GOVERNMENT OF INDIA
CIVIL AVIATION DEPARTMENT
DIRECTORATE GENERAL OF CIVIL AVIATION

OC NO 01 OF 2016
DATE:_____

OPERATIONS CIRCULAR

File No: AV22024/17/2015-FSD

Subject: **HELICOPTER EMERGENCY MEDICAL SERVICES (HEMS)**

1. PURPOSE

1.1 This Operations Circular (OC 01 of 2016), establishes approval requirements, equipment prerequisites, operational stipulations and training standards for operators seeking authorisation for Helicopter Emergency Medical Services (HEMS) operation.

2. RELEVANT REGULATIONS

2.1 Rule 133A of Indian Aircraft Rules 1937.

2.2 CAR Section 8 Series S Part VII – Operation of Aeromedical Transportation (AMT).

3. REFERENCE APPENDICES IN THIS OC

3.1 Appendix I – GM on Flight Data Monitoring.

3.2 Appendix II – GM on HEMS onboard medical equipment.

3.3 Appendix III - HEMS Operations Control Centre (HOCC).

3.4 Appendix IV – HEMS Operating Base Facilities.

3.5 Appendix V - GM on Operational Risk Assessment and Management (ORAM)

3.6 Appendix VI - AMC on HEMS Operational Training (HOT) Flight crew and HHO Crewmember.

3.7 Appendix VII - AMC on Night Vision Imaging System (NVIS) Training and Checking.

3.8 Appendix VIII - AMC on HHO Training & Checking.

3.9 Appendix IX – GM on HEMS Operational Training (HOT) for Medical Crew.

3.10 Appendix X – GM on HEMS Operational Training (HOT) for GEMS.

4. DEFINITIONS AND ABBREVIATIONS

4.1 Definitions. For the purpose of this OC, the following definitions shall apply:-

4.1.1 'Aircraft tracking' means a ground based process that maintains and updates at standardised intervals, a record of the four dimensional position of individual aircraft in flight.

4.1.2 'AMT payload' means to include patients, organs, blood, tissue, medical personnel or medical supplies carried in an AMT flight.

4.1.3 'Category A helicopter' means a multi-engined helicopter designed with engine and system isolation features specified in the applicable airworthiness codes and capable of operations using take-off and landing data scheduled under a critical engine failure concept that assures adequate designated surface area and adequate performance capability for continued safe flight or safe rejected take-off in the event of engine failure.

4.1.4 'Category B helicopter' means a single-engined or multi-engined helicopter that does not meet Category A standards. Category B helicopters have no guaranteed capability to continue safe flight in the event of an engine failure, and unscheduled landing is assumed.

4.1.5 'Congested area' means in relation to a city, town or settlement, any area which is substantially used for residential, commercial or recreational purposes.

4.1.6 'Contingency fuel' means the fuel required to compensate for unforeseen factors that could have an influence on the fuel consumption to the destination aerodrome or helipad.

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4.1.7 ‘Critical phases of flight’ in the case of helicopters means taxiing, hovering, take-off , final approach, missed approach, the landing and any other phases of flight as determined by the Pilot-in-Command or Commander.

4.1.8 ‘D’ denotes the largest dimension of the helicopter when the rotors are turning.

4.1.9 ‘Dangerous goods (DG)’ means articles or substances which are capable of posing a risk to health, safety, property or the environment and which are shown in the list of dangerous goods in the Technical Instructions or which are classified according to those Instructions.

4.1.10 “Dispatch policy” means a policy, procedure or guideline that addresses the medical issues relating to the selection and dispatch of HEMS to the scene of an emergency.

4.1.11 ‘Elevated helipad’ means a helipad that is at least 3 m above the surrounding surface.

4.1.12 'Exposure time’ means the actual period during which the performance of the helicopter with the critical engine inoperative in still air does not guarantee a safe forced landing or the safe continuation of the flight.

4.1.13 ‘Flight data monitoring (FDM)’ means the proactive and non-punitive use of digital flight data from routine operations to improve aviation safety.

4.1.14 ‘Flight following’ means the task of maintaining contact with specified aircraft for the purpose of determining en route progress and/or flight termination.

4.1.15 'Ground Emergency Medical Service (GEMS)’ means any ground ambulance emergency service.

4.1.16 ‘GEMS personnel’ means personnel operating ground ambulance, and also includes policemen, firemen etc. involved with HEMS and whose tasks are to any extent pertinent to helicopter operations.

4.1.17 ‘Helicopter Emergency Medical Services (HEMS)’ means a flight by a helicopter operating under a HEMS approval, the purpose of which is to facilitate emergency medical assistance, where immediate and rapid transportation is essential.

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4.1.18 ‘HEMS crew member’ means a technical crew member who is assigned to a HEMS flight for the purpose of attending to any person in need of medical assistance carried in the helicopter and assisting the pilot during the mission. In HEMS this typically would be the HHO crew member.

4.1.19 ‘HEMS medical crew member’ means a medical person carried in a helicopter during a HEMS flight, limited to doctors, nurses and paramedics who has received HEMS operational training.

4.1.20 ‘HEMS operating base (HOB)’ means an aerodrome/helipad at which the HEMS crew members and the HEMS helicopter may be on stand-by for HEMS operations. HOB may be co-located with HOCC.

4.1.21 ‘HEMS Operational Control Centre (HOCC)’ means a place from where the coordination or control of the HEMS flight takes place. It may be located in a HEMS operating base and retains Operational Control of the HEMS flight.

4.1.22 ‘HEMS operating site’ means a site selected by the commander during a HEMS flight for helicopter hoist operations, landing and take-off. This is a site other than an airfield or heliport. Usage of the term may be interchangeable with LZ.

4.1.23 ‘Helicopter Hoist Operation (HHO)’ means a flight by a helicopter operating under an HHO approval, the purpose of which is to facilitate the transfer of persons and/or cargo by means of a helicopter hoist.

4.1.24 ‘HHO crew member’ means a technical crew member who performs assigned duties relating to the operation of a hoist.

4.1.25 ‘HHO passenger’ means a person who is to be transferred by means of a helicopter hoist.

4.1.26 ‘Hostile environment’ means an environment in which:-

(i) a safe forced landing cannot be accomplished because the surface is inadequate, or

(ii) the helicopter occupants cannot be adequately protected from the elements, or

(iii) search and rescue response/capability is not provided consistent with anticipated exposure. or, there is an

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unacceptable risk of endangering persons or property on the ground.

In any case, the following areas shall be considered hostile:-

(i) open sea areas considered to constitute a hostile environment and designated by the appropriate authority in the appropriate Aeronautical Information Publication or other suitable documentation.

(ii) those parts of a congested area without adequate safe forced landing areas.

4.1.27 'Intended area of operations' means an area primarily served by HEMS service.

4.1.28 'Landing Zone (LZ)' means a specified area where a helicopter may land to embark/disembark AMT payload, or may hover to conduct HHO. This term is interchangeable with HEMS operating site.

4.1.29 'Medical passenger' means a medical person carried in a helicopter during a HEMS flight, including but not limited to doctors, nurses and paramedics.

4.1.30 'Night' means the period half an hour after local sunset and half an hour before local sunrise.

4.1.31 'Non-hostile environment' means an environment in which:

(i) A safe forced landing can be accomplished, or

(ii) The helicopter occupants can be protected from the elements and search and rescue response/capability is provided consistent with the anticipated exposure.

(iii) In any case, those parts of a congested area with adequate safe forced landing areas shall be considered non-hostile.

4.1.1 'Obstacle Clearance Procedure (OCP)' means laid down textual or graphical information that if followed during approach or takeoff from LZ, will ensure adequate margin of clearance from obstructions.

4.1.2 'Operation in performance class 1' means an operation that, in the event of failure of the critical engine, the helicopter is able to land within the rejected take-off distance available or safely continue the flight to an appropriate landing area, depending on when the failure occurs.

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4.1.3 'Operation in performance class 2' means an operation that, in the event of failure of the critical engine, performance is available to enable the helicopter to safely continue the flight, except when the failure occurs early during the take-off manoeuvre or late in the landing manoeuvre, in which cases a forced landing may be required.

4.1.4 'Operation in performance class 3' means an operation that, in the event of an engine failure at any time during the flight, a forced landing may be required in a multi-engined helicopter and will be required in a single-engined helicopter.

4.1.5 'Operational control' means the responsibility for the initiation, continuation, termination or diversion of a flight in the interest of safety. This responsibility is vested in HOCC.

4.1.6 'Public interest site (PIS)' means a site used exclusively for operations in the public interest. An example of a public interest site is a landing site based at a hospital located in a hostile environment in a congested area, which due to its size or obstacle environment does not allow the application of performance class 1 requirements that would otherwise be required for operations in a congested hostile environment.

4.1.7 'Safe forced landing' means an unavoidable landing or ditching with a reasonable expectancy of no injuries to persons in the aircraft or on the surface.

4.1.8 'Technical crew member' means a crew member in commercial air transport HEMS, HHO or NVIS operations other than a flight or cabin crew member, assigned by the operator to duties in the aircraft or on the ground for the purpose of assisting the pilot during HEMS, HHO or NVIS operations, which may require the operation of specialised on-board equipment.

