emergency medical service (HEMS)".

Operational decision point (ODP). By necessity, HMT flights often launch with a minimum amount of planning time. Changes in meteorological conditions, route or other operational considerations can result in a heavily task-loaded crew member unaware that their risk profile is escalating. Flight crews should be trained to apply techniques and procedures including threat and error management techniques that will allow them to continually assess their ongoing mission's level of risk and confirm that pre-launch decisions remain valid. Risk mitigation and avoidance measures may include a decision to delay or cancel departure, change routing, return to base, make an immediate landing, or any number of other safe options which may be available to the pilot(s). In every case, the action taken upon reaching an ODP should be appropriate to the triggering criteria.

Operators should establish ODP guidelines which define flight parameters such as minimum en-route IMC avoidance airspeed and altitude above ground[1], a reduction in estimated flight visibility below a predetermined distance and other objective considerations signifying that an ODP has been reached (trigger points). All personnel involved in flight operations should be trained to recognize key ODP triggers and risk factors including subjective indicators such as a generalized increase in concern and discomfort among crew members. If established parameters are violated or a safety concern is expressed by HMT team members (including on-board flight and medical crew, support personnel such as dispatch and maintenance personnel, and other mission responders), then an ODP has been reached and appropriate action must be taken. Pilots should be trained to identify ODPs and to take appropriate action on a recurrent basis.

Scene LZ selection. Ad hoc scene LZs which have not been prepared by trained ground first responders are generally higher risk landing sites than LZs which have been properly prepared, which in turn are higher risk than pre-surveyed, designated LZs. This results in a scene risk mitigation hierarchy where additional safety measures should be used by the pilot(s) to identify and avoid obstacles and hazards when operating to and from unprepared and non-designated LZs and at LZs where no ground support is available.[2]

Specific operational areas. In defining a specific operational area, the operator should take into account the cultural lighting, local hazards and topography. In those areas where the cultural lighting, hazards and topography make it unlikely that the visual cues diminish enough to make flying of the aircraft problematic, an HMT flight support member is assumed to be able to adequately assist the pilot, since under such circumstances instrument and control monitoring would not be required. In areas where visual cues may be limited or frequently degraded in adverse conditions[3] operations should be conducted with two pilots.

The following are considered implied tasks that should already be inherent to the operation:

a) minimum crew qualification, initial and recurrent training;

b) continuity of a crew concept; and

c) operating procedures, including crew coordination.

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1. Pilot(s) will normally slow down and/or descend in order to maintain adequate visual reference as en-route meteorological conditions deteriorate. As the flight continues, if a reduction in airspeed or altitude below the ODP guidelines is required to maintain comfortable and safe visual reference, appropriate flight abort or diversionary action should be taken.

2. These measures may include additional high- and low-level reconnaissance using night-vision goggles (NVG) for night landings at unprepared sites, the ability to hover-out-of-ground effect to assess hazards prior to landing and to disperse obscurants, etc.

3. No or minimal cultural lighting, traverse of large areas of white-out, brown-out, or glassy water; shadowing; sky glow or other NVG illusions and effects; limited meteorological condition reporting; unstable meteorological patterns, isolated mountainous terrain, etc.

Chapter 1

INTRODUCTION

1.1 OVERVIEW

1.1.1 The helicopter emergency medical services industry, also known as helicopter medical transport and hereinafter referred to as HMT, has come under increased public scrutiny over the past few years due to an increase in the number of fatal accidents. Analysis by several agencies, including the International Helicopter Safety Team (IHST), the European Aviation Safety Agency (EASA), the Helicopter Association International (HAI) and the Air Medical Physician Association (AMPA) suggests that, while national HMT accident rates are comparable to other specialized areas of the helicopter industry, the HMT accident severity rate is unacceptably high. A disproportionate number of HMT accidents result in fatalities or serious injuries to occupants. This, combined with a significant increase in HMT activity worldwide, has contributed to a public perception that action is required to reduce the number and severity of HMT accidents.

1.1.2 ICAO tasked the Operations Panel (OPSP) in the spring of 2009 to consider HMT safety issues and make recommendations for further action. The OPSP formed the HMT subgroup (HMTSG) to ensure that the appropriate expertise was involved in developing the recommendations. While HMT operations are almost entirely domestic and as such not normally subject to the requirements of the Chicago Convention and its nineteen Annexes, ICAO was concerned that a real or perceived increase in serious accidents within one or more geographic areas could be indicative of more widely spread, systemic problems.

