LEAFLET NO. 43: CONDUCT OF MOUNTAIN HEMS/AIR-RESCUE BY AN AOC HOLDER WHEN REQUIREMENTS OF JAR-OPS 3 CANNOT BE MET

Note: The material contained in this Leaflet has been issued in accordance with Chapter 10 of the Administrative & Guidance Material, Section Four: Operations, Part Two: Procedures, and is therefore authorised for use on a voluntary basis.

1 Statement of the Issues

1.1 The existing HEMS requirements do not take into consideration the limitations that could exist for All Engine Operating (AEO) Hover Out of Ground Effect (HOGE), and One Engine Inoperative (OEI) performance, when twin-engine helicopters are operated at altitudes close to 16,000ft – particularly with temperatures in excess of ISA conditions.

1.2 The requirements do not take into consideration the effect on HEMS response time when the number of potential casualties is subject to exceptional conditions that result from an influx of a large, and transient, population engaged in recreational activities such as winter sports.

1.3 The requirements do not take into consideration techniques and equipment currently used for the insertion and extraction of personnel in the mountain rescue environment.

2 Scope of the Document

2.1 This leaflet, in examining some of the challenges that are present in high mountain rescue operation takes, as an example, existing operations in Switzerland – a State which has a long history of using helicopters in mountain rescue and one that is currently seeking to implement JAR-OPS 3. Using their operational environment, three issues are explored in detail: helicopter performance at altitudes up to 16,000ft; dealing with peaks of demand when faced with a transient population that is mostly engaged in recreational activities; and technical aspects of mountain rescue that do not fit well into the existing regulation.

2.2 The leaflet examines the existing JAR-OPS 3 HEMS requirements - performance and otherwise - and provides data for an assessment of the ability of a range of helicopters to meet the requirement to operate to any, or all, of the types of HEMS sites. (Not discussed in this paper are issues that are within the medical domain; hence the subject of the carriage of trauma doctors or fixed medical equipment is not considered.)

2.3 Requirements are contained in the performance Subparts of F, G, H and I with specific alleviations provided in Appendix 1 to JAR-OPS 3.005(d) 'Helicopter Emergency Medical Service' and Appendix 1 to JAR-OPS 3.005(i) 'Helicopter operations at a public interest site'. Guidance for application of the requirements is contained in Section 2 of JAR-OPS 3 - specifically in Subpart B; these requirements and their associated guidance are now examined in detail.

3 Application of Extant Requirements

3.1 Performance requirements for HEMS are expected to be applied pragmatically; they are targeted at the three basic HEMS operational sites:

- The HEMS Operating Base;
- The HEMS Operating Site;

- The Hospital Site – i.e. a heliport at a hospital which is located in a congested-hostile-environment.

3.2 As is stated in paragraph 7 of ACJ to Appendix 1 to JAR-OPS 3.005(d):

> "**The HEMS philosophy attributes the appropriate levels of risk for each operational site; this is derived from practical considerations and probability of use. The risk is expected to be inversely proportional to the amount of use of the site.**"

The text that follows this statement (shown as bold in the following sections) explains the policy.

3.3 "***HEMS Operating Base;*** **from which all operations will start and finish. There is a high probability of a large number of take-offs and landings at this heliport and for that reason no alleviation from operating procedures or performance rules are contained in the HEMS appendix.**" This is a clear statement that the applicable requirements of Subparts F, G, H, I and JAR-OPS 3.240(a)(5)[1] should be applied. The text does not call for the application of any specific Performance Class *per se* only that the existing requirements for Commercial Air Transport - as contained in the main body of JAR-OPS 3 - be applied. Because the number of occupants carried in HEMS is usually less than nine[2], <u>any</u> applicable Performance Class could be applied.

3.4 "***HEMS operating site;*** **because this is the primary pick up site related to an incident or accident, its use can never be pre-planned and therefore attracts alleviations from operating procedures and performance rules - when appropriate."** When the requirement and this guidance was written, it was well known that HEMS would be performed in City Centres such a London and Amsterdam where, if the requirements of Subpart F were applied, PC1 would be the requirement. Obviously, with most accident sites there is little possibility of applying the associated requirements of PC1[3]. The text in Appendix 1 to JAR-OPS 3.005(d) paragraph (c)(2)(i)(B):

> "**Helicopters conducting operations to/from a *HEMS operating site* located in a hostile environment shall as far as possible be operated in accordance with Subpart G (Performance Class 1). The commander shall make every reasonable effort to minimise the period during which there would be danger to helicopter occupants and persons on the surface in the event of failure of a power unit…**"

was intended to be an indicator to the commander that no <u>unnecessary</u> risk should be taken; routes in and out of the accident site should be such that the consequence of engine failure would be minimised. Recent work on PC1 has reinforced the understanding that, even if one engine inoperative (OEI) hover out of ground effect (HOGE) performance is available, the approach and take-off flight paths still have to be assessed (surveyed) before obstacle clearance (a basic requirement for PC1 and PC2) can be established. Clearly, such assessment is not practical and can never be a requirement for the *HEMS Operating Site*[4].

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[1] The requirement, in PC3, to fly over surfaces which would permit a safe-forced-landing to be carried out - which is repeated in Appendix 1 to JAR-OPS 3.005(d) paragraph (c)(1).

[2] Specifically that the maximum approved passenger seating configuration (MAPSC) is nine or less.

[3] The requirements of PC1 are: a rejected take-off area with a suitable surface (in terms of size and surface condition) where a helicopter can be (re)landed OEI without damage; provision of specified obstacle clearance in the approach and take-off segments. These requirements have to be substantiated (calculated using graphs in the RFM) for a <u>surveyed</u> site before PC1 operations can be commenced.

[4] In a recent proposal, the requirement for "as far as possible be operated in PC1" has been replaced by "operated in PC2" – this has been accepted by EASA and is now part of the proposed regulation.

3.5 "***The hospital site*; is usually at ground level in hospital grounds or, if elevated, on a hospital building. It may have been established during a period when performance criteria were not a consideration. The amount of use of such sites depends on their location and their facilities; normally, it will be greater than that of the *HEMS operating site* but less than for a *HEMS operating base*. Such sites attract some alleviation under the HEMS rules.**" The text of paragraph 8 that follows this text in the ACJ clearly explains problems with existing hospitals; Appendix 1 to JAR-OPS 3.005(i) provides alleviation that can be applied to these locations by member States.

3.6 In summary it can be seen that for operations in a mountainous area (which must, by definition, be considered as hostile) JAR-OPS 3.240(a)(5) and Appendix 1 to JAR-OPS 3.005(d) paragraph (c)(1) require that a twin-engine helicopter be used. The *HEMS Operating Site* attracts a complete alleviation from the performance requirements; operation to/from a heliport at a hospital in a hostile environment attracts limited alleviation; but operation to/from the *HEMS Operating Base* attracts no alleviation.

4 Requirements other than Performance

4.1 The number of engines is not the only requirement that is placed upon the helicopter - the crewing requirement is also specified; Appendix 1 to JAR-OPS 3.005(d) paragraphs (c)(3)(iv)(A) and (B) require:

> ***"Day flight*: The minimum crew by day shall be one pilot and one HEMS crew member. This can be reduced to one pilot only in exceptional circumstances."**
>
> ***"Night flight*: The minimum crew by night shall be two pilots. However, one pilot and one HEMS crew member may be employed in specific geographical areas defined by the operator in the Operations Manual to the satisfaction of the Authority…"**

4.2 This text is augmented by the associated ACJ which explains that the HEMS Crew Member "**should be seated in the front seat (co-pilot seat) during the flight, so as to be able to accomplish the tasks that the commander may delegate as necessary".** The ACJ indicates that these tasks are primarily concerned with the flying aspect of the operation. It is clear that any helicopter used for HEMS must be able to carry a stretcher that can be fitted without interfering with either pilot's seat. The guidance indicates that the co-pilot's seat can be removed to fit a stretcher - after arriving at the *HEMS Operating Site* providing: none of the alleviations for visibility and cloud base are applied; and the pilot does not return to the *HEMS Operating Site* except under strict and controlled conditions[5].

4.3 This requirement might preclude some helicopters (singles and twins) from operating in HEMS.

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[5] This particular aspect of the ACJ was written in the knowledge that, at the time of writing, there were types of helicopters which could not have a stretcher fitted without reversing the co-pilot's seat. It was expected that these types (which were also regarded as underpowered for the HEMS task) would be replaced by more appropriate types in due course – this expectation has been borne out in practice. If the ACJ is examined in detail, it can be seen that (with the exception of the departure from the HEMS Operating Site – which should follow a thorough risk assessment by the commander) the revised, and restricted, conditions of operation are similar to non-HEMS CAT.

5 Performance - a Technical Discussion

5.1 General Requirements

5.1.1 Clearly, when conducting HEMS at altitude, the ability of the helicopter to fly to and from the location of the *HEMS Operating Site* is one issue; the ability to make a controlled landing and take-off from the *HEMS Operating Site* is another; meeting the requirement to operate to sites other than the *HEMS Operating Site* is a third. All of these issues are now considered.

5.1.2 *HEMS Operating Site;* when considering the general requirements for performance - after the application of any permitted alleviations - it is intuitively obvious that the minimum requirement has to be AEO HOGE. If mountain operations are also considered, it is imperative that there be sufficient reserve of power and control to permit the required handling in what could be turbulent conditions. (This could be stated in terms of a cross-wind component.)

5.1.3 *HEMS Operating Base;* only the investigation of existing sites can establish if there is a problem. The requirement for performance will be 'as required by the relevant Subpart'; data is provided in subsequent sections to permit examination of this aspect of performance.

5.1.4 *The Hospital Site;* it is not considered that there is a problem with performance at these types of site specifically because of their altitude. The requirement for performance will be 'as required by the relevant Subpart' - alleviated by Appendix 1 to JAR-OPS 3.005(i).

5.1.5 In mountain areas, the requirement for JAR-OPS 3.240(a)(5) and Appendix 1 to JAR-OPS 3.005(d) paragraph (c)(1) have to be met and the ability to continue to fly to and land at the destination or alternate following a power unit failure becomes a consideration. In view of this, the en-route requirement of JAR-OPS 3.500[6] 'En-Route - Critical power unit inoperative' has to be met. The actual requirement would depend on the circumstances of the flight; compliance with JAR-OPS 3.500(a)(1) would require a 50ft/min ROC following a power unit failure but compliance with JAR-OPS 3.500(a)(2) or (3) would not.