4.1.9 "Technical Instructions" means the instructions for the safe transport of dangerous goods by air, approved and issued periodically in accordance with the procedure established by the International Civil Aviation Organisation Council.

4.2 Abbreviations.

ADRS	Aircraft Data Recording System
AIRS	Airborne Image Recording System
AMC	Acceptable Means of Compliance

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AMT	Aeromedical Transportation
CARS	Cockpit Audio Recording System
DG	Dangerous Goods
DLRS	Data Link Recording System
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMS	Emergency Medical Services
EUROCAE	European Organisation for Civil Aviation Equipment
FDM	Flight Data Monitoring
FSTD	Flight Simulation Training Device
GEMS	Ground Emergency Medical Services
GM	Guidance Material
GSM	Global System for Mobile Communications
HEMS	Helicopter Emergency Medical Services
HHO	Helicopter Hoist Operations
HOCC	HEMS Operational Control Centre
HTAWS	Helicopter Terrain Awareness and Warning System
LZ	Landing Zone
MOPS	Minimum Operational Performance Standards
MPED	Medical Portable Electronic Devices
NVIS	Night Vision Imaging System
NVG	Night Vision Goggles
OpSpec	Operational Specifications
ORAM	Operational Risk Assessment and Management
PIS	Public Interest Site
RTCA	Radio Technical Commission for Aeronautics

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WSPS Wire Strike Protection System

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PART I - OVERVIEW

5. INTRODUCTION

5.1 The utilisation of helicopter in EMS role, or Helicopter Emergency Medical Services (HEMS) is a modern trauma care delivery system. It can deliver clinical benefits by shortening the time to transport patients with time-sensitive medical conditions to definitive care, or provide necessary specialised medical expertise/ equipment to patients before and/or during transport, or provide transport to patients inaccessible by other means of transport. It is a dedicated service which is always on standby with medical intervention technology and onboard medical expertise.

5.2 Helicopters are ideal delivery systems for EMS due to their capability to hover and land without being constrained to runways and can vault across road traffic delays unaffected by terrain. HEMS utilises the tenet of trauma management that clinical benefit increases considerably when care is delivered within the golden hour. The golden hour in EMS parlance is the time period where access to definitive care within an hour of occurrence of life-threatening trauma can make all the difference between life and death.

5.3 HEMS is not a substitute for GEMS ambulance service but is about an incremental improvement, expanded capability and enhanced accessibility. An efficient HEMS system expands the capability of the national trauma response system by enlarging the reach in any geographical setting but particularly in conditions where ground transportation is limited by terrain or traffic, and in areas where demographics and hospitals are widely dispersed.

5.4 HEMS due to its activity profile of swift tempo of operations and oft-unfamiliar operating environment, places itself at a much higher risk as compared to other commercial air transportation ventures. Consequently, the industry worldwide has been bedevilled by a higher accident/incident rate as compared to any other form of aerial transportation. Since HEMS straddles two complex environments of medicine and aviation it is far more intricate than any form of EMS in logistical planning as well in the effort to ensure effective system performance with safety.

6. DEFINING HEMS

6.1 HEMS flight means a flight by a helicopter operating under a HEMS approval, the purpose of which is to facilitate emergency medical assistance, where immediate and rapid transportation is essential by carrying:-

(a) Medical personnel or

(b) Medical supplies (equipment, blood, organs, drugs) or

(c) Any ill or injured persons and other persons directly involved.

6.2 A HEMS flight or mission shall normally start and end at the HEMS operating base following tasking by the HEMS operational control centre. Tasking can also occur when airborne, or on the ground at locations other than the HEMS operating base. The following elements are regarded as integral parts of the HEMS flight:-

(a) flights to and from the HEMS operating site when initiated by the HEMS operational control centre, or

(b) flights to and from an aerodrome/operating site for the delivery or pick-up of medical supplies and/or persons required for completion of the HEMS mission, or

(c) flights to and from an aerodrome/operating site for refuelling required for completion of the HEMS mission.

7. HEMS PHILOSOPHY

7.1 HEMS is an operation in the interest of the general public and for a social cause and accordingly some alleviation from the normal Commercial Air Transport (CAT) rules has been made admissible. However, alleviations are permissible only when appropriately mitigated by technology that ensures safer operations, stringent crew experience/training requirements and comprehensive operational usage procedures. Such operational credits are considered as risk offsets accrued due to increased use of technology that

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enhances safety coupled with higher levels of training of aircrew, as compared to other CAT operators.

7.2 It may be noted that a HEMS mission is not limited to transportation of a patient itself but also includes transportation of medical personnel and medical supplies with the overriding objective of an immediate and rapid transfer. In case this objective is lacking or the flight urgency is lower, the mission acquires the role of an air ambulance flight. An operator who has been accorded specific approval for HEMS may conduct a medical flight as HEMS flight or as an air ambulance flight depending upon the medical urgency. This nuanced difference can be exemplified using a road ambulance analogy:-

(a) If called to an emergency, an ambulance would proceed at great speed sounding its siren and proceeding against traffic lights – thus matching the risk of operation to the risk of a potential death (= HEMS operations).

(b) For a transfer of a patient (or equipment) where life and death (or consequential injury of ground transport) is not an issue, the journey would be conducted without sirens and within normal rules of motoring – once again matching the risk to the task (= air ambulance operations).

8. HEMS CERTIFICATION REQUIREMENTS

8.1 An operator intending to utilise a helicopter for the purpose of HEMS shall obtain specific approval by DGCA for HEMS operations. To obtain such approval, the operator shall:-

(a) hold an Air Operators Certificate.

(b) demonstrate cohesion and coordination of HEMS activities with local/state/national EMS structure.

(c) validate compliance with OpSpec requirements enumerated in this Operations Circular.

8.2 The helicopter due to its integrated EMS interiors and fixed medical equipment shall not be utilised for other than HEMS or AA tasks. Infringement will automatically entail cancellation of HEMS approval.

PART II – EQUIPAGE STANDARDS

9. MINIMUM HELICOPTER REQUIREMENTS FOR HEMS BY DAY

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(a) Category B helicopter.

(b) Wire Strike Protection System (WSPS) installation.

(c) Integrated communication suite on the aircraft that enables voice communication between cockpit and ground EMS and also on police radio channels. Continuous communications cover shall also be available between the helicopter and HOCC on sat/VHF/GSM links which could be either/or be data/voice.

(d) Flight Recording System (FRS) consisting of aircraft data recording system (ADRS), cockpit audio recording system (CARS), airborne image recording system (AIRS) and/or a data link recording system (DLRS). The flight recording system may conform to either EUROCAE ED-112A (MOPS for Crash Protected Airborne Recorder Systems) or EUROCAE ED 155 (MOPS for Lightweight Flight Recording Systems) specifications or such other specification with provision for ADRS, CARS, AIRS and/or DLRS. The mandatory requirement of this equipment shall come into effect from 01 Apr 2017.

(e) Basic engine usage monitoring system either by standalone or by onboard FADEC or FRS that can fulfil the requirement for recording and storing parameters in a usage monitoring system as given in Appendix I Para 2 (c) for Flight Data Monitoring (FDM) purpose. The mandatory requirement of this equipment shall come into effect from 01 Apr 2017.

(f) High visibility rotor paint scheme to increase blade conspicuity.

(g) Aircraft tracking system which is a ground based process to maintain and update at standardised intervals, a record of the four dimensional position of the aircraft in flight so that aviation security and air traffic concerns can be mitigated.

(h) EMS adapted interiors with as far as practicable gapless panelling to prevent leakage of fluids into interior spaces with flame retardant moisture-resistant interior panels.

10. MINIMUM HELICOPTER REQUIREMENTS FOR HEMS BY NIGHT. In addition to day equipage requirements the following shall be mandatory for HEMS operations by night:-

(a) Category A helicopter.

(b) IFR certification.

(c) Airborne weather radar.

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(d) Helicopter Terrain Awareness and Warning Systems (HTAWS) with current terrain database for intended area of operations. The equipment shall be in conformity to RTCA DO-309, (MOPS for HTAWS Airborne Equipment). The mandatory requirement of this equipment shall come into effect from 01 Apr 2017.

(e) NVIS equipment and compatible lighting that is as far as practicable Generation III and in conformity to RTCA DO-275 (MOPS for Integrated Night Vision Imaging System Equipment) or TSO C164 (Night Vision Goggles).

(f) Fully trainable NVIS compliant searchlight operable by the pilot for identifying obstructions around HEMS operating site and illuminating the landing area.

(g) High visibility anti-collision lights.

11. HELICOPTER EQUIPAGE IMPOSED RANGE LIMITATION

11.1 Helicopters meeting requirements of Para 9 shall be limited to 75 nm operating range from HEMS operating base unless installed with airborne weather radar and HTAWS.

12. MEDICAL EQUIPAGE REQUIREMENTS

12.1 The environmental conditions for medical devices used in HEMS are different from those expected in a normal hospital environment. In particular, this implies environmental conditions such as temperature and humidity, vibration and shock caused by movement of the air ambulances, variable atmospheric pressures and electromagnetic disturbances between the air ambulances and the medical device.

