OGP

Helicopter guidelines for land seismic & helirig operations

Report No. 420
June 2009

International Association of Oil & Gas Producers

OGP

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Helicopter guidelines for land seismic & helirig operations

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1 General

1.1 Introduction

1.1.1 The Aviation sub-committee of the OGP maintains a comprehensive worldwide database of accident statistics covering all aviation activities performed by the oil & gas industry, with a specific focus on helicopter operations.

1.1.2 Periodic review of this database highlights land seismic and helirig operations as the area that continues to incur the highest accident rates of all of the roles performed in support of oil & gas exploration & production.

1.1.3 The purpose of this document is to promote effective management of helicopter operations in support of land seismic surveys and helirig operations. The information contained within this document should be viewed as recommended best practices and each Party to the operations may identify additional or alternative controls pertinent to the area of operations and the activity being conducted.

1.1.4 These guidelines are to be used in conjunction with OGP report 390, *Aircraft management guidelines* (AMG). For specialist aviation matters the reader is referred to this AMG, while for more general material this document can be used stand alone.

1.1.5 Annex A is copied from the AMG and provides guidance on the general subject of risk management and risk reduction. The Risk Assessment Matrix (RAM) is defined in this annex, which will be referenced throughout this document.

1.2 Guidelines for use

1.2.1 This document is for guidance only and interpretation of the material provided in this document may require the services of an Aviation Advisor. (Ref. AMG Section 4.1)

1.2.2 Throughout this document, three Parties will be assumed to be involved in the operations: the Company, *ie* the E&P company that commissions the seismic survey, the Seismic Contractor, *ie* the seismic contractor that executes the survey, and the Helicopter Provider, *ie* the company that provides the helicopter and related personnel under a direct contract with Company or as a subcontractor to the Seismic Contractor.

1.2.3 Specific regions, operating roles or special project circumstances may dictate additional safety requirements. These additional requirements should be identified and implemented by senior, qualified staff of the Parties to the operations, in particular the Aviation Advisors.

1.3 Aircraft operation

1.3.1 All aircraft operations are to be conducted in strict compliance with all applicable regulations and legislation.

1.3.2 No guidelines or requirements specified in this document are to be construed as authority to operate aircraft or conduct operations other than in strict compliance with the regulations of the country in which an aircraft is registered or operated.

1.3.3 When the local Civil Aviation Authority (CAA) or either one of the Parties has established more stringent requirements, those will take precedence, provided the latter are not in conflict with applicable regulations

2 Health, safety & environmental management systems (HSE-MS)

2.1 Introduction

2.1.1 OGP (then E&P Forum) adopted HSE-MS as its recommended practice publishing Report 210 *Guidelines for the development and application of HSE-MS* in July 1994. For geophysical operations specifics were developed in OGP Report 317, *HSE aspects in a contracting environment for geophysical operations, Schedules and Plans*, May 2001.

In view of the extensive regulation applicable and elaborate safety systems already in place in aviation, OGP did not extend the requirement for HSE-MS to aviation matters in its earlier Report 239, *Aircraft Management Guide* (AMG) of March 1998. However, the current AMG (OGP Report 390) does require aircraft operators to have safety management systems and safety cases/safety expositions in place, for contracts of a duration of more than one year or involving more than 50 flying hours per month (ref. OGP Report 390 Section 3 and Appendix 4).

The minimum required for any operation is a documented risk assessment (as per Appendix 2 of the AMG) and an "operation specific safety exposition".

In all, HSE-MS is now being introduced in OGP related aviation industry, but is still in an early development stage. It is not within the remit of this document to elaborate on the subject matter and the user is referred to the other documents mentioned above, while it is expected that more will be developed in due time.

2.2 Recommended minimum requirement for HSE-MS

2.2.1 As explained above, the introduction of formal HSE-MS in aviation matters is still in a development stage. The recommended minimum elements to be in place are:

1. Company and seismic contractor to have documented systems and plans in place, compliant with OGP report № 317, *HSE aspects in a contracting environment for geophysical operations*, May 2001 (referred to as "OGP Report 317" in this document).
2. A Crew HSE plan and a Project HSE Plan (as per OGP Report 317) to cover all aspects of helicopter support to the operations, with the exception of specialist aviation matters. In particular it should contain written and procedures agreed by the three Parties, for HSE critical parts of the operations such as:
    a. Flight planning and flight authorisation, changes in flight plans.
    b. Passenger transport.
    c. Cargo transport, loading, external load operations.
    d. Refueling operations.
3. The Project HSE plan can be a document jointly developed and owned by the three Parties. An alternative is that the Project HSE Plan is owned by the Seismic Contractor and supplemented by interface documentation, addressing:
    a. Gaps, contradictions or differences between the three parties systems, *eg*:
    b. Standards applicable, which one prevails.
    c. Any activities where more than one Party has to play a role *eg*:
        i. Flight planning.
        ii. Emergency response.
        iii. Provision of fuel, PPE, equipment, training etc.
        iv. Use of equipment for specific tasks, *eg* carrousels, long line.
        v. Documented inspection and maintenance schedules of slings, cargo hooks, nets and any device involved in lifting of external loads.
    d. The recommendations of the acceptance audit of the Helicopter Provider carried out by either the Company or the Seismic Contractor.

e. The above must include descriptions, authorities, roles and responsibilities of each Parties' organisation, the interrelationships and lines of command during the operation. In particular, this must address the roles and responsibilities for the activities listed under c) i through v above.