5.1.6 Similarly, Category 'A' second segment climb[7] (150ft/min at Vy), one of the elements of PC1 (and PC2 after DPATO), would be necessary in a hostile environment.

5.1.7 In summary; for twin-engine helicopters to meet the requirements of the HEMS Appendix to operate to a *HEMS Operating Site* in the mountains – i.e. in a hostile environment - compliance will require the following: AEO HOGE performance at the site; second segment climb performance; and en-route performance in accordance with JAR-OPS 3.500 - 'En-route - Critical power unit inoperative'.

5.1.8 In order to establish whether these basic requirements can be met for the circumstances under consideration, data has been provided for a wide range of helicopters normally used for HEMS. This data permits individual analysis, comparison of twins, and comparison between twins and singles.

5.2 Provision of Data

5.2.1 Attachment A provides the following data (which has been taken from the RFMs):

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[6] In AL5, the text of JAR-OPS 3.530 was replaced with a pointer to JAR-OPS 3.500.

[7] When operating to an airport, the application of the Second Segment Climb will, in most cases, provide a Category A Clear Area take-off/landing mass. This is because it is unusual to find the Clear Area mass limited by the First Segment Climb performance.

a. Tables containing the operating mass of a number of helicopters with specific mission planning applied;

b. A series of tables for twin-engine helicopters containing the limiting masses for the following regimes:

   i. Second segment OEI climb

   ii. En-route OEI climb

   iii. AEO HOGE

   iv. Helipad profile

c. A series of tables for single-engine helicopters with limiting masses;

d. At temperature ranges between 5ºC and 20ºC in increments of 5ºC; and

e. At altitude ranges between 5,000ft and 8,000ft.

5.2.2 For brevity, attachment A does not provide an analysis of the limitations of the representative helicopters under ISA conditions; however, a statement of these limitations is contained in each of the relevant paragraphs below.

5.3 Analysis of Performance Data

5.3.1 The data provided in Attachment A is for on-specification engines; the environmental conditions at the landing site are as indicated in the tables and there is nil wind accountability. The masses shown are with the following power settings (unless otherwise stated): AEO HOGE at take-off power (although some may be shown - and annotated - at the lesser power setting of Maximum Continuous Power (MCP)); the 150ft/min and 50ft/min are both shown at OEI Continuous Rating; and the Category A Helipad at the rating specified in the Category A Supplement.

5.3.2 The data is simplistic in the sense that sector fuel (to the *HEMS Operating Site*) has not been deducted from the landing or take-off masses at the site. However, in compensation, the second segment climb and en-route performance have been calculated at the heights shown in the table and not 1,000ft above the take-off site; this is in recognition that it is unlikely that a climb to 1,000ft above the *HEMS Operating Site* would ever be undertaken unless specifically planned.

5.3.3 The data in the tables in the attachment is for the range of altitudes from 5000ft to 8000ft and for the temperature range from 5ºC to 20ºC. Where helicopter performance exceeds the requirement for the *HEMS Operating Site* – i.e. AEO HOGE, second segment climb or en-route performance – the actual limit in ISA conditions, at the specified mass, is provided for each type.

5.3.4 **EC 135T2;** the EC 135 meets all the performance requirement for the specified conditions[8] at the mission mass of 2,523kg; ISA limits are - AEO HOGE performance above 15,000ft, second segment climb performance at 14,000ft and en-route performance at 15,000ft. The Category A Helipad procedure tops out at **6,000ft at 10º**; this could be an issue if the *HEMS Operating Base* does not have adequate space without surrounding obstacles.

5.3.5 **EC 145;** the EC 145 meets all the performance requirement for the specified conditions at the mission mass of 2,682kg; ISA limits are - AEO HOGE above 16,000ft, second segment climb performance at 14,500ft and en-route performance at 15,500ft. The

[8] 'Specified conditions' in this section refers to 8,000ft at 20ºC

Category A Helipad procedure tops out at **7,000ft at 15ºC**; this could be an issue at that altitude if the *HEMS Operating Base* does not have adequate space without surrounding obstacles.

5.3.6 **A 109E**; the A 109E meets the performance requirement for the specified conditions (second segment climb (just by 2 kg) tops out at 8,000ft at ISA+20ºC) at the mission mass of 2,558kg; ISA limits are - AEO HOGE above 15,000ft, second segment climb at 14,500ft and en-route performance at 15,300ft. The Category A Helipad procedure tops out at **6,000ft and 10ºC -** this could be an issue if the *HEMS Operating Base* does not have adequate space without surrounding obstacles.

5.3.7 **A 109S**; the A 109S meets the performance requirement for the specified conditions at the mission mass of 2,668kg; ISA limits are - AEO HOGE above 15,000ft, second segment climb at 14,500ft and en-route performance at 15,300ft. The Category A Helipad procedure tops out at **7,000ft and 15ºC -** this could be an issue if the *HEMS Operating Base* does not have adequate space without surrounding obstacles.

5.3.8 **AS 355N**; the AS 355N meets the performance requirement for the specified conditions (second segment climb tops out at 8,000ft at ISA+20ºC) at the mission mass of 2,172kg; ISA limits are - AEO HOGE performance above 12,000ft, second segment climb at 11,000ft and en-route performance at 12,000ft. The Category A Helipad procedure tops out at 6**,000ft and 20ºC**; this could be an issue at that altitude if the *HEMS Operating Base* does not have adequate space without surrounding obstacles.

5.3.9 **MD 902 (P&W 207)**; the MD 902 meets all the performance requirement for the specified conditions at the mission mass of 5,084lbs; ISA limits are - AEO HOGE above 15,000ft, second segment climb at 14,500ft and en-route performance at 15,000ft. The Category A Helipad procedure tops out at **7,000ft** (no data is provided above this altitude); this could be an issue at that altitude if the *HEMS Operating Base* does not have adequate space without surrounding obstacles.

5.3.10 **AS 365N**; the AS 365N is the least powerful of any of the twins examined; does not have sufficient power for the specified conditions to meet: AEO HOGE performance; second segment climb performance; en-route performance was not established because the graphs did not permit calculation at the appropriate altitudes. With a mission mass of 3,305kg the Category A Helipad procedure tops out at **SL and 20ºC**; this could be an issue under any circumstances if the *HEMS Operating Base* does not have adequate space without surrounding obstacles.

5.3.11 **AS 365N2**; the AS 365N2 meets the performance requirement for the specified conditions (second segment climb tops out at 8,000ft at ISA+20ºC) at the mission mass of 3,399kg. The Category A Helipad procedure tops out at **400ft and 20ºC**; this could be an issue under any circumstances if the *HEMS Operating Base* does not have adequate space without surrounding obstacles.

5.3.12 **AS 365N3**; the AS 365N3 meets all the performance requirement for the specified conditions at the mission mass of 3,477kg; ISA limits are - AEO HOGE at 11,000ft, second segment climb at 10,000ft; and en-route performance at 11,000ft. The Category A Helipad procedure tops out at **5,000ft and 10º**; this could be an issue at that altitude if the *HEMS Operating Base* does not have adequate space without surrounding obstacles.

5.3.13 **AW139**; the AW 139 meets all the performance requirement for the specified conditions at the mission mass of 5,160kg; ISA limits are - AEO HOGE, second segment climb and en-route performance all above 16,000ft; Category A Helipad procedures tops out just above **8,000ft at 20ºC**.

5.4 Environmental Data for the European Alpine Regions

5.4.1 A submission from an operator in the European Alpine Region indicates that the average temperatures are distributed as follows:

a. Number of days in year that are ISA or below – 300 to 320 days/year

b. Number of days in year that are ISA + 10°C – 30 to 50 days/year

c. Number of days in year that are ISA + 20°C – 10 to 20 days/year

6 Discussion of Results

6.1 HEMS Operating Site

6.1.1 The analysis of data from the representative sample of helicopters appears to indicate that all twins - with the exception of the AS 365N - have an acceptable level of performance when equipped for HEMS at the mission masses and in the conditions specified. Most could, in ISA conditions, operate to a site between 14,000ft and 16,000ft

6.1.2 All twins examined - with the exception of the AS 365N - had AEO HOGE performance at the most limiting conditions specified (8,000ft at ISA+20ºC); the better ones above 14,000ft in ISA conditions. This would ensure that a landing and take-off would be conducted as it would be for a *HEMS Operating Site* at a lower altitude (outside mountain conditions) - but with less reserves of power. (The higher reserve of power at lower altitudes does provide a reduction of exposure - i.e. later departure from PC1 on approach and earlier entry to PC1 on departure; however, it is likely that operation at the *HEMS Operating Site* will always be inside the HV diagram or over obstacles that cannot be cleared following a power unit failure.)

6.1.3 Most twins examined had second segment performance at the most limiting conditions specified (8,000ft at ISA+20ºC); the better ones above 14,000ft in ISA conditions. Exceptions were limited and include: the A109E (just by 2 kg) and AS 365N2 (which were outside only if fuel burn is not considered); the AS 355N (limited only at 8,000ft at ISA+20ºC); and the AS 365N (limited at 8,000ft at ISA+15ºC). Hence exposure at the *HEMS Operating Site* would be limited only to the initial part of the take-off phase or late in the landing phase and, with the exceptions shown, it is possible for most helicopters to be in PC1 before they reach Vy.

6.1.4 All twins examined - with the exception of the AS 365N (for which calculation was not possible) - had en-route performance at the limiting conditions specified (8,000ft at ISA+20ºC); the better ones above 14,000ft in ISA conditions.

6.2 HEMS Operating Base

6.2.1 Depending upon its location, operating to/from the *HEMS Operating Base* might present problems as there is no alleviation from the performance standards of the appropriate Subpart[9]. However, the location of this base is a matter of Operator's choice and it would be unusual if it were sited such that PC1 is required.

[9] Nothing in the HEMS appendix specifies the Performance Class which must be used at the HEMS Operating Base; it is a matter of applying the standard required by JAR-OPS 3.470 in Subpart F. With the exception of the base situated in a Congested Hostile Environment, PC1, 2 or 3 could be used.