12.2 Guidance for medical standards.

(a) The use and fitment of medical equipment in HEMS shall be guided by standards laid down in BS EN 13718-1:2008 Part 1: Requirements for medical devices used in air ambulances, and BS EN 13718-2:2008 Part 2: Operational and technical requirements of air ambulances or any such equivalent standards.

(b) Onboard medical equipment including Medical Portable Electronic Devices (MPED) can cause serious potential electromagnetic interference with aircraft avionics, navigation, communications, flight or engine control systems. The electromagnetic emission and susceptibility of medical devices shall conform to ISO 7137 or RTCA DO-160D (Environmental Conditions and Test Procedures for Airborne Equipment) Sections 20 and 21. The operator must demonstrate that the

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medical equipage is electromagnetic compatible and EMC test report with source/victim matrix is established.

12.3 The fixed medical equipment in the helicopter may be Advanced Life Support (ALS) or Basic Life Support (BLS) level equipment that should be guided by Appendix II.

PART III – OPERATIONAL CRITERIA

13. HEMS ORGANISATIONAL REQUIREMENTS

13.1 Organisation Structure.

(a) HEMS is a specialised service that marries two critical activities of medicine and aviation. An appropriate governance model shall be implemented to provide oversight and management of the service.

(b) The organisation shall be headed on an operational level by an expert each from aviation and medicine, preferably at a Director level. This would ensure that adequate command and control mechanisms are built into the system with defined responsibilities and shared tasks that are steered by respective operational heads. With disparate professions conjoined under a common umbrella, cohesion of efforts in HEMS operations is essential to meet expectations and maintain safety.

13.2 Establishment of HEMS Operational Control Centre (HOCC).

(a) The purpose of HOCC is to implement operational control procedures to provide operational risk assessment and management, preflight information dissemination, flight tracking, information conduit for operations and overall flight operations support.

(b) HOCC shall be established by the HEMS operator that may be located within the HEMS operating base or at remote location.

(c) One HOCC may be implemented by each operator for its entire HEMS fleet. The HOCC of an operator may be shared by another HEMS operator for cost-effectiveness if clear lines of control between the two operators can be established.

(d) HOCC compliance and guidance material are enumerated in Appendix III.

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13.3 HEMS Operating Base Requirements.

(a) The operating base is the location from where all flight operations will commence and complete. There is a high probability of a large number of take-offs and landings from this location and for that reason no alleviation from operating procedures or performance rules are permitted.

(b) The operating base when located outside a licensed aerodrome or heliport and when used for day VFR only shall comply with landing area requirements as given in CAR Sec 4 Series B Part V – Minimum safety requirements for helicopter landing areas used on regular basis.

(c) The operating base when located outside a licensed aerodrome or heliport and when used for day/night, IFR/VFR shall comply with dimension and data quality requirements as given in CAR Sec 4 Series B Part III – Heliports.

(d) Every operating base shall have a system of obtaining current and reliable weather forecast information and shall be provided with satisfactory communications with the appropriate air traffic services (ATS) unit alongwith full communication link with HOCC, in case it is not co-located.

(e) Suitable infrastructural facilities should be created for housing operational support systems such as maintenance, stores, fuel etc. and crew support amenities as per guidance material at Appendix IV.

14. HEMS OPERATIONAL REQUIREMENTS

14.1 The operational envelope for HEMS extends beyond air ambulance (AA) flights and encompasses full flexibility response missions in primary, secondary and tertiary operational scenarios by day or night.

14.2 Minimum Flight Crew.

(a) The minimum flight crew for HEMS operations by day and night shall be two pilots.

(b) This may be reduced to one pilot for AA operation by day only.

14.3 Operating Minima.

(a) HEMS flights shall comply with the weather minima as tabulated below:-

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DAY MINIMA	
Ceiling	Visibility
300 ft – 599 ft	1500 m
> 600 ft	1000 m * (for PC 1 or PC 2 ops) 1200 m (for PC 3 ops with weather radar and HTAWS) 1500 m (for PC 3 ops)
* During the dispatch and en-route phase visibility may be reduced to 800 m for short periods when in sight of land provided that the helicopter is manoeuvred at a speed that will give adequate opportunity to observe any obstacles in time to avoid a collision, and the helicopter is flown by valid IR rated pilots with weather radar and HTAWS).	
NIGHT MINIMA	
Cloud Base	Visibility
1200 ft *	2500 m
* During the en-route phase, cloud base may be reduced to 1000 ft for short periods.	

(b) In the event that during the en-route phase the weather conditions fall below the cloud base or visibility minima shown, HEMS helicopter shall abandon the flight and conduct precautionary landing due to bad weather, or convert in all respects to a flight conducted under instrument flight rules (IFR), provided the flight crew are suitably qualified and the aircraft is certificated for IFR.

(c) In reduced visibility conditions for a short periods when in sight of land, the HEMS Commander shall evaluate the risk of flying temporarily into reduced visibility against the need to provide emergency medical service. He shall carefully assess if the aviation risk to third parties, the crew and the aircraft is proportionate to the task and he shall abandon the HEMS task if considered otherwise. The following advisory speeds should be complied in reduced visibility conditions so as to allow adequate opportunity to see and avoid obstacles.

REDUCED VISIBILITY SPEEDS	
Visibility (m)	Advisory Speed (kts)

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800	50
1500	100
2000	120

14.4 Performance Requirements.

(a) HEMS flights over congested area and/or hostile environment is recommended to be undertaken by Category A helicopters. For operations by Category B helicopter in such areas, the operator should implement routeing strategy to minimise risks to third party in the event of engine failure.

(b) It is in best practices to conduct operations in performance class 1 when operating to/from HEMS operating base located at elevated helipads and/or in congested hostile environment.

(c) HEMS operation over water bodies that extend more than 20 nm from shore shall be on Category A helicopter.

14.5 HEMS Operating Site.

(a) This is the primary pick up site related to an incident or accident and consequently its use can never be pre-planned. It therefore attracts alleviations from operating procedures and performance rules when appropriate.

(b) Types. The operating site or Landing Zone (LZ) could be either,

(i) Surveyed LZ – This is a LZ that has been reconnoitred by the HEMS operator and a general data set regarding size, obstructions, lighting, surfaces, wires etc. have been obtained. PIS would be an example of surveyed LZ.

(ii) Ad-hoc LZ – Does not satisfy the criteria of surveyed LZ and are expedient to a specific HEMS mission.

(c) Size. The minimum size of HEMS operating site is dependent upon D value which is the largest dimensions of the helicopter when its rotors are turning. The operator should establish guidance parameters

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for judgement based decision to ascertain that the size of ad-hoc LZ is adequately safe for the D value. The minimum size for surveyed LZ for day ops shall be 2D, and in case of night ops shall be 4D in length and 2D in width.

(d) Performance. During operations from HEMS operating sites the helicopter mass should not exceed the maximum mass specified in the AFM for a safe climb gradient with adequate clearance margin from flight path obstacles. The operator shall lay down obstacle clearance procedure (OCP) to be followed in HEMS operations.

(e) LZ Directory. The operator shall maintain a directory of surveyed LZ within its intended area of operations. This information should contain timely recording and identification of obstructions, ingress/egress factors and a reporting system for unsatisfactory or dangerous conditions.

14.6 Risk Assessment and Veto.

(a) The HOCC shall prepare ORAM for every HEMS requirement and decide if the task is go or no-go. The guidance material for ORAM is placed at Appendix V.

(b) Any HEMS flight crew, technical crew member or medical crew may exercise veto over HEMS tasking if he deems that the risk is not proportionate to the task.

14.7 Night Operations. Night operations shall be permitted in the following conditions:-

(a) the operator has been granted specific approval for night operations after meeting certification list criteria for night operations.

(b) such approval shall be accorded after the operator has demonstrated 100 hrs of safe HEMS operations by day.

(c) the minimum equipment list for HEMS night operations shall be functional.

(d) the aircrew are meeting training and recency standards and have valid IR on the type of helicopter.

(e) night HEMS by a pilot shall be permitted after he has completed 25 hours of day HEMS experience in the intended area of operations.

(f) cloud base and visibility criteria for HEMS operations are met.

(g) HEMS operating site is a surveyed LZ, or a large open area such as sports ground or highway where HEMS is not a first responder and

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communication with ground EMS is established. Landing at other ad-hoc LZ by night is not permitted.

14.8 Night Vision Imaging System (NVIS) Operations.

(a) HEMS operations by night shall be with the aid of NVIS. The operator shall obtain specific approval for night HEMS after demonstrating compliance with NVIS requirements and the integration of all its elements.

(b) Equipage Requirements.

(i) Each helicopter and all associated NVIS equipment shall have been issued with the relevant airworthiness approval.

(ii) Radio altimeter. The helicopter shall be equipped with a radio altimeter capable of emitting an audio warning below a pre-set height and an audio and visual warning at a height selectable by the pilot, instantly discernible during all phases of NVIS flight.

(iii) Aircraft NVIS compatible lighting. To mitigate the reduced peripheral vision cues and the need to enhance situational awareness, the following shall be provided:-

(aa) NVIS-compatible instrument panel flood-lighting, if installed, that can illuminate all essential flight instruments.

(bb) NVIS-compatible utility lights.

(cc) portable NVIS compatible flashlight.