1.1.3 In the fall of 2009, the HMTSG concluded that safety guidance for the international HMT industry in the form of an ICAO circular should be published. This approach was endorsed by the OPSP. It was agreed that both regulators and operators can productively learn from each other's experiences and best practices in an effort to build a safer and more effective worldwide HMT industry.

1.1.4 Consideration regarding the medical training, experience, expertise and decision-making of medical personnel involved in helicopter medical transport is outside the scope of this document. These aspects should be considered by the national department of health in coordination, where appropriate, with the department of transport.

1.1.5 This circular will be the baseline for an HMT manual which will be a "living" document that will be revised and updated as required to reflect consensus with evolving best practices. This circular is a record of the OPSP/HMTSG deliberative process and consensus-building among participating HMT experts.

1.2 PURPOSE AND SCOPE

The HMTSG relied on the accident and safety research compiled by other organizations and the collective regulatory and operational experiences of its members in producing this circular. The focus for the subgroup was safety risk mitigation and intervention, rather than historical analysis. This document is meant to provide guidance and information derived from HMT best practices all over the world and focuses on mitigation of the risks that were considered the main contributing factors for many HMT accidents that resulted in occupant fatalities and injuries.

1.3 DATA AND ASSUMPTIONS

The OPSP used the following data and assumptions in developing this circular:

a) Recent HMT safety research and analyses performed by leading industry associations and agencies, such as the HAI, IHST, EASA, AMPA and the United States National Transportation Safety Board (NTSB).

b) Correlations between specific measures and practices, including operations with two pilots, use of night vision imaging systems (NVIS), crew resource management (CRM) training, etc., and safety impact were difficult to establish and remained the subject of opinion and anecdotal evidence.

c) No attempt was made to provide supporting, statistical evidence for the efficacy of specific mitigations and measures.

d) Helicopter performance classification implementation and compliance standards were beyond the scope of this circular. However, HMT operators and States should adopt procedures and standards that minimize risk exposure to third parties resulting from flight operations at the scene and at the healthcare facility landing sites.

e) Compliance with existing ICAO Standards and Recommended Practices (SARPs) for helicopter operations is essential (see Annex 6 — *Operation of Aircraft,* Part III — *International Operations — Helicopters*).

f) A formal impact assessment of the safety recommendations contained in this circular was beyond the scope and the resources of the OPSP.

g) There should be a relationship between the HMT operational environment[1] and operational standards, practices, training and technologies. More demanding environments require more rigorous (and potentially costly) safety interventions[2] which may exceed national minimum regulatory requirements.

h) Guidance material, developed by OPSP, with an international view and therefore respected national differences and preferences. Mitigations and measures were generalized so that they are not based on specific regulations with the aim that they can be applied with minimal adaptation to achieve desired safety objectives.

1. The HMT flight environment is defined by the local terrain and prevailing meteorological conditions and the nature of the HMT services and capabilities on offer. These may include the ability or intention to provide search and rescue, high altitude hoisting, long distance response into unfamiliar and/or hostile regions, night flights within mountainous terrain, etc.

2. Example two pilots, twin-engined helicopters, NVIS-capable, first responder outreach training, Category A performance capability, etc.

1.4 METHODOLOGY

The safety analysis is based on the safety management system (SMS) and IHST principles and methodologies. Using this approach, technical advisors identified key HMT operational risks and made outcome-based recommendations supported by examples of specific interventions and minimum standards which may be used to achieve these outcomes. The analytical and decision-making process included the following components:

a) review of relevant HMT safety literature, accident data, reports and recommendations from other agencies and organizations including the United States NTSB, HAI, IHST, AMPA, the Commission on Accreditation of Medical Transport Systems (CAMTS), etc., to identify HMT risks and accident causes;

b) compilation of key HMT hazards or accident/incident causal factors;

c) creation of a baseline HMT at-risk operational profile (Appendix A); and

d) recommendation of practical HMT safety best practices which include desired outcomes and appropriate interventions, mitigations and remedies.