6.2.2 The siting of the *HEMS Operating Base* in a congested hostile environment would result in a requirement for operations in PC1. This would require the application of one of the Category A procedures in the RFM. The tables in Attachment A have a column in which masses for the most limiting of these profiles (the helipad procedure) has been provided. It can clearly be seen that if the *HEMS Operating Base* is sited above 5,000ft (for the AS 365N, Sea Level at 20ºC, and for the AS 365N2, 400ft at 20ºC) and the helipad procedure is required (for operations in a congested hostile environment), there could be insufficient performance available. As the location of the *HEMS Operating Base* is under control of the operator, it is not clear why it would ever be sited such that PC1 would be required. If the *HEMS Operating Base* is located at a hospital, as result of contractual agreement, the consequence should be made clear to the contractor.

6.2.3 It should be noted that the AS 365N and AS 365N2 have the most limiting Category A Helipad capability at mission masses (at any altitude); in view of that, siting of the *HEMS Operating Base* at a location where a Category A helipad procedures was required, or when operating to a hospital in a congested hostile environment (where specific climb gradients are required) might present a challenge to any HEMS operator using these helicopters.

6.2.4 The situation at the *HEMS Operating Base* would not be improved (in fact it would always be worse) if a twin-engine helicopter were not to be used. Any of the twins examined could be operated with engine failure accountability for all but the initial part of the take-off phase or late in the landing phase.

6.3 Hospital in a Congested Hostile Environment

6.3.1 Alleviation for twin-engine helicopters is currently available at these locations so they will not be considered further here.

7 Comparison of Twins and Singles

7.1 General

7.1.1 Helicopters used for HEMS should be able to carry a deployed stretcher without preventing the two pilots, or a pilot and a HEMS crew member, from occupying the front two seats; this in recognition that such flights can be conducted under operational or environmental conditions which would not be permitted for CAT operations other than HEMS. The arrival at the *HEMS Operating Site* - because it is close to the accident site and not therefore pre-planned - requires an operating crew of two 'up front' to ensure the safety of the flight. No further re-configuration should be necessary to deploy a stretcher when two crew members are in the front seats. Because of their internal size and configuration, this may not be possible with two of the single engine helicopters[10] considered in the attachment (and one of the twins).

7.2 The HEMS Operating Site

7.2.1 The single will be operating in Performance Class 3 at all stages - exposure to an engine failure will be at the generally acknowledged probability of 1 x 10^{-5} per hour. As these operations are being conducted over a hostile environment, an engine failure is likely to result in an accident.

7.2.2 As can be seen from analysis of the data, the twin will be operating with engine failure accountability for all but the final part of the landing and the initial part of the take-off. Engine failure will have consequences only during the period that the helicopter is exposed in

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[10] The A 119 has the same cabin form as the A 109 and does not suffer from this problem.

the final approach and the initial departure; exposure is therefore likely to be within an acceptable target of 5 x 10^{-8} for each event (an event being a take-off or a landing).

7.2.3 It is clear that the only time when the single has the same exposure as the twin is when they are both in the final part of the approach and the initial part of the departure. If it were to be established that the amount of reserve power available to the twin at the HEMS Operating Site was insufficient to maintain controllability, then a single with that capability would have to be preferred. In the event, the majority of twins examined appear to have AEO HOGE (at the limiting conditions specified) with some reserve (the exception being the AS 365N).

7.3 The HEMS Operating Base

7.3.1 Without further data being made available, it is not clear if there is a problem with *HEMS Operating Bases*; with the exception of the early marks of the AS 365s, most twin-engine helicopters examined are capable of performing a Category A Helipad procedure at and above 5,000ft at temperatures up to 20ºC - should it be required. A single-engine helicopter would not provide any benefit at this type of location.

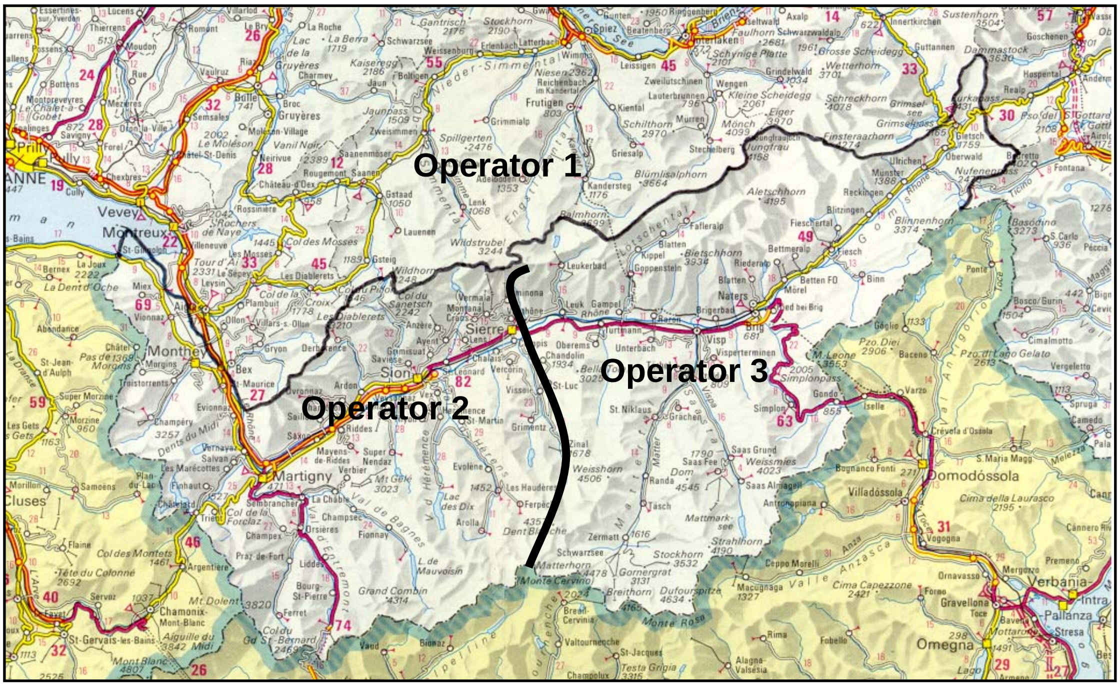
8 The Operating Environment (using Switzerland as an example)

8.1 Geography and Population of Potential Casualties

8.1.1 Switzerland has been chosen as an example of mountain operations because it has a substantial area of the European Alps within its territorial borders; for the time being, it is not implementing JAR-OPS 3[11]. Mountain rescue has been a feature of alpine activities for a considerable time; helicopters have been used for more than half a century although effectively only since the introduction of the Alouette. The growth of helicopters in mountain rescue has been organic; the present modus operandi has been developed over several decades using the best equipment that was available at the time. Helicopters which are used for mountain rescue may, with some operators, also be used for passenger transport and aerial work; the principle reason for this can be found in the business model - discussed later in the text.

8.1.2 The following map shows the southern part of Switzerland and the geographic distribution of the main HEMS/rescue operators (boundaries between operators are shown in black).

[11] Athough it does apply JAR-OPS 1 and is planning to be a signatory to EASA.



8.1.3 Specifically in the mountain regions, the population of casualties will be drawn from those who normally inhabit the area and those whose leisure activities take them there. In the summer they will be mainly climbers, bikers and hikers; in the winter, skiers and climbers. Evidence appears to indicate that, in the higher resorts, greater numbers are present during the skiing season.

8.1.4 Few people live above 8,000ft; however, some of the activities mentioned (particularly climbing) are carried out well in excess of 8,000ft (and up to 16,000ft). The ability of the twin to perform to the required operational standard will reduce as the altitude of a rescue site rises above 8,000ft (although performance will be better in the winter than the summer).

8.2 Upper Limit of Rescue Sites

8.2.1 To give an illustration of the altitude where rescue might have to be conducted, an operator was asked to provide the following: the three highest locations that are reached by ski-lift; the three highest locations that are reached by heliskiing; and the three highest mountain huts used by walkers and climbers. This resulted in the following:

Highest Locations			
Ski-lifts	Klein Matterhorn	Mittelallalin	Mt-Fort
	12,477ft	11,350ft	10,925ft
Heliskiing	Monte Rosa	Ebnefluh	Pigne d'Arolla
	13,517ft	12,361ft	12,073
Mountain Huts	Margueritha	Mönschjoch	Dt-Blanche
	14,941ft	11,906ft	11,506ft

8.2.2 These might not represent the highest altitudes that rescue will be required because, by its nature, climbing can be conducted above transportation means; however it does, for skiing, give an indication what the highest rescue altitude might be.

8.3 Distribution of the Workload

8.3.1 The HEMS/rescue workload in the European Alpine region is dominated by the influx of skiers in the winter and climbers/hikers/bikers in the summer. This results in two peak, and two shoulder, periods - more exaggerated with some operators than others.

8.3.2 The following graphs show the distribution of HEMS/rescue work for the years 2005 and 2006; the skiing season is mainly January to March (extending into April for the higher resorts) and the summer walking/climbing season mainly July and August (beginning in June for the lower resorts). The first shoulder season is between April and June and the second between October and December. There is a similar shape in the patterns but a marked variation in amplitude between operator 1 - who operates at all altitudes, and operators 2 and 3 - who work mainly at higher altitudes.

8.3.3 Operator 1 - who is exclusively a HEMS/rescue operator - has 10 bases[12] distributed across the State; of these, four are at relatively low altitudes (average 1,320ft) and are used for classic HEMS operations, the remaining six are mainly for higher altitude operations. The lower bases have an almost 1:1 distribution of primary and secondary tasks[13]; in the bases which cover higher altitudes, this ratio varies from 1.4:1 to 5.5:1 with an average of 4:1 – i.e. four primary to one secondary.