(dd) a means for removing or extinguishing internal NVIS non-compatible lights.

(iv) Additional NVIS equipment. The following additional NVIS equipment shall be provided:-

(aa) a back-up or secondary power source for the night vision goggles (NVG).

(bb) a helmet with the appropriate NVG attachment.

(v) All required NVGs on an NVIS flight shall be of the same type, generation and model.

(vi) Continuing airworthiness. Procedures for continuing airworthiness shall contain the information necessary for carrying out ongoing maintenance and inspections on NVIS equipment installed in the helicopter and shall cover, as a minimum:-

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(aa) helicopter windscreens and transparencies.

(bb) NVIS lighting.

(cc) NVGs.

(dd) any additional equipment that supports NVIS operations.

(vii) Any subsequent modification or maintenance to the aircraft shall be in compliance with the NVIS airworthiness approval.

(c) NVIS operating minima.

(i) Operations shall not be conducted below the VFR weather minima.

(ii) The operator shall establish the minimum transition height from where a change to/from aided flight may be continued.

14.9 Helicopter Hoist Operations (HHO).

(a) HHO may be conducted by HEMS operator if the operator has obtained specific approval after demonstrating compliance with HHO requirements and the integration of all its elements.

(b) Equipage Requirements.

(i) The installation of all helicopter hoist equipment and any subsequent modifications shall have an airworthiness approval appropriate to the intended function. Ancillary equipment shall be designed and tested to the appropriate standard as required by the competent authority.

(ii) Maintenance instructions for HHO equipment and systems shall be established by the operator in liaison with the manufacturer and included in the operator's helicopter maintenance programme

(c) Two-way radio communication shall be established with ground personnel at the HHO site for day/night operations.

(d) Helicopter performance during HHO for HEMS has no performance restrictions but the Commander should exercise considerations for minimising exposure time and risk to HHO passenger and third parties on ground in case of engine failure.

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(e) In situations that require HEMS at night from unsurveyed sites, Night HHO may be considered as an alternative.

(f) As part of risk analysis and management process the operator shall specify risks associated with the HHO environment and minimisation strategies in the operations manual by describing requirements of selection, composition and training of crews, and normal and likely abnormal operations.

(g) Where patient condition is feasible, HHO passengers shall have been briefed and made aware of the dangers of static electricity discharge and other HHO considerations.

14.10 Fuel Planning.

(a) The fuel planning for HEMS mission conducted under VFR within 75 nm from HOB, can establish final reserve fuel to ensure that on completion of the mission, the fuel remaining is not less than an amount of fuel sufficient for:-

(i) 30 minutes of flying time at normal cruising conditions, or

(ii) when operating within an area providing continuous and suitable precautionary landing sites, 20 minutes of flying time at normal cruising speed.

14.11 Load and Trim sheet Considerations.

(a) HEMS helicopter are permanently installed with specialised medical equipment and can also embark carry-on medical equipment. Large volume equipment such as isolettes and intra-aortic balloon pump (IABP) may not be installed and when carried would be treated as carry-on baggage to be properly secured and counted as payload.

(b) The load and trim sheet for HEMS mission shall be prepared for the commencement flight and any subsequent changes by the HOCC. Whilst actual weight for crew members and equipment shall be used, standard weights shall be used for the patient.

(c) The helicopter may be switched off at operating site to facilitate on-site stabilisation procedures and transfer of patient. In such an event this shall be counted as subsequent leg of HEMS flight and hence will not require fresh load and trim sheet.

(d) Before returning to base if the HEMS flight is tasked for another response, no fresh load and trim sheet shall be required unless a fuel uptake has occurred.

14.12 Emplane/Deplane.

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(a) The HEMS helicopter may be required to emplane/deplane AMT payload expeditiously which entails that the helicopter rotors could be turning. Such movements may be permitted if the operator specifies appropriate safe procedures for compliance in his Operations Manual.

(b) AMT payload is permitted to be emplaned/deplaned by HHO if approval has been accorded to the operator.

14.13 Dangerous Goods.

(a) Articles and substances which would otherwise be classified as dangerous goods shall be exempted from approval for HEMS flight when it is carried for the purpose of medical aid and to the extent specified in the Technical Instructions.

(b) This exemption shall be accorded if the operator can demonstrate procedures and compliance regarding the following:-

(i) Gas cylinders/canisters have been specifically designed for the purpose of containing a particular gas and its safe aerial transportation and dispensing.

(ii) Drugs, medicines and other medical matter are under the control of trained personnel during the time when they are in use in the helicopter.

(iii) Equipment containing batteries are secured and maintained in such a way so as to prevent spillage of the electrolyte or lead to overheat conditions.

(iv) Proper provision has been made to stow and secure all the medical equipment during take-off and landing and at all other times when deemed necessary by the HEMS Commander.

(v) Medical articles and substances intended as replenishments are transported in accordance with Technical Instructions.

15. MEDICAL OPERATIONAL REQUIREMENTS

15.1 Dispatch and Handoff Protocols.

(a) Guideline protocols for dispatch and usage of helicopter in HEMS duty shall be defined in the Medical Manual. It should enumerate conditions that require HEMS intervention and the triage process so as to diminish medical oversight variability and justify appropriateness in usage.

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(b) Handoff is the transfer of information, responsibility, and authority from one provider to another in respect of the patient. Procedures for handoff from GEMS to HEMS or HEMS to hospital /vice-versa, should be detailed in the Medical Manual to prevent gaps in trauma care when the patient responsibility is shifted.

15.2 Patient Safety.

(a) Passenger briefing cards are required to be carried in HEMS helicopter and should document procedures for,

(i) the proper restraint of patient and passengers.

(ii) procedures for patient safety during HHO.

(iii) restraint measures for hysterical or combative patients.

(b) The requirement for safety briefing for patients shall be waived off in cases when medical condition of the patient makes it impracticable.

15.3 Infection and Biohazard Control.

(a) The operator shall establish procedures for infection and biohazard control and educate pilots, medical crewmembers and maintenance personnel in mitigating exposure to blood borne pathogens and biohazards.

(b) It is good practice to observe universal precautions and receive appropriate vaccinations prior to working on or around HEMS helicopter. Procedures should be established at operating bases for equipment cleaning and the disposal of biohazard materials.

15.4 Medical Equipment Installation and Removal.

(a) Medical equipment from the helicopter may be required to be removed or replaced due to items being expended, consumed or rendered unserviceable. If this operation is uncomplicated and does not require specialist tools, a person other than certified mechanic could be trained and authorised to remove or replace such equipment.

(b) In such cases the documented instructions and training procedures shall be included in the Operations Manual and Training Manual.

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(c) The procedures for handling and securing of special medical equipment such as stretchers, isolettes, balloon pumps and ventilators should be documented in the Medical Manual.

15.5 Electrical Load Analysis.

(a) Electrical load analysis of installed and portable medical equipment shall be done and the data endorsed in the cockpit emergency check-off list for load shedding planning in an electrical emergency that warrants such action in consultation with the medical crew.

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PART IV – TRAINING AND CHECKING CRITERIA

16. HEMS FLIGHT CREW REQUIREMENTS

16.1 HEMS Experience Levels.

(a) Initial HEMS Training. Before undertaking HEMS operational flying, all pilots shall undergo initial HEMS training which shall conform to the AMC for HEMS Operational Training (HOT) placed at Appendix VI.

(b) Flight Experience. The experience level of the HEMS Commander conducting HEMS flight shall not be less than:-

(i) Either,

(aa) 2000 hours as pilot-in-command/commander on helicopters, or

(bb) 1000 hours as co-pilot in HEMS operations of which 500 hours are as pilot-in-command under supervision and 100 hours pilot-in-command/commander of helicopters.

(ii) 500 hours operating experience in helicopters gained in a similar operational environment which includes casevac in military or experience in confined area operations, and

(iii) for pilots engaged in night operations, 100 hours of night as pilot-in-command/commander on helicopters.

16.2 Recency.

(a) For day operations, 30 min of day flying in HEMS role in last 90 days in the helicopter or FSTD.

(b) For night operations, 1 hours of night flying in HEMS role in last 90 days in the helicopter or FSTD.

16.3 Flight Recurrent Checks and Training.

(a) One proficiency check of minimum 45 min duration within the last 180 days in the helicopter or approved FSTD. If the operator has been granted approval for night operations, every alternate proficiency check shall be NVIS aided.

(b) One line check by day of minimum 30 min duration within the last 180 days on a HEMS flight.

(c) If the operator has been granted approval for night operations, one line check by night of minimum 30 min duration within the last 180 days on a HEMS flight.

(d) 30 min flight by sole reference to instruments in a helicopter or approved FSTD within the last 90 days.

(e) Critical Emergency training of 2.5 hours duration in an approved FSTD within the last 18 months.

16.4 Ground Recurrent Checks.

(a) HOT for flight crew completed within the last 12 months.

(b) CRM training completed within the last 12 months.

(c) Emergency and Survival Training completed within the last 12 months.

(d) Dangerous Goods training completed within the last two years.

(e) In case of offshore HEMS, Helicopter Underwater Escape Training (HUET) completed within the last three years.

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17. NVIS TRAINING REQUIREMENTS

17.1 A minimum experience of 100 hours of night flying as pilot-in-command/commander of a helicopter shall be required before commencing NVIS training.