The guidance in this circular stems from the OPSP recommendations. The application of the guidance herein should be proportional and in the best interests of the public, patients and operators.

Note.— Guidance on implementation of an SMS is contained in the Safety Management Manual (SMM) *(Doc 9859).*

Chapter 2

HMT SAFETY ANALYSIS

2.1 GENERAL HAZARDS AND ACCIDENT FACTORS

The HMTSG reviewed relevant accident and safety analyses completed by various organizations. Using this information, the HMTSG attempted to identify critical risks or hazards which have resulted in elevated accident rates for the HMT industry (see Appendix B — Bibliography). Risks or hazards that are more generic or less uniquely associated with HMT operations were not considered. This review identified the following key issues:

a) a disproportionate percentage of HMT accidents occur at night and during low-level operations;

b) all legs associated with an HMT flight are (more or less) equally at risk, including legs with no patients on board;

c) HMT critical accident events are predominantly associated with:

   1) controlled flight into terrain (CFIT) which may include collision with obstacles when it occurs during the en-route phase;

   2) loss of control – in flight (LOC-I); and

   3) collision with obstacle(s) during take-off and landing (CTOL);

d) accident patterns and causal factors were found to be similar among those geographical areas surveyed. While it is the highly perceived rate of severe HMT accidents in the United States which has caused the most public concern, a recent EASA study and anecdotal evidence review show proportionally elevated HMT accident and incident rates for CFIT, LOC-I, and CTOL in both Europe and Canada;

e) for the purposes of this HMT circular, CFIT and LOC-I, while different events, will be considered to be closely related since they are often preceded by similar leading events and root causes during HMT operations in marginal meteorological conditions (especially the transition to flight in inadvertent instrument meteorological conditions (IMC)).

2.2. CONTROLLED FLIGHT INTO TERRAIN (CFIT) AND LOSS OF CONTROL – IN FLIGHT (LOC-I)

Experience obtained in both the operational and regulatory environment identify CFIT and LOC-I as factors in the majority of HMT accidents. Contributing key causal factors include:

a) incomplete or inaccurate meteorological information;

b) poor meteorological minima compliance, preflight and/or en route;

c) dispatch pressure;

d) poor pilot dispatch decision-making influenced by:

1) fatigue and/or shift work/circadian rhythm adaptation issues;

2) poor CRM;

3) high risk tolerance;

4) disregard for aircraft limitations (e.g. aircraft approved for visual flight rules (VFR) only, flown in IMC); and

5) failure to follow standard operating procedures (SOPs);

e) continuing into marginal VMC/IMC:

1) no briefing or plan;

2) completion pressures — inadequate diversion or abort decision-making; and

3) poor instrument flight rules (IFR) proficiency and/or inadequate equipment;

f) lack of established technical flight procedures:

1) low-level helicopter route network;

2) point-in-space (PinS) procedures; and

3) required navigation performance authorization required (RNP AR) procedures.

2.3 COLLISION WITH OBSTACLE(S) DURING TAKE-OFF AND LANDING (CTOL)

Collisions with obstacles during the approach, landing, take-off or departure flight phases occur in both good and poor meteorological conditions. While some HMT CTOL accidents occur at the hospital and fixed-base landing sites, the majority occur when arriving at or leaving a “scene call” location on a highway or other ad hoc LZ. A partial list of CTOL key causal factors includes:

— “didn’t see it” — preoccupied or distracted;

— LZ inadequate — too small, does not meet standards;

— last-minute change of LZ;

— rearward or blindside hover;

— “forgot it was there”;

— poor LZ control;

— unnecessary low-level reconnaissance, manoeuvring, or flight in obstacle rich environment below 300 ft AGL;

— inadequate power; and

— lack of LZ hazard information (e.g. national obstacle information register).

———————

Chapter 3

MITIGATION AND INTERVENTION

Mitigations and interventions to reduce the risk of CFIT, LOC-I and CTOL occurrences should improve crew situational awareness, resource management, decision-making skills, procedural compliance and organizational culture.