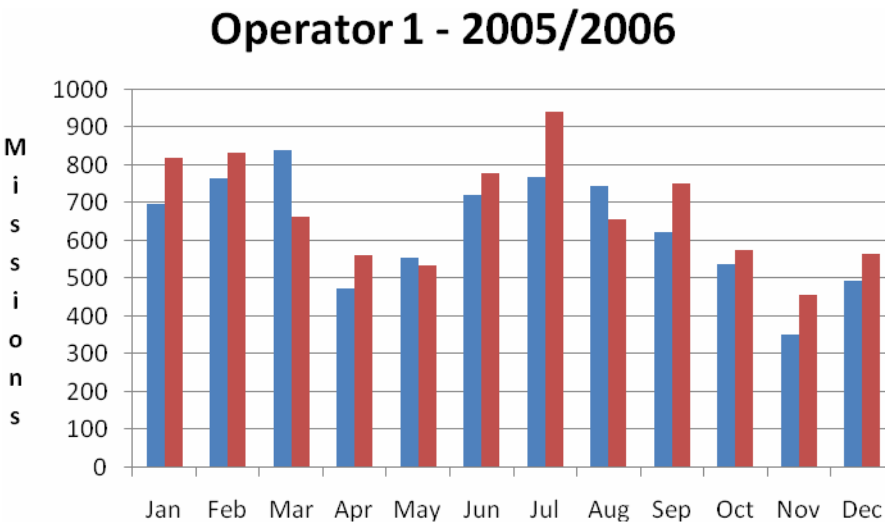


Figure 1 - Operator 1 Missions

8.3.4 The mix of locations and operational tasks (classic HEMS and rescue) explains the more even distribution of workload for operator 1. In the second chart (below) the first three categories are clearly mountain related whilst the last six (with perhaps the exception of aviation) are more likely to be classic HEMS.

[12] In addition to the 10 permanent bases, there are three more that are contracted from other operators, on a part or full time basis.

[13] In this State (which does not yet apply JAR-OPS for helicopters) *primary* missions are those which operate to a HEMS Operating Site (accident site) and *secondary* from hospital to hospital (or equivalent). Primary missions include mountain rescue of climbers, skiers, hikers or bikers. The primary/secondary categorisation is not used in JAR-OPS although it is used informally in most States – the JAR-OPS equivalence is explained in ACJ to JAR-OPS 3.005(d).

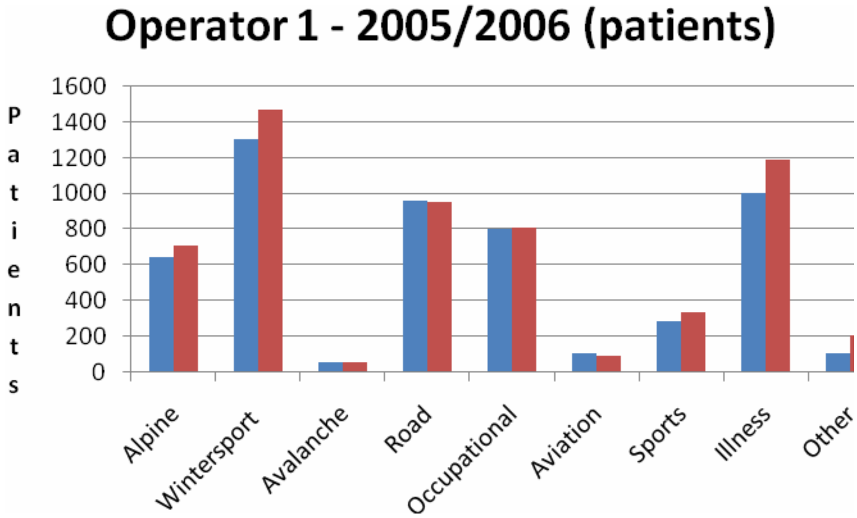


Figure 2 - Operator 1 Activities

8.3.5 Operators 2 and 3, who share an operating area in the same Canton, do not have HEMS/rescue as their sole activity; the aircraft/crews are used also for commercial air transport and aerial work. In a single day – even in the skiing (high) season – a helicopter might be used to transport skiers to the high slopes prior to being put on stand-by for rescue missions.

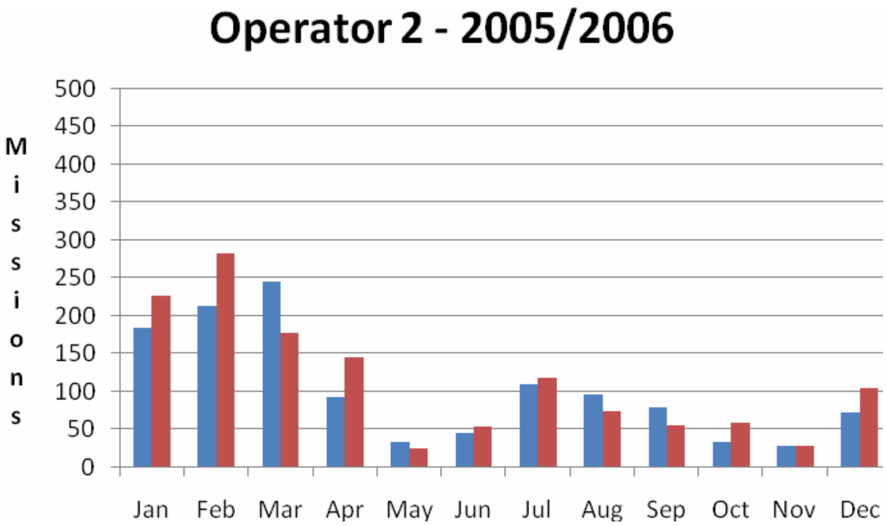


Figure 3 - Operator 2 Missions

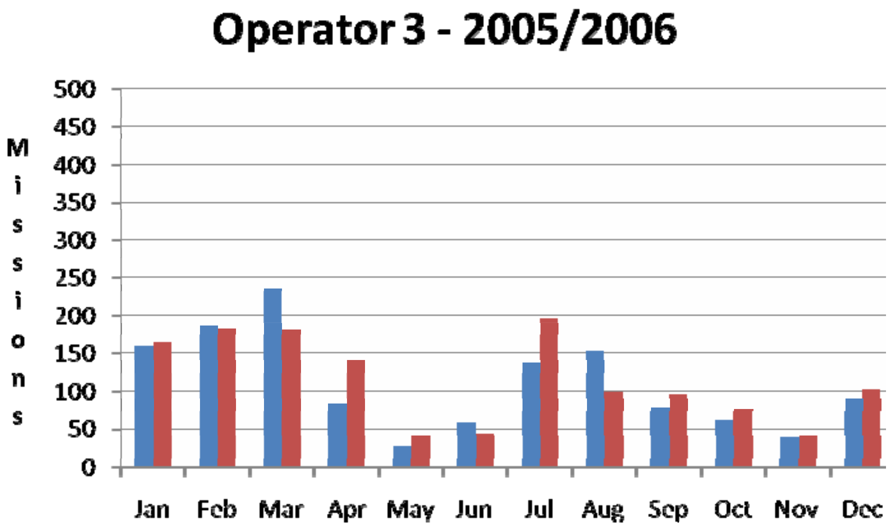


Figure 4 - Operator 3 Missions

8.4 Allocation of Resources to Task

8.4.1 There are three major HEMS/rescue operators in Switzerland; in addition, three smaller operators subcontract to operator 1. Most incidents are reported to a call centre (telephone 144 or 1414) which allocates the mission to the operator nearest to the site. In the event of a large incident, HEMS/rescue operators cooperate to achieve the best result for the patients/casualties.

8.4.2 Operator 1 operates exclusively[14] for HEMS/rescue and has a permanent allocation of helicopters to task. To permit periodic servicing, a pool of spare aircraft is retained at the main base.

8.4.3 Operators 2 and 3 have a flexible locating and tasking policy, allocating their available resources to bases, as required, for the season.

8.4.4 Operator 2 allocates four helicopters for HEMS/rescue during the months December to April; two of these machines are available for heli-skiing transportation until 10:00hrs. Additional helicopters can be taken from the pool should the need arise. (In 2007, there were 21 missions between 10:00hrs and 17:00hrs on a single day requiring five helicopters on task.) During the rest of the year, a single helicopter is allocated to HEMS/rescue; this can be augmented by additional helicopters – as is usually the case at weekends.

Note: This does not take account of operator 2's satellite bases which are used for HEMS/rescue in the skiing season.

8.4.5 Operator 3 has one helicopter on standby for HEMS/rescue at each of its two bases (and a Lama for high altitude rescue for the climbing peaks); in addition another six (including the Lama) can be allocated as required. Complex rescue operations, such as avalanche or crevasse accidents, require two or more helicopters on task at the same time. The allocation of helicopter to site varies to suit the distribution of the tasks – summer to winter. The helicopters can be reconfigured from passenger transfer to rescue in 3 - 5 minutes.

[14] There is an exception; in the summer months when animals are put to the high pastures to graze, operator 1 takes a responsibility to move them as-and-when-necessary for rescue or to prevent ecological pollution.

8.5 Distribution of Missions by Altitude

8.5.1 The distribution of missions by altitude is dependent upon the location and function of the base(s); Operator 1 has the widest geographical coverage with bases covering most of Switzerland; Operator 2 has three HEMS bases, one working year round on HEMS/rescue with subsidiary bases working in HEMS/rescue only in the winter season; Operator 3 has two bases, one at an altitude of 5,276ft. Anecdotal evidence from Operators 2 and 3 indicate that the majority of their missions are performed between 6,000ft and 10,000ft.

8.5.2 Skiing is mostly conducted at altitudes between 5,000ft and 10,500ft; the highest ski-lift is at 12,500ft[15]; and, a small population are engaged in heli-skiing up to 13,500ft[16].

8.5.3 Summer activities are conducted at altitudes between 1,600ft and 14,500ft - with only a small proportion above 10,000ft.

8.5.4 Operator 1 reports the following distribution of missions by altitude:

	2005	**2006**
Missions between 6,000ft and 10,000ft	1,394	1,445
Missions above 10,000ft	59	80
Total mission above 6,000ft	1,453	1,525
Total missions	7,583	8,417

8.5.5 Operator 3 (with a base at 5,276ft) reports:

	2005	**2006**
Missions above 10,000ft	431	463
Total missions	1,320	1,376

representing, respectively, 32% and 34% of total missions.

8.6 Distribution of Missions by Landing/HEC

8.6.1 Because of the nature of mountain operations, landing is not always possible at HEMS/rescue sites; it is therefore necessary to have available a means of access/recovery utilising Human External Cargo (HEC) provisions. HEC is undertaken by hoist, long haul or short haul (the last two using fixed ropes attached to the cargo hook(s) – suitably approved for that purpose).