17.2 The NVIS training and checking should be in conformity to the AMC - NVIS Training and Checking material placed at Appendix VII and should be completed within the last 180 days.

173 Recency. All pilots and NVIS technical crew members conducting NVIS operations shall have completed 1 hour of NVIS flights in the last 180 days in the helicopter or an approved FSTD.

17.4 Checking. Frequency of NVIS checks shall follow the night recurrent schedule and could be combined with those checks.

18. HHO TRAINING REQUIREMENTS

18.1 HHO crew member shall complete HEMS specific HHO training in accordance with HHO procedures contained in the operations manual. The HHO training and checking should be in conformity to the AMC - HHO Training and Checking material placed at Appendix VIII which shall be completed within last 180 days.

18.2 For night operations, HHO crew member shall complete all phases of NVIS ground training that is given to flight crew and be trained to operate around helicopter employing NVIS.

18.3 The minimum experience level for the commander conducting HHO flights shall not be less than:-

(a) 2000 hours as pilot-in-command/commander of helicopters.

(b) 100 hoist cycles, of which 20 cycles shall be at night if night operations are being conducted, where a hoist cycle means one down-and-up cycle of the hoist hook.

18.4 Recency. All pilots and HHO crew members conducting HHO shall have completed in the last 180 days,

(a) when operating by day, any combination of three day or night hoist cycles each of which shall include a transition to and from the hover.

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(b) when operating by night, three night hoist cycles each of which shall include a transition to and from the hover.

18.5 Checking. HHO crew shall complete HOT within the last 12 months.

19. MEDICAL CREWMEMBER TRAINING

19.1 All medical crew members shall undertake HEMS Orientation Training (HOT) prior to being utilised in any HEMS flight. The purpose of HOT is to ensure familiarity with the HEMS working environment and equipment, operation of on-board medical and emergency equipment and participation in normal and emergency entry and exit procedures.

19.2 The guidance material on HOT for Medical Crewmembers is placed at Appendix IX. The valid frequency of this training shall be within the last 6 months. Medical Crewmembers shall be exempt from passenger briefing.

20. GROUND EMERGENCY SERVICE PERSONNEL TRAINING

20.1 GEMS personnel comprise EMS responders, law enforcement personnel and hospital staff who are an important facet for ensuring a safe environment during HEMS activity from the operating LZ. Due to the large dispersion of GEMS personnel, formalised training in HEMS aspects is not feasible for every individual. Therefore, HEMS operators shall take all reasonable measures to ensure that HOT for GEMS personnel is percolated to the majority by all conceivable means such as training pamphlets, training material on the operator's web site, peer group training methods etc.

20.2 The guidance material on HOT for GEMS personnel is placed at Appendix X.

PART V – DOCUMENTATION CRITERIA

21. INFORMATION MANAGEMENT (IM) SYSTEM

21.1 The HEMS operator shall incorporate a robust Information Management (IM) system for performance monitoring and tracking operational efficiency. This is required because of higher costing per response by HEMS as compared

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to GEMS and performance information pertaining to efficiency and appropriateness of dispatch decisions should be available for review.

21.2 The system should be capable of generating reports that relate to the performance of the air medical and critical care system from call receipt time to the time the mission is completed in an automated and integrated fashion. The system should be capable of reporting missions by queries across multiple fields (e.g. date of service, location of mission, crew completing mission, aircraft type, patient demographic, etc.) to enable facilitated and complete reporting on case reviews for investigators and quality improvement purposes.

21.3 The IM data should have appropriate InfoSec policy due to patient confidentiality requirements with fail-safe redundancy standards and all past data should be indefinitely preserved.

22. OPERATIONS MANUAL

22.1 The operations manual should include the following additional aspects:-

(a) HOCC duties and dispatch process flow.

(b) Guidance for the selection of the HEMS operating site and judgement based parameters to ascertain size of ad-hoc LZ.

(c) Guidance on take-off and landing procedures at ad-hoc LZ.

(d) Hazard map of the intended area of operations.

(e) Procedures to be followed in case of inadvertent entry into cloud.

(f) Risk Analysis procedures, mitigation and management.

(g) Use of portable equipment on board.

(h) Fuel and oxygen replenishment procedures.

(i) Flight crew and medical crew training and checking.

(j) Equipment to be carried and its limitations.

(k) Minimum equipment list (MEL) entry covering the equipment specified.

(l) Communication procedures with HOCC, GEMS and medical crew.

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(m) CRM training for aviation and medical crews.

(n) Obstacle Clearance Procedures (OCP).

(o) Refuelling procedures with medical personnel and/or patient on board.

22.2 On NVIS aspects, the Ops manual should contain:-

(a) selection and composition of crew.

(b) pre and post-flight procedures and documentation.

(c) crew coordination procedures, including:-

(i) flight briefing.

(ii) procedures when one crew member is wearing NVG and/or procedures when two or more crew members are wearing NVGs.

(iii) procedures for the transition to and from NVIS flight.

(iv) use of the radio altimeter on an NVIS flight.

(v) inadvertent instrument meteorological conditions (IIMC) and helicopter recovery procedures, including unusual attitude recovery procedures.

(d) in-flight procedures for assessing visibility, to ensure that operations are not conducted below the minima stipulated for non-assisted night operations.

(i) weather minima for HEMS operation.

(j) the minimum transition heights to/from an NVIS flight.

22.3 On HHO aspects, the Ops manual should contain:-

(a) risks associated with the HHO.

(b) performance criteria.

(c) training of crews.

(d) levels of equipment and dispatch criteria.

(e) the criteria for determining the minimum size of the HHO site, operating procedures and minima.

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(f) normal and likely abnormal operations and mitigation techniques.

(g) the method by which crew members record hoist cycles.

23. SECURITY PROGRAMME

23.1 The HEMS operator in his Security Manual shall specifically cover aspects regarding security of helicopter at HEMS operating sites and preventative security measures considering nature of HEMS operations.

24. FLIGHT RECORDER SYSTEM (FRS)

24.1 The FRS shall automatically start to record the data prior to the helicopter being capable of moving under its own power and shall stop automatically after the helicopter is incapable of moving under its own power. The FRS data recorded during at least the preceding 25 hours should be available.

24.2 The recording history should include data from aircraft data recording system (ADRS), cockpit audio recording system (CARS), airborne image recording system (AIRS) and/or a data link recording system (DLRS).

25. HOCC MANUAL

25.1 This should contain organisational instructions on assignment of duties to personnel, method of sourcing of data, dissemination of data, work process flow, risk management strategies and monitoring of events.

25.2 It should also contain procedures on shift-change, pre-flight briefings and use of technical tools.

26. HOCC RECORD

26.1 Events in HOCC should be recorded and be available for at least the preceding 15 days.

26.2 This shall include history of telephone messages, messages, data link records and all communication transcripts.

27. MEDICAL MANUAL

27.1 The Medical Manual should contain procedures and guidelines on:-

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(a) Dispatch Policy governing usage of HEMS helicopter.

(b) Medical Control procedures.

(c) Inventory and safekeeping of medical articles and substances, handling procedures, safety aspects and security of dangerous drugs.

(d) Clinical risks in AMT.

(e) Patient handoff procedures.

(f) Procedures for handling and securing of special medical equipment.

(g) Procedures for handling of portable electrical sources.

(h) Patient loading, unloading and safety procedures.

(i) Infection and Biohazard Control.

(j) Selection criteria of medical crew and their training programme.

(k) Evacuation procedures.

28. TRAINING MANUAL

28.1 The Training Manual should contain syllabus, standards and frequency of training on:-

(a) HEMS flight crew training.

(b) HHO crew training.

(c) Medical crew training.

(d) HOCC personnel training.

(e) GEMS training.

(f) Air Medical Resource Management (AMRM) and collaborative CRM training with all elements as above.

(Capt Ajay Singh)
Chief Flight Operations Inspector
For Director General of Civil Aviation

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APPENDIX I

GUIDANCE MATERIAL ON FLIGHT DATA MONITORING

1. HEMS operations by both Category A and B helicopters have been permitted with the intent to propagate HEMS and make it an affordable option for trauma care delivery to needy persons. Although robust engine technologies have resulted in increasing engine reliability statistics for newer helicopters as compared to those fitted with older technology engines, operators shall implement a risk management program to diminish risks of engine fallibility.

2. Engine Risk Management Program.

(a) Attain and then maintain the helicopter/engine modification standard defined by the manufacturer that has been designated to enhance reliability during the take-off and landing phases.

(b) Conduct the preventive maintenance actions recommended by the helicopter or engine manufacturer as follows:-

(i) engine oil spectrometric and debris analysis, as appropriate.

(ii) engine trend monitoring, based on available power assurance checks.

(iii) engine vibration analysis (plus any other vibration monitoring systems where fitted).

(iv) oil consumption monitoring.

(c) Implement a usage monitoring system that should fulfil at least the following:-

(i) Recording of the following data:-

(aa) date and time of recording, or a reliable means of establishing these parameters;

(bb) amount of flight hours recorded during the day plus total flight time;

(cc) N1 (gas producer RPM) cycle count;

(dd) N2 (power turbine RPM) cycle count (if the engine features a free turbine);

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(ee) turbine temperature exceedance: value, duration;

(ff) power-shaft torque exceedance: value, duration (if a torque sensor is fitted);

(gg) engine shafts speed exceedance: value, duration.