3.1. CONTROLLED FLIGHT INTO TERRAIN (CFIT) AND LOSS OF CONTROL – IN FLIGHT (LOC-I) MITIGATION

3.1.1 Flight information and assessment

Desired outcome: Improved access to higher quality and more timely flight information for the time and route of flight. Improved access should be accompanied by improved motivation and commitment on the part of flight crews to make effective use of this information. Recommended interventions include:

a) improve preflight meteorological conditions information and access:

1) encourage local authorities to install more or upgraded automatic meteorological observing systems[1] and other meteorological conditions reporting technologies;

2) encourage flight crews to make better use of all available weather observations including highway or other web cameras. Approved aviation meteorological conditions reporting and forecasting information should take precedence when compliance with regulations is required (e.g. take-off minima, special VFR, IFR alternate heliport); and

3) encourage flight crews to cross-check multiple weather and flight information sources for discrepancies or ambiguities (especially when using non-aviation certified sources). Flight crews should resolve ambiguities prior to mission acceptance or revert to appropriate actions based on the worst-case information;

b) improve en-route in-flight meteorological conditions information and access — upgrade on board capabilities to access meteorological data and/or augment flight-following communications (e.g. satellite) with available meteorological conditions reports;

c) dispatch risk assessment tool:

1) create, implement and maintain a dispatch hazard identification and decision-making checklist or evaluation tool;

1. Guidance on automatic meteorological observing systems is given in the *Manual on Automatic Meteorological Observing Systems at Aerodromes* (Doc 9837).

2) provide a method for identifying escalation of risk — e.g. colour coding (visual trouble tree) or numeric scoring to aid in crew decision-making;

3) provide a procedure for escalating team briefing, consultation and decision-making as risk increases. For single pilot operations, clearly define risk escalation levels which may require mandatory consultation with the FSM, AMC, dispatchers/flight-followers, and, if required, operational management. Clearly establish that pilots may decline a flight request at any point during the escalation process; at no time should pilots feel it is implied that they accept the mission or that they are under explicit pressure to accept the mission as the risk increases;

4) provide clear guidance from management on acceptable risk levels and organizational risk management philosophy (e.g. turn down a mission if in doubt and debrief afterwards without fear of unreasonable disciplinary action); and

5) ensure all flight crew members understand the importance of initially making the correct go/no-go decision to avoid high pressure en-route re-evaluations with incomplete information or support.

Note.— Guidance on safety risk management is contained in the Safety Management Manual (SMM) *(Doc 9859).*

3.1.2 Training and simulation

Desired outcome: Improved local area knowledge and marginal meteorological conditions assessment, avoidance and decision-making skills. Recommended interventions include:

a) local area knowledge:

1) provide mandatory initial and recurrent training to all flight crews with a focus on local area knowledge, routes, obstacles, known hazards, meteorological conditions interpretation, etc. Each new base pilot should be trained and found competent in local area knowledge. Incorporate local operating knowledge into the recurrent training and assessment programme;

2) provide a knowledge log or area route guide to capture, disseminate and make available essential navigation and hazard information;

3) provide current and complete operations charts, tables, guides, SOPs, etc., appropriate to the operating environment and existing capabilities in a location and format that is readily accessible to the pilot(s) for shift and preflight planning activities; and

4) create, implement and maintain base-specific SOPs which are current and reflect evolving practices, hazards, changing environments, etc.

b) scenario-based training — to include marginal VMC and inadvertent IMC identification, avoidance (for VFR/VMC qualified operations) and/or recovery training (VFR/VMC/marginal VMC and IMC for IFR qualified operations):

1) determine baseline crew member proficiency and competency to identify areas of weakness and on going skill building;

2) improve flight crew member proficiency and competency levels through use of a training programme using a qualified flight simulation training device;

3) reinforce the creation of a safe HMT culture which focuses on normal aviation risk management and decision-making, using CRM tools and procedures. All training should emphasize that HMT is not emergency flying; and

4) include use of ODP (minimum abort/diversion visibility and minimum height above ground) which is to be briefed by the pilot.