8.6.2 The graph below shows, for Operator 2, the relative distribution of missions for landing/HEC - the upper section of each bar being HEC (2006 only is shown as the proportions are similar for other years).

[15] The highest lift being the Klein Matterhorn

[16] The heli-skiing site located at Monte Rosa.

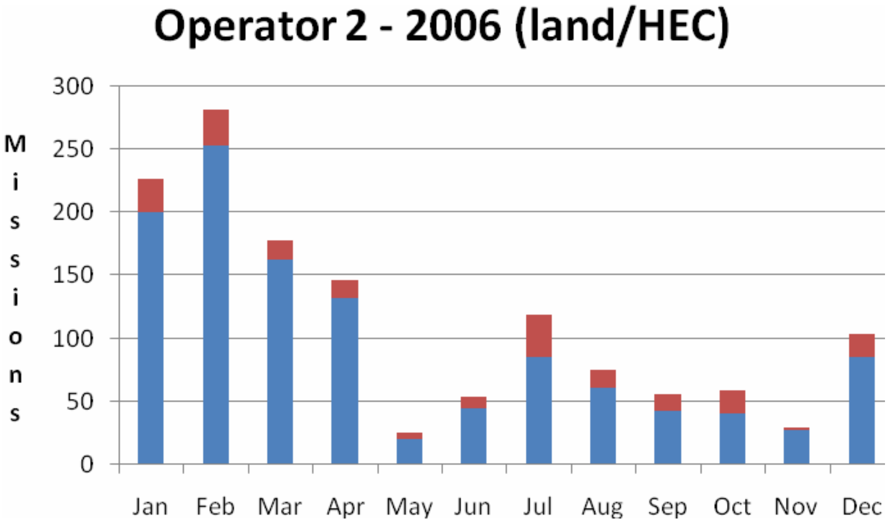


Figure 5 - Operator 2 - Mix of Missions

9 The Business Model

9.1 HEMS in Europe is dominated by a single business model - a contractual arrangement between the operator and a third party for the provision of dedicated resources[17]. The third party is made aware of the conditions that are placed on the operator by being in compliance with the regulations, and the contract is tailored accordingly.

9.2 The third party might be an: agency of the national health provider; the local/state[18] government; or a charitable organisation. (In some States the operator is itself a subsidiary of a national organisation[19].) In some cases, the third party pays a monthly and a flying hour fee. The maximum number of hours flown is part of the agreement; exceeding the maximum can result in adjustments to the available resources - this can impact severely upon costs.

9.3 Cost recovery from the patient/casualty, is not a major feature of the European HEMS business model – most States have an obligation to provide such services as part of their social policy.

9.4 People who take part in recreational activities such as skiing or climbing/hiking/biking in the mountains routinely carry health or travel insurance. Such insurance is in place because the risk of injury is part of the profile of these activities (which are also routinely conducted in a foreign State). Cost recovery[20] is a part of the normal process of rescue/evacuation of persons associated with mountain recreation. Rescue/evacuation by helicopter is an expectation of skiers who have been injured.

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[17] With this business model, an operator in another State has 16 HEMS locations averaging 2-3 missions per day (averaged over the year) or 60-85 missions/month. The average transit time to an incident is 8 minutes and time to the hospital 10 minutes.

[18] For example in Germany, the 16 Lände issue the operating contracts but responsibility for payment is with the Health Insurance .

[19] In a number of European States, this national organisation is the motoring club – e.g. ANWB, ADAC, RAC etc.

[20] Which is at a pre-agreed rate - suitably scaled for twins and singles.

Note: where a casualty does not have insurance, costs may be underwritten by a third party – in parts of Switzerland that can be the local Canton.

9.5 Alpine States with a road system which can be slow and, in the winter, very difficult, sometime have a 'card system' (patrons); for a small yearly charge, members are given access to the HEMS/rescue system. Such a system can provide a background income[21] to the operator permitting resources to be deployed regardless of cost recovery at the point of delivery – this is very similar to the single sourcing model used in other States. When this is combined with the cost recovery system, it provides a very effective business model.

9.6 The financial health of those operators in the mountains without access to a 'patron' system is dependent upon a mix of operations; the seasonal nature of demand lends itself well to such a mix. During the peak period in the winter, heli-skiing and HEMS/rescue provide good utilisation of the fleet. In other periods, construction and other aerial work tasks (not shown in the graphs above) combine with mountain rescue to the same effect. Fleets are tailored towards this mix of activities.

9.7 The HEMS fleet in most of Europe has had a complete change of helicopters and systems to permit operations in compliance with the JAR-OPS HEMS philosophy (a model which has been developed in accordance with the Risk Assessment). More modern and powerful twins have been introduced to permit operations to be conducted anywhere and, specifically, to city centres and hospitals in built up areas.

9.8 The HEMS philosophy is specifically associated with the normal distribution of medical casualties in the, fairly static, urban/suburban environment and takes little account of extremes (of population influx and altitude) that might be present for recreational activities in the mountains.

10 Establishing a Standard Response Time for HEMS/rescue

10.1 The Golden Hour

10.1.1 The following description of the golden hour is taken from Wikipedia[22]:

> "The strategy developed for pre-hospital care in North America is called Scoop and Run. It is based on the golden hour concept, i.e. a victim's best chance for survival is in an operating room, with the goal of having the patient in surgery within an hour of the traumatic event. This is especially true in case of internal bleeding. Thus, the minimal pre-hospital care is performed (ABCs, i.e. ensure airway, breathing and circulation; external bleeding control; spine immobilization; endotracheal intubation) and the victim is transported as fast as possible to a trauma centre. This philosophy is aptly summarized by the following quotation from "The Rules of EMS": "Trauma is treated with diesel first." The aim in "Scoop and Run" treatment is generally to transport the patient within ten minutes of arrival; hence the birth of the phrase, "the platinum ten minutes" (in addition to the "golden hour"), now commonly used in EMT training programs. It should be noted the "Scoop and Run" is a method developed to deal with trauma, rather than strictly medical situations (e.g. cardiac or respiratory emergencies)."

10.1.2 The European HEMS model (and that for most other regions in the world) is based upon meeting the golden hour target – i.e. base response, site arrival, site departure and arrival

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[21] For operator 1 the annual 'charge' to 'patrons' represents 60% of income.

[22] The whole articles can be found at http://en.wikipedia.org/wiki/Emergency_medical_service

at the hospital all within one hour. To achieve this, operational areas are defined which will permit all the phases of a HEMS mission to be completed and the casualty delivered to the hospital within the golden hour[23].

10.2 Establishing Base Resources

10.2.1 As has been indicated above, the resources applied by a HEMS operator have to be tailored to meet demand so that completion of missions can be within the golden hour. Custom and practice in Europe appears to indicate that in a rural environment response time can be met when the number of missions per helicopter/day (averaged over a year) is between 2 and 3[24].

10.2.2 In Switzerland, averaging the missions for operators 2 and 3 (contained in Figures 3 and 4) over the year would lead to the following:

Operator	Missions Per Year		Missions Per Day		Number of Helicopters	
	2005	2006	2005	2006	2005	2006
2	1,233	1,354	3.4	3.7	2	2
3	1,320	1,376	3.6	3.8	2	2

If on the other hand it is decided to tailor resources to the peak (the four-month winter) period the resulting figures would be:

Operator	Missions per Peak		Missions per Day		Number of Helicopters	
	2005	2006	2005	2006	2005	2006
2	736	833	6.1	6.9	3	3
3	668	675	5.6	5.6	2	2

Taking just the peak month (and dividing by the days in that month) would lead to the following:

Operator	Highest Month		Missions Per Day		Number of Helicopters	
	2005	2006	2005	2006	2005	2006
2	246	282	7.9	10.1	3	4
3	236	185	7.6	6.6	3	3

10.2.3 As has been seen in 8.4 above, Swiss operators allocate resources in order to meet the response target. However, economically providing resources for the peak period and not the yearly average is dependent upon alternative utilisation of the resources in the lesser-peak and shoulder periods.

10.2.4 Clearly, dealing with recreational activities in the mountains (with its large transient population) requires careful allocation of resources but also demands a flexibility that is not normally required in classic HEMS (unless dealing with major incidents/accidents for which contingency plans for marshalling available resources - under control of the State - are usually extant). Even if compliant resources are based upon the daily average in the highest month, they can still be overwhelmed by a spate of accidents.

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[23] A major operator in the UK reports a mean operating time of call-to-hospital of 40 minutes.

[24] This is a rule-of-thumb for rural locations; in city centre locations such as Berlin, where the average time on mission is between four and eight minutes, the number of missions/helicopter that can be accomodated is three times that amount.

11 Operations Conducted Outside of the (normal) HEMS Operational Requirement

11.1 The Performance Envelope

11.1.1 JAR-OPS 3 specifies, for operations in a hostile environment[25], that the requirements of Performance Class 1 or 2 are met. At the HEMS Operating Site PC2, in the form of AEO HOGE and Second Segment Climb, is required; en-route performance is also required (stay-up or safe drift down).

11.1.2 As can be seen from the analysis of performance, there will be combinations of altitude and temperature at a potential rescue site in the high Alps for which some twin-engine helicopters will not have the required performance. Furthermore, it can be seen that some of the twins analysed[26] are not suited to mountain operations because of a basic lack of power. For those twins which do have the reserves of power – i.e. six of the 10 analysed - it is clear that they can both reach, and operate at, the highest locations and, in ISA conditions, meet the operational requirements.

11.1.3 In section 5.4 there is a report that for 300 – 320 days of the year, the temperatures are at or below ISA conditions. It can therefore be safely assumed that, for the winter months (i.e. the skiing season), appropriate twins will have sufficient performance to reach and permit the rescue of any skier.

11.1.4 In the same section it was also reported that, for 10 to 20 days per year, the temperatures can reach ISA + 20; on these days, rescue of climbers from the highest peaks might not be possible within the operational requirements - even with a number of the more powerful twins.