(ii) Data storage of the above parameters, if applicable, covering the maximum flight time in a day, and not less than 5 flight hours, with an appropriate sampling interval for each parameter.

(iii) The system should include a comprehensive self-test function with a malfunction indicator and a detection of power-off or sensor input disconnection.

(iv) A means should be available for downloading and analysis of the recorded parameters. Frequency of downloading should be sufficient to ensure data is not lost through over-writing.

(v) The analysis of parameters gathered by the usage monitoring system, the frequency of such analysis and subsequent maintenance actions should be described in the maintenance documentation.

(vi) The data should be stored in an acceptable form and accessible to the competent authority for at least 24 months.

(d) The training for flight crew should include the discussion, demonstration, use and practice of the techniques necessary to minimise the risks.

(e) Report to the manufacturer any loss of power control, engine shutdown (precautionary or otherwise) or engine failure for any cause (excluding simulation of engine failure during training). The content of each report should provide:

(i) date and time;

(ii) operator (and maintenance organisations where relevant);

(iii) type of helicopter and description of operations;

(iv) registration and serial number of airframe;

(v) engine type and serial number;

(vi) power unit modification standard where relevant to failure;

(vii) engine position;

(viii) symptoms leading up to the event;

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(ix) circumstances of engine failure including phase of flight or ground operation;

(x) consequences of the event;

(xi) weather/environmental conditions;

(xii) reason for engine failure - if known;

(xiii) in case of an in-flight shutdown (IFSD), nature of the IFSD (demanded/un-demanded);

(xiv) procedure applied and any comment regarding engine restart potential;

(xv) engine hours and cycles (from new and last overhaul);

(xvi) airframe flight hours;

(xvii) rectification actions applied including, if any, component changes with part number and serial number of the removed equipment; and

(xviii) any other relevant information.

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APPENDIX II

GUIDANCE MATERIAL ON HEMS ONBOARD MEDICAL EQUIPMENT

1. The range of medical equipment depends upon the response strategy for EMS trauma care. In case of 'stay and play' system of EMS delivery the medical expertise is in the form of physicians and the helicopter is equipped with ALS (Advanced Life Support) pre-hospital care. The doctor may use invasive methods such as intravenous

fluids, administer life-saving drugs/medications and intubate at the scene and during transport.

2. In case of ‘scoop and run’ EMS delivery the aim is to swiftly convey patients to the hospital with less pre-hospital interventions. Trained paramedics and Emergency Medical Technicians (EMT) in HEMS helicopter equipped with BLS (Basic Life Support) clinically supervise and provide pre-hospital emergency care including stabilization intervention. The typical HEMS onboard equipment is tabulated below for guidance.

ROYAL SOCIETY OF MEDICINE RECOMMENDED MINIMUM STANDARDS IN MEDICAL HELICOPTER SYSTEMS	
Adult	Neonatal
• positive pressure ventilation • pulse oximeter • blood pressure measurement • electrocardiograph • defibrillator • suction device • oxygen supply • intubation equipment • IV fluid equipment • drugs for resuscitation • drugs for continuing management	• transport • incubator • temperature • monitor • neonatal ventilator • pulse oximeter • umbilical artery oxygen monitor • blood pressure measurement • electrocardiograph • suction device • oxygen supply • air supply • intubation equipment • drugs for resuscitation • drugs for continuing management

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ROYAL SOCIETY OF MEDICINE RECOMMENDED MINIMUM STANDARDS IN MEDICAL HELICOPTER SYSTEMS	
Adult	Neonatal
• positive pressure ventilation • pulse oximeter • blood pressure measurement • electrocardiograph • defibrillator • suction device • oxygen supply • intubation equipment • IV fluid equipment • drugs for resuscitation • drugs for continuing management	• transport • incubator • temperature • monitor • neonatal ventilator • pulse oximeter • umbilical artery oxygen monitor • blood pressure measurement • electrocardiograph • suction device • oxygen supply • air supply
TYPICAL HEMS PORTABLE MEDICAL EQUIPMENT	
Portable Equipment	Thomas Pack containing
• multimodal monitor • pulse oximeter • ventilator and oxygen • cervical collars • suction device • traction splint • MAST garment • scoop stretcher • Vacumat stretcher • drugs pack containing:- - resuscitation (ALS) drugs - opiate analgesics - anaesthetic agents - muscle relaxants - bronchodilator	• stethoscope • sphygmomanometer • torch • intubation equipment • bag-valve-mask system • needle cricothyroidotomy set • surgical airway set • chest drain set • IV administration sets • central venous cannulae • sterile surgical pack • aortic cross clamp • Gigli amputation saw • dressings • warmed IV fluids: - crystalloid solution - colloid solution - mannitol 20%

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APPENDIX III

GUIDANCE MATERIAL ON HEMS OPERATIONAL CONTROL CENTRE (HOCC)

1. Helicopters engaged in HEMS operate in a dynamic environment due to the technically challenging nature of HEMS flight operations and the time-critical nature of such operations. This positions HEMS with a heightened risk profile that can be sizeably diminished with enhanced operational control procedures by providing HEMS flight crew with critical information invaluable to flight safety decision process. This guidance material is designed to provide HEMS operators with an overview of key ideas, considerations, concepts, technologies, processes and best practices for the development, implementation and integration of HOCC and enhanced operational control processes in support of HEMS operations.

2. HEMS Operational Control Centre (HOCC) is a control organisation that shall coordinate and support flight operations by,

(a) assisting HEMS flight crew with risk analysis and navigation planning.

(b) organising, coordinating and disseminating flight information such as air traffic procedures, enroute weather, HEMS operating site report and route information.

(c) supervising progression of flight by flight tracking technology.

(d) monitoring dynamic flight considerations such as weather and fuel.

(e) acting as conduit for flow of information between the helicopter, government agencies and ground EMS agencies.

3. HOCC Personnel.

(a) HOCC Controller (‘Controller’) should be decidedly knowledgeable in aviation aspects with specific regard to HEMS and the types of helicopter that are operated. It is desirable that the Controller should be a helicopter pilot but any other experienced aviation personnel with sufficient aviation knowledge could also serve as the Controller. The Controller should be capable to plan, coordinate and support HEMS operations. The Controller is responsible to maintain a situational awareness of all considerations affecting operations.

(b) Communication Officer (‘Comms’) should be capable to support HEMS operations by relaying coordination information among the flight crew, EMS personnel or any other involved parties. He supports the Controller in maintaining the operational plot of the situation.

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(c) IT Support are individuals specifically trained to maintain and support the HOCCs technology infrastructure and may be employed in-house or outsourced.

4. HOCC Work Flow.

(a) The HOCC is the nerve centre for all HEMS operations by an operator. Accordingly, the HOCC should be manned by at least one Controller and assisted by one Comms during HEMS operational and standby periods.

(b) The request for HEMS could be received by Comms and is assessed by the Controller to check that dispatch protocols have been followed.

(c) The Controller prepares ORAM and authorises the HEMS tasking.

(d) ORAM is reviewed and jointly concurred with HEMS Commander for HEMS mission acceptance.

(e) HOCC coordinates air traffic scheduling, supplementary flight information such as weather, route navigation and operating site considerations, and disseminates to HEMS flight crew.

(f) HOCC supervises and monitors helicopter activities from take-off to return.

(g) In a hub-spoke model, the HOCC (hub) will control different HEMS operating base Ops Room (spokes) in a similar work flow process.

5. HOCC Technology Design.

(a) The technical complexity of a HOCC is relative to the scale of operations but redundancy overlays should be incorporated for achieving fail-safe operations. This would include but not limited to the following hardware/software resources:-

(i) Reliable internet access.

(ii) Networking architecture within HOCC and between Ops Rooms.

(iii) Communication technology based on landline, mobile and satcom.

(iv) Datalink facility.

(v) Weather analysis tools.

(vi) Flight information systems.

(vii) Risk analysis software.

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(viii) Aircraft tracking tools.

(ix) GIS presentations for tracking, weather and operating site data.

(b) The technology in HOCC is the foundation for controlling flight operations and consequently the impact of technology failure in the HOCC is a cause for alarm. It is therefore crucial to design system architecture such that failure of an equipment or technology enabler does not imperil operations. Plans for temporary or less-severe failures and outages along with severe technology failures should also be expected and prepared for in the HOCC IT disaster recovery plan.

6. Training.

(a) Presently there are no regulatory training requirements for HOCC Controller and it is preferred that Controller duties should be tasked with suitably experienced helicopter pilots who have knowledge of the intended area of operations, aircraft and operational scenarios. However, training programme for technical instructions on systems and communication procedures should be included in the HOCC Manual in addition to aviation elements such as risk management, CRM, ATC procedures and aircraft performance amongst others.

(b) There are also no regulatory training requirements presently for Comms but it is in good practice that he should possess an overview of aviation knowledge for supporting the Controller. He should also be given training on technical instructions on communication, control systems, dispatch process and the work flow progression.