3.1.3 Human factors

Desired outcome: Improve effective use of all crew members and flight resources including dispatchers, air traffic control (ATC), flight information specialists, and ground first responders, as applicable, to support safe decision-making. Reduce fatigue and stress. Recommended interventions include:

a) AMRM theory and practical training for the entire crew including pilot(s), FSMs, AMCs, dispatchers, maintenance technicians and management (for both the air operator and the medical programme):

1) emphasize effective shift change, preflight, in-flight (especially for unanticipated conditions and contingency planning) and post-flight briefings;

2) adopt “crew concept” and emphasize shared responsibility for flight safety and shared decision-making;

3) provide meteorological conditions interpretation, safety culture awareness, decision-making, hazard identification, etc., for FSM, AMC and flight dispatchers/flight-followers, especially for single pilot operations;

4) use flight training devices (FTDs) or other innovative technologies to create realistic scenarios which encourage and support pilot/FSM/AMC/dispatchers/flight-followers interaction;

5) create realistic scenarios to train and encourage FSM, AMC and dispatcher/flight-follower to provide assistance to the pilot(s) for ODP compliance and to support good pilot decision-making; and

6) encourage discussion of aviation and medical safety and risk cultures and how they may support or detract from safe flight decision-making.

b) integration of fatigue reduction and illness support measures:

1) include fatigue, shift work and crew composition factors on dispatch risk assessment tool;

2) support for no-penalties in case of mission declines due to fatigue or illness — including a policy for timely relief by a standby or other crew member to relieve pressure on the crew member on duty;

3) apply consistent fatigue reduction and mitigation measures to all flight crew and flight support members who are part of the active operational HMT team including pilots, FSM, AMC, dispatchers/flight-followers, and maintenance engineers, as applicable; and

4) consider shortened duty days and/or modified shift schedule for single pilot operations.

3.1.4 Operational control

Desired outcome: Improved guidance, Standards, and limitations to clarify and standardize operational risk management procedures. Create and continuously improve the information and feedback loop between flight crews, operational support personnel, and air and medical programme management. Recommended interventions include:

a) SMS based on, but not limited to, the following:

1) a process to identify actual and potential safety hazards and assess the associated risks;

- provide an effective incident/occurrence reporting system with timely action by responsible person(s) and feedback;

2) a process to develop and implement remedial action necessary to maintain an acceptable level of safety;

- collect flight data, when feasible, in support of a helicopter operations monitoring programme where data are regularly analysed to identify pilot performance and compliance issues for focused training remediation and skill building;

3) provisions for continuous monitoring and regular assessment of the appropriateness and effectiveness of safety management activities;

- institute a safety culture which encourages information-sharing without fear of unreasonable disciplinary action; and

4) use proactive hazard identification, assessment, and mitigation procedures;

b) medical and aviation dispatch procedures should:

1) provide dispatch support for safe pilot decision-making and information-sharing;

2) where feasible, establish a centralized regional medical dispatch with effective triage and resource (appropriate transport mode, proximity, capability and timeliness) allocation procedures. Streamline the system activation process to encourage or permit single point, one-call access;

3) require the medical dispatcher to advise the air service/base/pilot if another air service/base/pilot has declined the mission due to meteorological conditions or other safety related reasons;

4) adjust the air service compensation/contractual model where applicable so flying/not flying is as revenue-neutral as possible;

5) ensure fair compensation for risk management interventions and mitigations which support higher levels of HMT safety;

6) protect the pilot(s) from knowledge of detailed patient condition or other information during the preflight phase which may increase pressure and negatively impact safe dispatch decision-making;

7) ensure, for each air operator, clear definition and separation of medical dispatch/triage and flight support functions. Flight dispatch/flight-following personnel should support the flight crew with timely and accurate flight information and assist in flight safety decision-making (especially identification of the ODP and support for alternative action) without distraction or pressure due to patient need or from the sending or receiving medical agencies; and

8) ensure that the flight crew is given sufficient time from dispatch to take-off to properly assess all potential hazards and identify mitigation strategies without undue time pressure;

c) a flexible and adaptable HMT quality management (QM) system which provides protection for time threshold performance to reduce pressure on the flight crew to expedite critical flight information assessment and decision-making. This QM system should include provisions to:

1) provide for extended meteorological conditions checks or other systems to collect and assess information for other specified exceptional circumstances;

2) provide extended mission briefings for difficult or complex missions; and

3) adjust threshold times, where applicable, to reflect base and operator-specific conditions.

3.1.5 Standards and minima by operational type

Desired outcome: Provide recommended minimum operational Standards and requirements which help manage risk at acceptable levels for different service capabilities and operational conditions.