11.1.5 With the appropriate choice of helicopter (and the analysis appears to indicate that there are a number to choose from) any problem with the performance envelope will be limited to those 5% - 10% of occasions when conditions are at the extreme and, specifically, related to rescue of climbers.

11.1.6 Clearly though, satisfying operational regulations cannot be a barrier to rescue; flexibility must be provided to ensure that this does not occur.

11.2 Dealing with Peak – and/or Exceptional – Periods of Activity

11.2.1 As was shown above, there are two peak periods: one in the winter season and the other in the summer. Even within the peak season there can be variability (the example of 21 missions in a single day in 2007 – i.e. double the mean). That this exceptional demand could be satisfied was due to the system of taking helicopters/crews from the operator's pool of resources.

11.2.2 For pooling to be conducted in compliance with the regulations, all helicopters, crews and equipment would have to meet the requirements of JAR-OPS 3 – as amended by Appendix 1 to JAR-OPS 3.005(d).

11.2.3 As was mentioned above, population influx resulting in the probability of multiple casualties at different sites was not considered when the basic HEMS risk assessment was

[25] It is generally accepted that mountain operations are conducted over a hostile environment.

[26] The twins analysed in this paper, are the more able of those for which data is available; there are others, used for HEMS in lower altitudes, which have not been considered because it is already known that their performance would not permit missions to be undertaken even on the lower slopes.

undertaken. Additionally, the fall-back system of ground based resources (ambulance and crew) is also not available, or practical. Under these circumstances, the rescue/recovery of some casualties will be outside the Golden Hour unless additional resources are applied to the task. This can be considered to be outside the scope of the original HEMS concept and one for which alternative/contingency strategies have to be considered.

11.3 The "Rendezvous System"

11.3.1 Not all mountain missions are medical emergencies; sometimes there is a need to extricate a climber, hiker or skiier from a situation that is, or could be, dangerous. For these 'technical missions' (which can be quite complex because they are concerned with crevasse, avalanche, climbing, off piste or hiking path rescue) two helicopters are deployed – one for 'technical' part of the mission and the other for the 'medical' part. This is known as the 'Rendezvous System'.

11.3.2 The 'technical' helicopter carries the mountain specialist and paramedic together with their equipment; if it is clear from the dispatch-call that there is an injured person, the doctor with basic medical equipment is also carried. At the rescue site, the mountain specialist (complete with communication equipment) is winched, or lowered, to assesses the situation and take care of the casualty. If the specialist decides that medical assistance is required (to deal with trauma, broken bones or serious injuries such that the patient must be transported in a special bag), the doctor is lowered and the specialist steps back - securing both the patient and the doctor.

11.3.3 When it is confirmed that there is a patient, the 'medical' helicopter is called to redezvous - for example to a mountain hut or a flat spot at the base of the mountain where both helicopters can land. The 'technical' helicopter completes the lift of the patient from the accident site to the rendezvous and the patient is transferred to the waiting 'medical' helicopter for onward carriage to the hospital. If, at this stage, the specialists have not been recovered, the 'technical' helicopter returns immediately to picks them up.

11.3.4 This particular system was implemented after some unfortunate experiences in the Swiss Alps. On several occasions, two or three mountain specialists were needed to recover a casualty from the mountains. The specialists were hoisted into the site by the helicopter; as soon as the patient was ready, he was lifted out of the accident site and flown to the hospital - leaving the specialists on the mountain face (they were not ready to be picked up and it would have delayed the departure). The weather changed and the specialists were faced with critical exposure. Since then 'technical missions' have been dealt with differently from 'medical missions'.

12 Strategies for Dealing with Abnormal or Exceptional Conditions

12.1 In some sense, the title of this section misrepresents the nature of mountain operations; the conditions discussed above are abnormal only in that they are outside the JAA conceptual model of HEMS (the risk assessment that resulted in the JAA philosophy was predicated upon a model of distribution of medical casualties in the relatively static urban/suburban environment). Unless regulations are applied flexibly to recreational activities in the mountains, it could result in a situation where: casualties cannot be picked up without disregarding the rules; the response target (the golden hour) cannot be met; or, existing and well established methods of dealing with mountain rescue cannot be employed.

12.2 As seen in 11.1, there will be occasions when environmental conditions will not permit the helicopter to be operated within its performance envelope[27]. Under these circumstances, continued operations will only be possible by applying a contingency plan (appropriately risk assessed to ensure that additional hazards have been considered and are acceptable under the circumstances). Such a plan might include provision of relief from requirements for a specific phase of flight which cannot be met in extreme environmental conditions; or, the use of a non-compliant helicopter or Performance Class.

12.3 In the classic HEMS model, appropriate resources, based upon a projected number of sorties per day, are provided (it was previously shown that, for a rural situation, this might be 3 missions per day (averaged over the year) or 60-85 missions/month); this has been shown to be sufficient to meet the universally accepted performance target (the golden hour) - but only where the workload is evenly distributed. The peak/exceptional conditions discussed in 11.2 could be addressed by adding appropriate resources - over and above basic resources - in the short term. However, this does not fit well into the HEMS conceptual model which requires sophisticated helicopters, adequate resources and well trained crew members to be permanently available; it poses the question - where would the additional resources come from?

12.4 Under circumstances where response time is likely to degrade - such that the rescue/recovery of casualties moves unacceptably outside the golden hour - the conditions of the risk assessment change and contingency planning comes into effect[28]. Provided that this contingency plan is pre-assessed and the implementation controlled, introduction of other (perhaps non-compliant) resources should be considered for a limited period. Any such system must be part of a plan that is known to the Emergency Call Centre and pre-agreed by all interested parties.

12.5 Any contingency system which is developed in order to address these issues must be clear in its scope and specific enough such that the regulator and operator are both aware of the conditions under which the plan is to be brought into effect and when normal operations are to be resumed. Formal reporting should be a requirement; the report should contain precise details of the date and time the plan was brought into effect, the time of reversion to the standard system and the reasons for its use.

12.6 The Swiss ‘Rendezvous System’ has been developed to meet a specific requirement of mountain rescue i.e. for ‘technical missions’. Historically, Search and Rescue (SAR) has been outside the scope of Commercial Air Transport (CAT) and therefore not part of ICAO SARPs[29] or JAR-OPS 3. In the case of mountain rescue, there is no obvious and clear boundary between rescue and HEMS; however for a ‘technical mission’ using the ‘Rendezvous System’ there is a clear division of tasks that permits such a distinction to be drawn. It is therefore suggested that, in spite of the fact that a casualty may be lifted from a rescue site, the ‘technical’ part of the mission is not a HEMS flight for the purposes of JAR-OPS 3.

12.7 The authors of JAR-OPS 3 debated these issues when they were first considered and the following note was added to the HEMS Appendix:

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[27] Choice of helicopters should be made on the basis of the Operational Requirement – this will immediately rule out some of the helicopters that have been assessed in this paper.

[28] This would be analogous to a serious incident ‘anywhere’ and where contingency planning would permit the mustering of available resources to address the situation.

[29] In the ICAO model, Search and Rescue (SAR) is regarded as Aerial Work; in the A-NPA for JAR-OPS 4 (Aerial Work) it was suggested that, in view of the nature of terrain over which SAR might be conducted, the regulation of SAR should be left to individual States.

Note: the Authority is empowered to decide which is a HEMS operations in the sense of this Appendix.

12.8 This note was added to account for those exceptional conditions which could not be foreseen and for which contingency planning might be required; and those specific types of rescue which the Authority did not wish to see constrained to CAT (HEMS) – i.e. those conditions which are described in 12.1 to 12.7 above.

13 Conclusions

13.1 As has been shown in 11 above, there are aspects of mountain rescue which cannot be conducted under the existing requirements of the HEMS appendix.

13.2 Provision should be made to permit a contingency plan for evacuation of a casualty when operations to/from the HEMS Operating Site are beyond the capability of a twin-engine helicopter operating in PC2.

13.3 Provisions should be made to permit a contingency plan to come into effect when exceptional[30] demand for HEMS missions will result in the target response time being exceeded.

13.4 It should be clarified that for mountain rescue involving more than one helicopter, the one which, as part of its mission, is performing the act of inserting the mountain specialist(s) is not considered to be operating in CAT.

13.5 It should be clarified that mountain rescue involving a helicopter using a Personal Carrying Device System (PCDS) in a Fixed Line Flyaway[31] - i.e. a rope attached to the helicopter and colloquially called 'short haul' or 'long haul' – is not considered to be CAT.

13.6 The Authority should ensure that adequate equipment, meeting the requirements of CS 27/29 in respect of HEC, together with procedures in the Operations Manual to provide a JAR-OPS 3 equivalent safety for crew members and casualty - i.e. operational procedures, training & checking, equipment standards and MELs – should be considered as part of any Approval.

14 Recommendations

14.1 An AOC holder with a HEMS Approval should be alleviated from the requirement to conduct the phases of operations shown below under the (full) requirements of JAR-OPS 3.

1. For mountain rescue where environmental conditions of high altitude and high temperature - in excess of ISA – exists at the HEMS Operating Site such that adequate reserves of performance are not available to meet the requirements for PC2, provided AEO HOGE is available, the requirement for PC2 may be disregarded or additional resources, not meeting the requirements of Appendix 1 to JAR-OPS 3.005(d), may be employed.

2. For mountain rescue where the number of requests for HEMS missions is such that the target response time (with the appropriately established resources) is certain to be

[30] Exceptional in this context is considered to indicate demand that exceeds the capability of the appropriately specified-equipped-and-crewed resources provided in accordance with the regulations and operational assessment.

[31] Explanation of both the terms PCDS and Fixed Line Flyaway can be found in the guidance of AC 29-2C MG 12.

exceeded, additional resources, not meeting the requirements of Appendix 1 to JAR-OPS 3.005(d), may be employed.

14.2 The alleviation of 1 or 2 above should be permitted to an AOC holder only in compliance with a risk assessed contingency plan submitted to, and accepted by, the Authority[32]. Reversion to Standard Operations should occur as soon as the period of exceptional conditions no longer exists.

14.3 The following phases of operation should not be regarded as being operations in Commercial Air Transport and therefore should not be required to be conducted under the requirements of JAR-OPS 3.

1. For mountain rescue involving more than one helicopter, the one which, as part of its mission tasking, is performing the act of inserting the mountain specialist(s), is not considered to be operating in Commercial Air Transport.