(c) The operational control procedures in HOCC (and Ops Rooms if in hub-spoke hierarchy) shall be formalised to ensure consistent methodologies is applied in HEMS dispatch procedures. This would ensure that pertinent essential tasks are under surveillance especially during periods of high work load and abnormal operations.

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APPENDIX IV

GUIDANCE MATERIAL ON HEMS OPERATING BASE

INFRASTRUCTURAL REQUIREMENTS

1. The HEMS operating base is an establishment at an airfield or helipad from which HEMS helicopter and its crew members may be on stand-by for HEMS operations. All HEMS flight originate and end from this location.

2. It is therefore concomitant that the operating base should have operational support systems and facilities that enable and also sustain HEMS operations that are typified with long wait times and uncertainly timed short mission durations. If crew members are required to be on standby with a reaction time of more than 45 minutes, the provision of dedicated suitable accommodation would not be applicable.

3. The following is a guideline for infrastructural facilities to be made available in an operating base:-

(a) Maintenance hangar.

(b) Workshop and maintenance storage.

(c) Fuel storage and dispensation.

(d) General stores area.

(e) Medical equipment stores area.

(f) Flight planning area with briefing/ debriefing rooms.

(g) Operations Room linked with HOCC in cases when HOCC is not co-located.

(h) Air traffic control facilities when operating base is not co-located within airfield or heliport.

(i) Office area for resident flight crew, medical crew and maintenance crew.

(j) Suitable accommodation spaces for flight crew, medical crew and maintenance crew.

(k) Shower and washroom facilities.

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(l) Kitchen/pantry facilities.

(m) Recreational facilities.

(n) Security barriers around operating base.

(o) Storm water management.

(p) Utilities connections including networking and communications facility.

(q) Parking area for helicopter and vehicles.

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APPENDIX V

GUIDANCE MATERIAL ON

OPERATIONAL RISK ASSESSMENT AND MANAGEMENT (ORAM)

1. Risk is defined as “a state of uncertainty where some of the possibilities involve a loss, catastrophe, or other undesirable outcome. It is the assessed potential for adverse consequences resulting from a hazard. Risk shall mean the combination of the overall probability, or frequency of occurrence of a harmful effect induced by a hazard and the severity of that effect”. The main objective of Operational Risk Assessment and Management (ORAM) is to make sure that all risks remain at an acceptable level.

2. ORAM is an evaluation based on engineering and operational judgement and/or analysis methods in order to establish whether the perceived risks for completion of a flight mission is acceptable or tolerable. ORAM must consider the potential consequences and produce a quantitative result. If mitigations will not reduce risk to an acceptable level, the HEMS flight should not be authorized.

3. ORAM is developed in three different contexts:

(a) Individual events and factors may reflect a level of risk affecting safety to an operation and all such event factors need to be identified. This is known as hazard identification and is a part of risk assessment.

(b) The hazard identification is attached a risk value to each event which is necessary for creating safety statistics. The risk process may lead to the identification of safety issues, which need to be risk assessed to determine what actions, if any are needed. The result is an operational risk profile which is an overview of all operational risks.

(c) The operational risk profile can be reduced in severity by the implementation of de-risking or risk reduction measures. This can be by application of safer technology that diminishes the level of risk of an event, or by higher skill set/experience that early identifies the risk event and can influence a safer outcome.

4. ORAM consists of three elements which are Hazard Identification, Risk Assessment and Risk Reduction or mitigation. The ORAM process should identify hazards associated with the HEMS operation and assess the risks associated with each hazard. After the risks are assessed, risk mitigation strategies should be

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identified, developed and implemented and finally when risks are still considered unacceptable, the flight shall not be authorized.

5. All HEMS operators shall ensure that risks are systematically analysed (in terms of probability of occurrence and severity of hazard effects), assessed (in terms of tolerability) and controlled to an acceptable level (by implementation of mitigation measures). The operator shall also define those levels of management with authority to make decisions regarding safety risks tolerability.

6. Once hazards and their effects have been determined by means of hazard identification, an analysis is required to assess the probability of the hazard effects occurring, and the severity of these effects on aircraft operation. ICAO Doc 9859 - Safety Management Manual highlights the importance of distinguishing between hazards (the potential to cause harm) and risk (the likelihood of that harm being realised during a specified amount of risk exposure). Risk assessment is applied based on the evaluation of the severity of a hazard, the probability (frequency) of its occurrence and tolerability of its effects. The steps in the ORAM process are given in succeeding paragraphs.

7. Step I: Hazard Identification.

(a) This ORAM process is carried out in order to identify the hazards in the organisational systems and operational environment, and to determine their effects. The hazards should be identified in a systematic, robust and intellectually cohesive manner taking into consideration all HEMS events/factors from organisational and operational aspects.

(b) The severity of a hazard is the impact on the safety of aircraft and its occupants and other persons who may be directly affected. A typical table depicting the severity of hazard is placed at Table I of this Appendix.

(c) The estimation of the frequency of hazard occurrence or probability of a hazard occurring is usually achieved by means of structured review using a standard classification scheme. However, the estimation of the probability of occurrence of hazards (and their effects) which is associated with human error is not straightforward. Unless there is a very high capture rate of relevant occurrence data which has been appropriately stratified, it may be difficult to find meaningful empirical data and subjective assessment will then be all that is possible. As with the estimation of the severity of a hazard, the development of informed judgments from a structured review by people with extensive experience in their respective fields applied to a standard classification scheme will be the best substitute for absolute values. A typical table depicting the probability of occurrence of hazard is placed at Table II of this Appendix.

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8. Step II: Risk Assessment.

(a) This ORAM process is the analysis and assessment of the probability of occurrence and the severity of the hazard effects to determine the magnitude of the risk.

(b) Using a typical risk matrix as given in Table III of this Appendix, the risk tolerability is determined. This is done by assigning colour codes (or values) to risks and a range of values may be assigned in order to categorise risks as acceptable, undesirable or unacceptable which are described as follows:-

(i) Acceptable Risks (Green)

Where the assessed risk falls into the green area, it may be accepted without further action and the flight dispatched. The objective should always be to reduce risk to as low as practicable regardless of whether or not the analysis shows that it can be initially accepted.

(ii) Undesirable Risks/ Tolerable with Mitigation Risks (Yellow)

When the risk analysis falls into the yellow area, risk may be accepted under defined conditions with the application of risk reduction measures or risk mitigation strategy. It means that the affected persons are prepared to live with the risk in order to have certain benefits, in the understanding that the risk is being mitigated as best as possible.

(iii) Unacceptable (Red)

Where combinations of severity and likelihood cause the risk to fall into the red area, the risk would be assessed as unacceptable. The flight should not be authorized under the current conditions and operations must cease until the risk is reduced to at least the tolerable level or controls are developed which eliminate the associated hazard, or which would control the factors that lead to higher risk likelihood or severity.

9. Step III: Risk Mitigation

(a) The ORAM process of risk mitigation is to identify measures which when implemented will minimise the risk or even remove it from the system when the risk assessment falls in the yellow area category of undesirable risks. Risk mitigation can be applied in green category too.

(b) When a risk has been found to be undesirable, control measures may be introduced to assess if the risks would degrade to tolerable levels. The level of risk can be lowered by:-

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(i) Reducing the exposure to that risk. Eg. choosing an alternate route to a LZ to avoid localised weather thereby minimising exposure to weather risk.

(ii) Reducing the probability of occurrence of harmful effects. Eg. limiting helicopter AUW during high density altitude landing due to risks emanating out of reduced helicopter performance.

(iii) Reducing the severity of potential consequences. Eg. selecting an alternate lower altitude LZ where aircraft performance would not be affected as significantly as compared to higher altitude LZ.

10. For some risks, the number of variables and the availability of both suitable data and mathematical models may lead to credible results with quantitative methods (requiring mathematical analysis of specific data). However, ICAO states that few hazards in aviation lend themselves to credible analysis solely through quantitative methods. Typically, these analyses are supplemented qualitatively through critical and logical analysis of the known facts and their relationships. Determination of severity should be independent of the probability of occurrence, and vice versa, the probability of occurrence should not be considered when determining severity. Over time, quantitative data may support or alter the determinations of severity and probability, but the initial risk determinations will most likely be qualitative in nature, based on experience and judgment more than factual data.

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TABLE I			
HAZARD SEVERITY MATRIX			
Hazard Class	Effect on Operations	Effect on Occupants	Effect on Aircrew
5 Catastrophic	Normally with hull loss. Total loss of flight control, mid-air collision, flight into terrain or high speed surface movement collision.	Multiple fatalities.	Fatalities or incapacitation.
4 Hazardous	Large reduction in safety margins or aircraft functional capabilities.	Serious or fatal injury to a small number of passengers or cabin crew.	Physical distress or excessive workload impairs ability to perform tasks.
3 Major	Significant reduction in safety margins or aircraft functional capabilities.	Physical distress. Possibly including injuries.	Physical discomfort, possibly including injuries or significant increase in workload.
2 Minor	Slight reduction in safety margins or aircraft functional capabilities.	Physical discomfort.	Slight increase in workload.
1 Negligible	No effect on operational capabilities or safety.	Inconvenience.	No effect on flight crew.