Examples of HMT operational levels are described below. Each of the four levels progressively supports a higher level of service capability. Operational Level 1 specifies minimum acceptable Standards and criteria (as permitted by authorities) for single pilot VFR operations conducted between pre-surveyed designated LZs. Each of the following operational levels is a modification of the one preceding:

a) ***Level 1*** — Day/night VFR/VMC (visual meteorological conditions) single pilot inter-facility transports:

1) en-route VFR meteorological conditions criteria: ceiling 250 m (800 ft) and visibility 3 km (2 sm) during the day and ceiling 450 m (1 500 ft) and 5 km (3 sm) at night;

2) dispatch meteorological conditions go/no-go criteria with a specified margin that is greater than the minimum en-route meteorological conditions required to maintain flight in VMC (e.g. if the en-route criteria has a ceiling of 250 m (800 ft) and a 3 km (2 sm) visibility, the go/no-go criteria may have a ceiling of 360 m (1 200 ft) and a visibility of 5 km (3 sm)). The specified margin should be established by the operator after the completion of a safety risk assessment;

3) operator predetermined ODP with full crew briefing and shared decision-making. The ODP parameters should be established by the operator for anticipated flight and environmental conditions (e.g. day or night, mountain operations, etc.) after the completion of a safety risk assessment. Pilots should be trained to divert, abort, land, or transition to IMC if IFR-certified, if one or more of the ODP minimum thresholds or trigger points is reached (e.g. descent to or below 150 m (500 ft) above the highest en-route obstacle to maintain VMC, and/or reduction of in-flight visibility to 3 km (2 sm) and/or a reduction in safe manoeuvring speed to V_y (best rate of climb speed) or below);

4) operational control with timely provision of critical flight information;

5) annual training and demonstrated proficiency in marginal VMC identification, avoidance and recovery including immediate landing if VMC cannot be maintained; and

6) operational control support for flight aborts, en-route terminations, and alternate patient transport.

b) ***Level 2*** — Day/night VFR/VMC single pilot scene operations within a specific operational area — same as Level 1 above and in addition:

1) specific operational area with adequate visual ground references and demonstrated pilot familiarity supported by annual recurrent local area knowledge, scenario-based training, exam and flight check;

2) FSM seated in the cockpit to support the pilot during all HMT flight legs. The FSM may occupy a non-cockpit seat when the patient is on board provided mitigation measures are implemented to ensure an equivalent level of safety (compared to when the FSM is seated in the cockpit). Mitigation measures may include, but are not limited to, increased departure and en-route meteorological conditions minima, increased ODP minima, and enhanced cockpit/medical cabin CRM information-sharing and decision-making procedures;

3) radar altimeter, including an aural warning, with a visual display in the normal panel scan area of the pilot(s) and/or FSM;

In addition, for night operations:

4) approved NVIS and NVG should be available to each flight crew member and the FSM to enhance flight safety at night;

5) illumination (NVIS-compatible as applicable) from the helicopter to adequately identify LZ hazards; and

6) a stability augmentation system.

c) ***Level 3*** — Day/night VFR/VMC/marginal VMC and IFR/IMC single pilot within a specific operational area — same as Level 2 above except:

1) reduced meteorological conditions to less than a ceiling of 250 m (800 ft) and a visibility of 3 km (2 sm) during the day and a ceiling of 450 m (1 500 ft) and a visibility of 5 km (3 sm) at night, but not less than the minimum State regulations for HMT VMC appropriate to the airspace;

2) no dispatch meteorological conditions go/no-go margin — dispatch meteorological conditions go/no-go criteria may be the same as the minimum en-route requirement;

3) air operator's authorization for IFR operations is required (including full pilot and aircraft single pilot IFR qualification and certification, where applicable) with demonstrated proficiency and currency; and

4) training, once a year, to demonstrate proficiency in marginal VMC/IMC identification and avoidance, inadvertent IMC recovery including safe transition to IFR and other training, such as identifying and assessing icing conditions, contingency fuel and IFR alternate calculations.

d) ***Level 4*** — Day/night VFR/VMC/marginal VMC and IFR/IMC for operations with two pilots — same as Level 3 above except no specific operational area.