2. For mountain rescue a helicopter using a Personal Carrying Device System (PCDS) in a Fixed Line Flyaway - i.e. a rope attached to the helicopter and colloquially called ‘short haul’ or ‘long haul’ - is not considered to be operating in Commercial Air Transport.

[32] The acceptance of a contingency plan should be dependent upon the establishment of appropriate resources to meet the ‘normal’ operational requirement (see section 10.2 above).

ATTACHMENT A

	EC 135 T2	EC 145	A 109 E	A 109 S
Empty weight	1800 kg	1900 kg	1800 kg	1910 kg
Fuel capacity	534 kg	692 kg	476 kg	476 kg
Fuel consumption	210 kg/h	260 kg/h	240 kg/h	240 kg/h
Pilot + HCM	85 kg per person= 170 kg	85 kg per person=170 kg	85 kg per person=170 kg	85 kg per person=170 kg
1 paramedic	85 kg	85 kg	85 kg	85 kg
1 injured	98 kg	98 kg	98 kg	98 kg
Medical equipment	127 kg	127 kg	127 kg	127 kg
Fuel needed	45 minutes = 157.5 kg	45 minutes= 195 kg	45 minutes= 180 kg	45 minutes= 180 kg
Contingency fuel	10% =15.75 kg	10% =19.5 kg	10% = 18 kg	10% = 18 kg
Final reserve fuel	20 minutes = 70 kg	20 minutes = 87 kg	20 minutes = 80 kg	20 minutes = 80 kg
Total weight	2523.25 kg	2681.5 kg	2558 kg	2668 kg

	AS 355 N	MD 902	AS 365N
Empty weight	1500 kg	1542 kg	2500 kg
Fuel capacity	576 kg	452 kg	892 kg
Fuel consumption	165 kg/h	250 kg/h	280 kg/h
Pilot + HCM	85 kg per person=170 kg	85 kg per person=170 kg	85 kg per person=170 kg
1 paramedic	85 kg	85 kg	85 kg
1 injured	98 kg	98 kg	98 kg
Medical equipment	127 kg	127 kg	127 kg
Fuel needed	45 minutes=124 kg	45 minutes= 187 kg	45 minutes= 210 kg
Contingency fuel	10% =12.4	10% = 19 kg	10% = 21 kg
Final reserve fuel	20 minutes = 55 kg	20 minutes = 83 kg	20 minutes = 93.5 kg
Total weight	2171.5 kg	2311 kg = 5084 lbs	3304.5 kg

ATTACHMENT A

	AS 365N2	AS 365N3	AW139
Empty weight	2600 kg	2600 kg	4220 kg
Fuel capacity	915 kg	908 kg	1588 kg
Fuel consumption	275 kg/hr	300 kg/h	400 kg/h
Pilot + HCM	85 kg per person=170 kg	85 kg per person= 170 kg	85 kg per person=170 kg
1 paramedic	85 kg	85 kg	85 kg
1 injured	98 kg	98 kg	98 kg
Medical equipment	127 kg	127 kg	127 kg
Fuel needed	45 minutes= 206 kg	45 minutes = 225 kg	45 minutes= 300 kg
Contingency fuel	10% = 21 kg	10% = 22.5kg	10% = 30 kg
Final reserve fuel	20 minutes = 92 kg	20 minutes =100 kg	20 minutes = 135 kg
Total weight	3399 kg	3477 kg	5165 kg

ATTACHMENT A

EC 135 T2 (Operational Mass = 2524 kg)				
	Climb 150ft/min	**En Route Climb 50ft/min**	**AEO HOGE**	**Cat A Helipad**
5000 ft, 5°	2835 kg	2835 kg	2835 kg	2660 kg
5000 ft,10°	2835 kg	2835 kg	2835 kg	2620 kg
5000 ft, 15 °	2835 kg	2835 kg	2835 kg	2580 kg
5000 ft, 20°	2835 kg	2835 kg	2835 kg	2530 kg
6000 ft, 5°	2835 kg	2835 kg	2835 kg	2560 kg
6000 ft,10°	2835 kg	2835 kg	2835 kg	2520 kg
6000 ft, 15 °	2835 kg	2835 kg	2835 kg	2475 kg
6000 ft, 20°	2835 kg	2835 kg	2730 kg	2440 kg
7000 ft, 5°	2835 kg	2835 kg	2835 kg	2460 kg
7000 ft,10°	2835 kg	2835 kg	2825 kg	2420 kg
7000 ft, 15 °	2835 kg	2835 kg	2730 kg	2380 kg
7000 ft, 20°	2800 kg	2835 kg	2620 kg	2340 kg
8000 ft, 5°	2835 kg	2835 kg	2800 kg	2360 kg
8000 ft,10°	2835 kg	2835 kg	2710 kg	2320 kg
8000 ft, 15 °	2835 kg	2835 kg	2620 kg	2280 kg
8000 ft, 20°	2700 kg	2800 kg	2520 kg	2240 kg

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

EC 145 (Operational Mass = 2682 kg)				
	Climb 150ft/min	En Route Climb 50ft/min	AEO HOGE	Cat A Helipad
5000 ft, 5°	3585 kg	3585 kg	3465 kg	3000 kg
5000 ft,10°	3585 kg	3585 kg	3465 kg	2950 kg
5000 ft, 15 °	3585 kg	3585 kg	3465 kg	2900 kg
5000 ft, 20°	3585 kg	3585 kg	3460 kg	2850 kg
6000 ft, 5°	3585 kg	3585 kg	3465 kg	2900 kg
6000 ft,10°	3585 kg	3585 kg	3465 kg	2840 kg
6000 ft, 15 °	3560 kg	3585 kg	3420 kg	2800 kg
6000 ft, 20°	3440 kg	3550 kg	3430 kg	2740 kg
7000 ft, 5°	3585 kg	3585 kg	3430 kg	2770 kg
7000 ft,10°	3460 kg	3585 kg	3420 kg	2720 kg
7000 ft, 15 °	3400 kg	3540 kg	3420 kg	2660 kg
7000 ft, 20°	3300 kg	3440 kg	3415 kg	2620 kg
8000 ft, 5°	3400 kg	3540 kg	3400 kg	2650 kg
8000 ft,10°	3310 kg	3460 kg	3400 kg	2600 kg
8000 ft, 15 °	3250 kg	3400 kg	3395 kg	2550 kg
8000 ft, 20°	3150 kg	3260 kg	3390 kg	2500 kg

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

A 109E (Operational Mass = 2558 kg)				
	Climb 150ft/min	**En Route Climb 50ft/min**	**AEO HOGE**	**Cat A Helipad**
5000 ft, 5°	2850 kg	2850 kg	2850 kg	2680 kg
5000 ft,10°	2850 kg	2850 kg	2850 kg	2600 kg
5000 ft, 15 °	2850 kg	2850 kg	2850 kg	2540 kg
5000 ft, 20°	2850 kg	2850 kg	2850 kg	2460 kg
6000 ft, 5°	2850 kg	2850 kg	2850 kg	2560 kg
6000 ft,10°	2850 kg	2850 kg	2850 kg	2500 kg
6000 ft, 15 °	2850 kg	2850 kg	2850 kg	2440 kg
6000 ft, 20°	2850 kg	2850 kg	2850 kg	2360 kg
7000 ft, 5°	2850 kg	2850 kg	2850 kg	2450 kg
7000 ft,10°	2850 kg	2850 kg	2850 kg	2410 kg
7000 ft, 15 °	2760 kg	2810 kg	2850 kg	2380 kg
7000 ft, 20°	2670 kg	2770 kg	2850 kg	2360 kg
8000 ft, 5°	2823 kg	2850 kg	2850 kg	2440 kg
8000 ft,10°	2795 kg	2850 kg	2850 kg	2400 kg
8000 ft, 15 °	2676 kg	2758 kg	2850 kg	2380 kg
8000 ft, 20°	2556 kg	2660 kg	2740 kg	2360 kg

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

A 109S (Operational Mass = 2668 kg)				
	Climb 150ft/min	**En Route Climb 50ft/min**	**AEO HOGE**	**Cat A Helipad**
5000 ft, 5°	3175 kg	3175 kg	3175 kg	3000 kg
5000 ft,10°	3175 kg	3175 kg	3175 kg	2947 kg
5000 ft, 15 °	3175 kg	3175 kg	3175 kg	2888 kg
5000 ft, 20°	3175 kg	3175 kg	3175 kg	2826 kg
6000 ft, 5°	3175 kg	3175 kg	3175 kg	2890 kg
6000 ft,10°	3175 kg	3175 kg	3175 kg	2835 kg
6000 ft, 15 °	3175 kg	3175 kg	3175 kg	2776 kg
6000 ft, 20°	3141 kg	3175 kg	3175 kg	2715 kg
7000 ft, 5°	3175 kg	3175 kg	3175 kg	2780 kg
7000 ft,10°	3175 kg	3175 kg	3175 kg	2727 kg
7000 ft, 15 °	3095 kg	3174 kg	3175 kg	2682 kg
7000 ft, 20°	3015 kg	3093 kg	3175 kg	2609 kg
8000 ft, 5°	3122 kg	3162 kg	3175 kg	2674 kg
8000 ft,10°	3072 kg	3149 kg	3175 kg	2621 kg
8000 ft, 15 °	2974 kg	3054 kg	3175 kg	2564 kg
8000 ft, 20°	2877 kg	2958 kg	3127 kg	2504 kg