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TABLE II		
PROBABILITY OF OCCURRENCE MATRIX		
Probability Class	Qualitative Definition	Quantitative Definition
5 Frequent	May occur once or several times during operational life.	1 to 10^{-3} per flight hour
4 Reasonably probable	May occur once during total operational life of one system.	10^{-3} to 10^{-5} per flight hour
3 Remote	Unlikely to occur during the total operational life of each system but may occur several times when considering several systems of the same type.	10^{-5} to 10^{-7} per flight hour
2 Extremely remote	Unlikely to occur when considering several systems of the same type, but nevertheless has to be considered as being possible.	10^{-7} to 10^{-9} per flight hour
1 Extremely improbable	Should virtually never occur in the whole fleet life.	< 10^{-9} per flight hour

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SEVERITY OF HAZARD IMPACT

PROBABILITY OF HAZARD OCCURRENCE

	5 Catastrophic	4 Hazardous	3 Major	2 Minor	1 Negligible
5 Frequent	**Unacceptable**	**Unacceptable**	**Unacceptable**	**Undesirable**	**Undesirable**
4 Reasonably probable	**Unacceptable**	**Unacceptable**	**Undesirable**	**Undesirable**	**Undesirable**
3 Remote	**Unacceptable**	**Undesirable**	**Undesirable**	**Undesirable**	**Acceptable**
2 Extremely remote	**Undesirable**	**Undesirable**	**Undesirable**	**Acceptable**	**Acceptable**
1 Extremely improbable	**Acceptable**	**Acceptable**	**Acceptable**	**Acceptable**	**Acceptable**

Unacceptable	Where combinations of severity and likelihood cause risk to fall into the red area, the risk would be assessed as unacceptable.
Undesirable	Acceptable with Mitigation. When the risk analysis falls into the yellow area, risk may be accepted under defined mitigated conditions.
Minor	Acceptable. Where the assessed risk falls into the green area, it may be accepted without further action and the flight dispatched.

APPENDIX VI

ACCEPTABLE MEANS OF COMPLIANCE OF HEMS OPERATIONAL TRAINING (HOT)

FOR FLIGHT CREW AND HHO CREW

1. Purpose. The purpose of HEMS Operational Training (HOT) for flight crew and HHO crew is to ensure that flight crew and HHO crew are familiar with HEMS operational aspects and knowledge of intended area of operations. These guidelines shall be used for initial training and subsequent recurrent training.

2. Scope. The scope of training should include:-

(a) topographical familiarisation of the intended area of operations.

(b) knowledge of the local airspace and air traffic facilities.

(c) local area meteorology training concentrating on the understanding and interpretation of available weather information.

(d) preparation of the helicopter and specialist medical equipment for subsequent HEMS departure.

(e) HEMS flight planning.

(f) factors for the assessment of suitability of HEMS operating sites.

(g) helicopter performance and landing/take-off profiles likely to be used at HEMS operating sites.

(h) HOCC interface and utilization.

(i) communication procedures with HOCC, GEMS and other agencies.

(j) knowledge of surveyed LZ.

(k) low level flight in poor weather.

(l) HTWAS operation and limitations.

(m) weather radar operation and limitations.

(n) NVIS operation and limitations, if applicable.

(o) the medical effects air transport may have on the patient.

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(p) decision making training to emphasize that the medical condition of the patient should not be a factor in the Commander's decision to accept or decline a flight.

(q) techniques for handling patients, the medical consequences of air transport and some knowledge of hospital casualty reception.

3. Approval. HOT for flight crew and HHO crew shall be evaluated and specifically approved for inclusion in the operators Training Manual and should specify flight and ground training segments of instruction and checking.

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APPENDIX VII

ACCEPTABLE MEANS OF COMPLIANCE OF NVIS TRAINING AND CHECKING SYLLABUS

1. The flight crew and technical crew training syllabus should include the following:-

(a) NVIS working principles, aero-medical factors relating to the use of NVIS, eye physiology, vision at night, limitations and techniques to overcome these limitations.

(b) NVG performance and scene interpretation.

(c) preparation and testing of NVIS equipment.

(d) preparation of the helicopter for NVIS operations.

(e) normal and emergency procedures including all NVIS failure modes.

(f) maintenance of unaided night flying.

(g) crew coordination concept specific to NVIS operations.

(h) practice of the transition to and from NVG procedures.

(i) awareness of specific dangers relating to the operating environment.

(j) NVIS operations flight planning to include night terrain interpretation and factors affecting terrain interpretation.

(k) risk analysis, mitigation and management.

2. The flight crew checking syllabus should include:-

(a) night proficiency checks, including emergency procedures to be used on NVIS operations.

(b) line checks with special emphasis on the following:-

(i) local area meteorology.

(ii) NVIS flight planning.

(iii) NVIS in-flight procedures.

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(iv) transitions to and from night vision goggles (NVG).

(v) normal NVIS procedures.

(vi) crew coordination specific to NVIS operations.

(c) Whenever the crew is required to also consist of an NVIS HHO crew member, he/she should be trained and checked in the following items:-

(i) NVIS working principles, eye physiology, vision at night, limitations, and techniques to overcome these limitations.

(ii) duties in the NVIS role, with and without NVGs.

(iii) the NVIS installation.

(iv) operation and use of the NVIS equipment.

(v) preparing the helicopter and specialist equipment for NVIS operations.

(vi) normal and emergency procedures.

(vii) crew coordination concepts specific to NVIS operations.

(viii) awareness of specific dangers relating to the operating environment.

(ix) risk analysis, mitigation and management.

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APPENDIX VIII

ACCEPTABLE MEANS OF COMPLIANCE ON HHO TRAINING AND CHECKING SYLLABUS

1. The flight crew training syllabus should include the following:-

   (a) fitting and use of the hoist.

   (b) preparing the helicopter and hoist equipment for HHO.

   (c) normal and emergency hoist procedures by day and, when required, by night.

   (d) crew coordination concepts specific to HHO.

   (e) practice of HHO procedures.

   (f) the dangers of static electricity discharge.

2. The flight crew checking syllabus should include:-

   (a) proficiency checks, which should include procedures likely to be used at HHO sites with special emphasis on:-

      (i) HHO flight planning.

      (ii) a transition to and from the hover at the HHO site.

      (iii) HHO departures.

      (iv) normal and simulated emergency HHO procedures.

      (v) crew coordination.

3. HHO technical crew members should be trained and checked in the following:-

   (a) duties in the HHO role.

   (b) fitting and use of the hoist.

   (c) operation of hoist equipment.

   (d) preparing the helicopter and specialist equipment for HHO.

   (e) normal and emergency procedures.

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(f) crew coordination concepts specific to HHO.

(g) operation of inter-communication and radio equipment.

(h) knowledge of emergency hoist equipment.

(i) techniques for handling HHO passengers.

(j) effect of the movement of personnel on the centre of gravity and mass during HHO.

(k) effect of the movement of personnel on performance during normal and emergency flight conditions.

(l) techniques for guiding pilots over HHO sites.

(m) awareness of specific dangers relating to the operating environment.

(n) the dangers of static electricity discharge.

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APPENDIX IX

GUIDANCE MATERIAL ON HEMS OPERATIONAL TRAINING (HOT) FOR MEDICAL CREW MEMBER

1. Purpose. The purpose of HEMS Operational Training (HOT) for medical crewmembers is to ensure that the medical crewmember understands and is familiar with his role in the HEMS operation.

2. Scope. The scope of training should include:-

(a) familiarisation with the type of helicopter operated.

(b) In-flight emergencies and emergency landing procedures.

(c) entry and exit under normal and emergency conditions both for self and patients.

(d) loading/unloading and use of the relevant on-board specialist medical equipment.

(e) the need for the commander's approval prior to use of specialised equipment.

(f) lights, vents and power outlets.

(g) method of supervision of other medical staff .

(h) the use of helicopter inter-communication systems and portable sets.

(i) location and use of on board fire extinguishers.

(j) if operating by night, the differences between day and night operations.

(k) biohazard containment and infection control.

3. Approval. HOT for Medical crewmembers shall be evaluated and specifically approved for inclusion in the operators Training Manual.

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APPENDIX X

GUIDANCE MATERIAL ON HEMS OPERATIONAL TRAINING (HOT) FOR GEMS PERSONNEL

1. Purpose. The purpose of HOT for GEMS personnel is to instil awareness about HEMS operations and safety aspects amongst EMS responders, law enforcement personnel and hospital staff in HEMS operating site. The operator shall take all reasonable measures to ensure that ground emergency service personnel are familiar with the HEMS working environment and equipment and the risks associated with ground operations at HEMS operating site.

2. Scope. The ambit of awareness campaign should include:-

(a) suitability and evaluation of LZ.

(b) hazard/obstacle identification.

(c) communication and the use of basic hand signs for positioning and parking the helicopter.

(d) personal safety in and around the helicopter.

(e) loading/unloading of patient with with/without rotors running.

(f) in case of night operations, method of illuminating LZ.

(g) security against incursions and other hazards.

(h) disruptive/unruly crowd identification and control.

(i) evacuation procedure of helicopter occupants following an accident.

3. Approval. Methods for percolation of HOT for GEMS personnel shall be evaluated and specifically approved for inclusion in the operators Training Manual.

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