3.2 COLLISION WITH OBSTACLE(S) DURING TAKE-OFF AND LANDING (CTOL) MITIGATION AND INTERVENTIONS

Many of the flight information, training and simulation, human factors, and operational control interventions discussed in 3.1 under CFIT and LOC-I risk reduction will also reduce the risk of CTOL.

Desired outcome: To increase crew situational awareness and decision-making during the approach, landing, take-off and departure phases of flight, especially when operating at scene locations. Recommended interventions include:

a) FSM or second pilot for operations to LZs;

b) SOP for full 360 degrees scene reconnaissance at safe altitude above obstacle rich environment with a full crew briefing prior to final descent and landing to include:

   1) identification of obstacles and hazards to safe flight;

   2) identification of obstacles and hazards to ground operations and safe access by AMC;

   3) communication of approach and landing intentions including direction, altitudes, anticipated manoeuvring, and abort procedures;

   4) request for “all eyes out” and alerting of pilot(s) and/or FSM if an unbriefed obstacle, hazard or unsafe condition is identified; and

   5) LZ safety and hazard report from ground first responders prior to, or during the reconnaissance. If air to ground communications cannot be established, the pilot(s) should visually ascertain that the LZ is secure and all hazards have been identified;

c) LZ and helicopter safety procedure training for first responders to include:

   1) LZ selection and required surfaces;

   2) LZ marking and lighting;

   3) hazard identification, removal and mitigation;

   4) LZ officer assignment and marshalling procedures;

   5) LZ safety and protection; and

   6) air to ground communication procedures:

      i) radio procedures;

      ii) skyshout and use of sirens;

      iii) marshalling;

      iv) LZ and hazard report.

d) operate with helicopter masses at scene locations that provide a margin of residual performance sufficient to allow the pilot to:

1) arrest descent to hover-out-of-ground effect (HOGE) during the final stage of the approach in order to avoid unanticipated hazards and/or to blow away obscuring snow, sand or dust prior to landing;

2) safely execute a missed approach to avoid hazards;

3) manoeuvre during landing as needed to avoid hazards and position the helicopter safely; and

4) take off vertically with adequate height at transition in order to forward flight so that obstacles can be overflown and avoided.

e) LZ risk mitigation hierarchy:

1) operator pre-surveyed and designated safe rendezvous sites are preferred. Operator surveyed, designated, and charted landing sites should be used when possible to complete the rendezvous and patient transfer with ground emergency response services;

2) LZs may be used when a suitable pre-surveyed rendezvous site is not available. The LZ should be assessed by trained ground first responders and prepared as follows:

- survey and protect surfaces and slopes to a practicable regulatory equivalent;
- identify, remove, mitigate and/or mark hazards;
- provide appropriate marking and lighting;
- remove or secure objects which may cause foreign object damage to the aircraft or personnel;
- provide control for LZ personnel and vehicles; and
- provide approach, landing and take-off marshalling;

3) first response LZs without ground support may be used when no other pre-surveyed or first responder assessed site is available. In addition to normal LZ airborne reconnaissance and safety procedures, operators should have additional airborne first response flight training and procedures to ensure that:

- an equivalent level of safety is established with respect to the suitability of the potential LZ, obstacle and hazard identification (including foreign object damage assessment and avoidance procedures), and identification of suitable visual references for landing, take-off and manoeuvring; and
- flight training and procedures are used for safe LZ operations when ground crew and ground marking/support is not available, including white-out/brown-out and recovery.

f) wire strike protection kit;

Chapter 4

SUPPORTING TECHNOLOGIES

4.1 GENERAL CONSIDERATIONS

New, innovative or proven technologies can be used effectively to support the CFIT, LOC-I, and CTOL desired outcomes and interventions listed in Chapter 3. In order to do so, HMT technological safety enhancements should:

a) be appropriate — they should be evaluated for the operational task, environment and human factors issues using the best available methodologies;

b) improve situational awareness while reducing workload. If workload is increased (e.g. NVIS, IFR), the benefit should be proportional and other measures should be implemented to maintain or reduce baseline risk (e.g. addition of a stability augmentation system, auto-hover and/or autopilot); and

c) be as simple and affordable as possible.