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

AS 355 N (Operational Mass = 2172 kg)				
	Climb 150ft/min	En Route Climb 50ft/min	AEO HOGE	Cat A Helipad
5000 ft, 5°	2600 kg	2600 kg	2520 kg	2330 kg
5000 ft,10°	2550 kg	2600 kg	2510 kg	2320 kg
5000 ft, 15 °	2500 kg	2550 kg	2480 kg	2260 kg
5000 ft, 20°	2450 kg	2500 kg	2470 kg	2200 kg
6000 ft, 5°	2500 kg	2600 kg	2480 kg	2270 kg
6000 ft,10°	2450 kg	2530 kg	2470 kg	2220 kg
6000 ft, 15 °	2400 kg	2450 kg	2450 kg	2180 kg
6000 ft, 20°	2350 kg	2400 kg	2430 kg	2115 kg
7000 ft, 5°	2380 kg	2400 kg	2440 kg	2240 kg
7000 ft,10°	2330 kg	2380 kg	2425 kg	2130 kg
7000 ft, 15 °	2300 kg	2350 kg	2410 kg	2080 kg
7000 ft, 20°	2250 kg	2280 kg	2380 kg	2030 kg
8000 ft, 5°	2320 kg	2400 kg	2400 kg	2100 kg
8000 ft,10°	2280 kg	2300 kg	2360 kg	2050 kg
8000 ft, 15 °	2180 kg	2250 kg	2340 kg	2000 kg
8000 ft, 20°	1980 kg	2200 kg	2280 kg	1950 kg

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

MD 902 (PW 207E Operational Mass = 5084 lbs)				
	Climb 150ft/min	**En Route Climb 50ft/min**	**AEO HOGE**	**Cat A Helipad**
5000 ft, 5°	6250 lb	6250 lb	6250 lb	5760 lb
5000 ft,10°	6135 lb	6250 lb	6250 lb	5640 lb
5000 ft, 15 °	6005 lb	6220 lb	6250 lb	5510 lb
5000 ft, 20°	5820 lb	6035 lb	6250 lb	5370 lb
6000 ft, 5°	6075 lb	6250 lb	6250 lb	5550 lb
6000 ft,10°	6020 lb	6235 lb	6250 lb	5450 lb
6000 ft, 15 °	5845 lb	6060 lb	6250 lb	5320 lb
6000 ft, 20°	5725 lb	5950 lb	6250 lb	5180 lb
7000 ft, 5°	5950 lb	6170 lb	6250 lb	5330 lb
7000 ft,10°	5830 lb	6050 lb	6250 lb	5270 lb
7000 ft, 15 °	5675 lb	5900 lb	6250 lb	5240 lb
7000 ft, 20°	5490 lb	5715 lb	6250 lb	5180 lb
8000 ft, 5°	5760 lb	5970 lb	6250 lb	
8000 ft,10°	5675 lb	5900 lb	6250 lb	
8000 ft, 15 °	5540 lb	5660 lb	6225 lb	
8000 ft, 20°	5335 lb	5550 lb	6050 lb	

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

AS 365N (Operational Mass = 3305 kg)				
	Climb 150ft/min	**En Route Climb 50ft/min**	**AEO HOGE**	**Cat A Helipad**
5000 ft, 5°	3800 kg		3680 kg	2900 kg
5000 ft,10°	3740 kg		3600 kg	2850 kg
5000 ft, 15 °	3660 kg		3520 kg	2780 kg
5000 ft, 20°	3600 kg		3440 kg	2740 kg
6000 ft, 5°	3660 kg		3560 kg	2790 kg
6000 ft,10°	3600 kg		3470 kg	2720 kg
6000 ft, 15 °	3540 kg		3400 kg	2680 kg
6000 ft, 20°	3460 kg		3320 kg	2620 kg
7000 ft, 5°	3540 kg		3420 kg	2680 kg
7000 ft,10°	3480 kg		3340 kg	2640 kg
7000 ft, 15 °	3400 kg		3270 kg	2580 kg
7000 ft, 20°	3320 kg		3190 kg	2540 kg
8000 ft, 5°	3400 kg		3290 kg	2580 kg
8000 ft,10°	3340 kg		3220 kg	2540 kg
8000 ft, 15 °	3260 kg		3140 kg	2480 kg
8000 ft, 20°	3200 kg		3070 kg	2440 kg

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

AS 365N2 (Operational Mass = 3399 kg)				
	Climb 150ft/min	**En Route Climb 50ft/min**	**AEO HOGE**	**Cat A Helipad**
5000 ft, 5°	3950 kg	4150 kg	4100 kg	3020 kg
5000 ft,10°	3900 kg	4050 kg	4010 kg	2960 kg
5000 ft, 15 °	3800 kg	3950 kg	3950 kg	2900 kg
5000 ft, 20°	3700 kg	3900 kg	3850 kg	2850 kg
6000 ft, 5°	3850 kg	3950 kg	3950 kg	2890 kg
6000 ft,10°	3750 kg	3900 kg	3860 kg	2850 kg
6000 ft, 15 °	3700 kg	3850 kg	3800 kg	2800 kg
6000 ft, 20°	3600 kg	3750 kg	3700 kg	2750 kg
7000 ft, 5°	3700 kg	3850 kg	3790 kg	2790 kg
7000 ft,10°	3600 kg	3750 kg	3710 kg	2740 kg
7000 ft, 15 °	3550 kg	3700 kg	3650 kg	2690 kg
7000 ft, 20°	3450 kg	3600 kg	3580 kg	2650 kg
8000 ft, 5°	3500 kg	3650 kg	3650 kg	2680 kg
8000 ft,10°	3450 kg	3600 kg	3580 kg	2630 kg
8000 ft, 15 °	3400 kg	3500 kg	3500 kg	2590 kg
8000 ft, 20°	3350 kg	3450 kg	3430 kg	2540 kg

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

AS 365N3 (Operational Mass = 3477)				
	Climb 150ft/min	**En Route Climb 50ft/min**	**AEO HOGE (MCP)**	**Cat A Helipad**
5000 ft, 5°	4290 kg	4450 kg	3910 kg	3550 kg
5000 ft,10°	4190 kg	4350 kg	3890 kg	3480 kg
5000 ft, 15 °	4120 kg	4250 kg	3865 kg	3420 kg
5000 ft, 20°	4030 kg	4150 kg	3840 kg	3350 kg
6000 ft, 5°	4140 kg	4300 kg	3870 kg	3420 kg
6000 ft,10°	4040 kg	4200 kg	3840 kg	3350 kg
6000 ft, 15 °	3960 kg	4100 kg	3805 kg	3280 kg
6000 ft, 20°	3880 kg	4000 kg	3770 kg	3220 kg
7000 ft, 5°	3980 kg	4100 kg	3820 kg	3280 kg
7000 ft,10°	3880 kg	4000 kg	3800 kg	3220 kg
7000 ft, 15 °	3810 kg	3900 kg	3710 kg	3150 kg
7000 ft, 20°	3740 kg	3800 kg	3620 kg	3100 kg
8000 ft, 5°	3820 kg	3950 kg	3740 kg	3150 kg
8000 ft,10°	3740 kg	3850 kg	3660kg	3100 kg
8000 ft, 15 °	3660 kg	3750 kg	3570 kg	3050 kg
8000 ft, 20°	3580 kg	3650 kg	3480 kg	2980 kg

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

AW139 (Operational Mass = 5165 kg)				
	Climb 150ft/min	**En Route Climb 50ft/min**	**AEO HOGE (MCP)**	**Cat A Helipad**
5000 ft, 5°	6400 kg	6400 kg	6400 kg	6150 kg
5000 ft,10°	6400 kg	6400 kg	6400 kg	6050 kg
5000 ft, 15 °	6400 kg	6400 kg	6400 kg	5950 kg
5000 ft, 20°	6400 kg	6400 kg	6400 kg	5850 kg
6000 ft, 5°	6400 kg	6400 kg	6400 kg	5950 kg
6000 ft,10°	6400 kg	6400 kg	6400 kg	5850 kg
6000 ft, 15 °	6400 kg	6400 kg	6400 kg	5750 kg
6000 ft, 20°	6400 kg	6400 kg	6400 kg	5650 kg
7000 ft, 5°	6400 kg	6400 kg	6400 kg	5750 kg
7000 ft,10°	6400 kg	6400 kg	6400 kg	5650 kg
7000 ft, 15 °	6400 kg	6400 kg	6350 kg	5550 kg
7000 ft, 20°	6400 kg	6400 kg	6250 kg	5450 kg
8000 ft, 5°	6400 kg	6400 kg	6350 kg	5550 kg
8000 ft,10°	6400 kg	6400 kg	6325 kg	5450 kg
8000 ft, 15 °	6400 kg	6400 kg	6300 kg	5350 kg
8000 ft, 20°	6390 kg	6400 kg	6275 kg	5250 kg

Mission is not possible

Extrapolated from Graph

ATTACHMENT A

	AS 350 B2	AS 350 B3	A 119
Empty weight	1220 kg	1232 kg	1541 kg
Fuel capacity	426 kg	426 kg	476 kg
Fuel consumption	147 kg/h	149 kg/h	215 kg/h
2 paramedics	85 kg per person= 170 kg	85 kg per person= 170 kg	85 kg per person= 170 kg
1 pilot	85 kg	85 kg	85 kg
1 injured	98 kg	98 kg	98 kg
Medical equipment	127 kg	127 kg	127 kg
Fuel needed	45 minutes = 110 kg	45 minutes = 112 kg	45 minutes = 161 kg
Contingency fuel	10% = 11 kg	10% = 11 kg	10% = 16 kg
Final reserve fuel	20 minutes = 49 kg	20 minutes = 50 kg	20 minutes = 72 kg
Total weight	1743 kg	1885.5 kg	2270 kg

	AS 350 B2	AS 350 B3	A 119
5000 ft, 5°	2250 kg	2250 kg	2720 kg
5000 ft,10°	2250 kg	2250 kg	2720 kg
5000 ft, 15 °	2250 kg	2250 kg	2720 kg
5000 ft, 20°	2250 kg	2250 kg	2720 kg
6000 ft, 5°	2250 kg	2250 kg	2720 kg
6000 ft,10°	2250 kg	2250 kg	2720 kg
6000 ft, 15 °	2250 kg	2250 kg	2720 kg
6000 ft, 20°	2200 kg	2250 kg	2698 kg
7000 ft, 5°	2250 kg	2250 kg	2720 kg
7000 ft,10°	2200 kg	2250 kg	2720 kg
7000 ft, 15 °	2150 kg	2250 kg	2678 kg
7000 ft, 20°	2100 kg	2250 kg	2595 kg
8000 ft, 5°	2170 kg	2250 kg	2714 kg
8000 ft,10°	2130 kg	2250 kg	2652 kg
8000 ft, 15 °	2090 kg	2250 kg	2573 kg
8000 ft, 20°	2020 kg	2250 kg	2494 kg