4.2 OPTIONAL TECHNOLOGICAL ENHANCEMENTS

The following technologies support the CFIT, LOC-I, and CTOL interventions described in Chaper 3. Specific technologies should be evaluated and installed if they enhance crew situational awareness and/or reduce crew workload depending on the operational environment and offered capabilities:

a) enhanced terrain avoidance warning system;

b) moving map/multifunction display/electronic horizontal situation indicators, etc.;

c) real-time meteorological conditions identification and avoidance aides, either self-contained (e.g. radar) or using remote data;

d) synthetic/enhanced vision in addition to NVIS;

e) head-up displays (HUD)/helmet displays;

f) usage monitoring systems, health and usage monitoring systems, helicopter operations monitoring programme and cockpit information recording systems;

g) low-level IFR infrastructure including:

   1) satellite-based augmentation system (SBAS) point-in-space (PinS) approaches and departures to/from heliports;

   2) heliport identification lighting for PinS operations;

   3) direct low-level routes separated from other IFR and VFR traffic;

h) satellite flight-following and two-way communications;

i) ADS-B.

Chapter 5

CONCLUSION

It is recognized that States and operators will not be able to implement all of these recommended interventions and mitigations immediately. Some of the measures will be difficult to implement due to aircraft and equipment limitations or funding constraints. However, States and operators are encouraged to take the guidance in this circular into consideration when making future equipment upgrades, fleet replacements and regulatory decisions. The guidance in this circular is not intended to be definitive or prescriptive, but rather should become the foundation for an adaptive, evolving safety risk approach for effective HMT risk identification and mitigation.

Appendix A

At-risk operational profile

The identification of key HMT safety factors enables the creation of a composite profile for a typical at-risk HMT operation. This profile establishes a baseline for safety enhancing mitigations and interventions. This does not necessarily suggest that demonstrable correlations exist between any one or more of these practices or conditions and high accident and accident severity rates.

a) Crew composition, qualification and currency:

   1) single pilot without FSM;

   2) IFR-rated but marginally proficient and current;

   3) limited recent single pilot experience (especially ex-military pilots);

   4) limited flight experience (e.g. less than 2 000 hours total flight experience (TT) with 1 000 hours on helicopter);

   5) minimal unaided night experience (especially ex-military pilots);

   6) limited HMT experience;

   7) marginal overall currency and proficiency due to low annual flight hours; and

   8) limited or no shared flight safety decision-making with AMC members or flight dispatchers.

b) Second crew member (non-pilot):

   1) an AMC may occupy the second cockpit position (if there is one) on the leg without the patient on board;

   2) the AMC will most likely have received minimal training to fill an effective safety role assisting the crew member; and

   3) flight legs with a patient on board are flown by a single pilot without assistance from the AMC.

c) Initial and recurrent training:

   1) initial type training when being hired — (typically 6 to 12 hours);

   2) initial line indoctrination — (typically 10 hours on operational flights with a senior pilot);

   3) recurrent training every 12 months with an instructor pilot to include the minimum requirements such as review of IFR, emergency and inadvertent IMC procedures;

4) little or no use of flight simulation training devices;

5) no recurrent line-oriented flight training (LOFT);

6) CRM theory instruction but limited practical application during training due to lack of available and affordable flight simulation training devices and procedures trainers; and

7) limited or no combined crew training (pilots and AMC) or practical cross-training.

d) Operational control:

1) pilot “self-dispatch” system — the pilot checks the meteorological conditions and accepts the mission launch request autonomously — limited or no consultation with FSM, AMC and/or medical dispatcher;

2) limited or no flight-following or en-route flight information updates other than that available through normal flight information services; and

3) significant cost, as well as competitive pressure for job security, for crew implicitly linked to mission volume. Pressure may be driven either by the air operator (typically the “vendor”) and/or programme economics (i.e. hospital recovery of high-value patients) or both.

e) Aircraft and equipment:

1) may not be IFR-certified and/or equipped with a stability augmentation system;

2) may be a light single- or twin-engined helicopter with limited cockpit space for second crew member or no isolation of patient from pilot; and

3) limited instrumentation and technological safety systems such as airborne collision avoidance system/traffic alert and collision avoidance system (ACAS/TCAS), enhanced ground proximity warning system (EGPWS), weather radar, radar altimeter, etc.

APPENDIX B

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