4. All aviation and related aspects of the operation to be subject to a formal process of risk management, *ie* identification, assessment and implementing controls to mitigate and minimise the risks to ALARP (see 2.3 below).
5. Agreed processes to be followed by all Parties with respect to:
   i. Meeting schedule and communications.
   ii. Inspections and supervision.
   iii. Incident reporting and investigation.
   iv. Change management.
   v. Communication with third parties.

2.3 Risk Assessment

2.3.1 A formal Risk Assessment process must be applied during all stages of the operation, which can be described as a number of phases with increasing levels of detail and confidence:

1. Before the tender process is initiated for a project, Company should conduct an initial risk assessment of the project, addressing at least the highest risks present in the operation ("High" on the risk matrix as described in Annex A). It is recommended that Company makes this risk assessment available to the companies invited to bid, together with its minimum expectations in terms of risk controls to be applied during the operations.
2. The Seismic Contractor and Helicopter Provider should perform the same high level risk assessment, before submitting their bids. It is recommended they submit their risk assessment(s) at bidding stage, further supporting the risk controls proposed in their bid(s).
3. Company to evaluate the risk assessments provided by the bidders, to assess the risk control measures proposed and to take this information into account in its selection of the Seismic Contractor and Helicopter Provider for the project.
4. After contract award, the Parties should jointly develop and review a full risk assessment as part of the process of developing the Project HSE plan before the start of the operations.
5. During the operations, senior staff, including the Aviation Advisors, should monitor the operations and the continued validity of the risk assessments and ensure new risks not identified in earlier stages are recognized and addressed.

2.3.2 Annex A provides further guidance on the process of risk management.

2.3.3 Annex G provides a generic hazard register. The register presents an inventory of known hazards in land helicopter supported geophysical operations. It also incorporates suggested controls that may be used to reduce the risks presented by these hazards. The inventory captures industry experience on causes of accidents in the past and should be consulted when compiling the formal Hazard Register for the HSE Management System (HSE-MS) of an operation with helicopters.

3 Personnel qualifications, training and staffing levels

3.1 Flight crew qualifications and experience

3.1.1 Flight crews and Engineers must meet qualification and experience requirements as defined in Appendix 5 of the AMG.

3.1.2 For seismic external load operations, it is recommended that additional experience requirements are stipulated for Flight crews as follows:

1. External Load Experience 300 hrs
2. Ext. Loads Last 90 Days 3 hrs†

† Or a long line/external load base check with an approved Check Captain within last 90 days.

3.1.3 For remote locations, consideration should be given to require higher experience and staffing levels for Engineers than described in this guideline, depending on the level and nature of maintenance expected to be carried out on site and the level of external support anticipated. In particular, the amount of maintenance expected to be carried out at night should be taken into account.

3.2 Internal & refresher training by Helicopter Provider – Flight crew

3.2.1 Flight crew, technical and support crew training and experience requirements are documented in AMG Section 8.

3.2.2 Flight crew will further complete an internal company training programme as outlined in the Helicopter Provider's training manual. This internal company training programme will consist of ground instructions and flight instructions.

3.2.3 Where available for the type of aircraft, the Helicopter Provider should establish a simulator training programme, using approved Synthetic Training Devices for all Flight crew at a preferred frequency of 12 months and not less than once per 24 months. Requirements are detailed in AMG Section 8.1.2. Given the prevalence of short term support contracts and recognising the high risk nature of these operations, the need for simulator training should not be linked to the contract length, as it is in AMG Section 8.1.2, but should be required of any Helicopter Provider offering to provide support to land seismic and helirig operations.

3.2.4 Level C or Level D Flight Simulators are preferred. Where a Flight Simulator is not available for the helicopter type, the use of Flight Training Devices (FTDs) during training is strongly encouraged. Details of FTD applicability can be found in the AMG Section 8.1.2.

3.2.5 While it is recognised that the use of simulators allows practice in handling emergencies that cannot be practiced in the air, the emphasis of this training should also be on the development of Crew Resource Management (CRM) for multi-crew aircraft or Aeronautical Decision Making (ADM) for single piloted aircraft, including practice of CRM/ADM principles. When appropriate, this should be in the form of Line Oriented Flight Training (LOFT), the exercises for which should be developed between the Helicopter Provider and the simulator operators to provide "real time" exercises using simulated local operational, weather and environmental conditions.

3.2.6 Flight crew recurrent training and flight checks will be conducted as per AMG, Section 8.1.3. Annual flight training should be a minimum of 5 hours, which can include flight simulators/FTD, role training and flight checks.

3.2.7 It is recommended that recurrent training include at least the following:

1. Ground:
    a. Aircraft Systems.
    b. Applicable CAA (Civil Aviation Authority) regulations and changes.
    c. CRM/ADM (Crew Resource Management/Aeronautical Decision Making).
    d. First Aid (not to exceed 3 years).
    e. Fire fighting (not to exceed 3 years).
    f. Aircraft emergency procedures.
    g. Appropriate Geographical Location, *ie* jungle, mountain
    h. Weather/meteorological.
    i. Refueling.
    j. Applicable emergency survival equipment carried on the aircraft.
    k. HAZMAT.
    l. MEL (Minimal Equipment List) and/or MDS (Minimal Departure Standards)
    m. Weight and balance.
    n. SMS training.
    o. Company SOPs
2. Flight:
    a. Aircraft Emergency Procedures to include:
        i. Inadvertent IFR including recovery from unusual attitude and a competency check.
        ii. Role and Environment Specific, *eg* brownout and whiteout
    b. Standard Operating Procedures.
    c. Role Specific, *ie* vertical reference/long-line.
    d. Confined/Restricted Area Operations.
    e. Environment Specific where applicable, *ie* high altitude, jungle, mountain.

3.3 Internal & refresher training by Helicopter Provider – Flight engineer and other regular on board crew.

3.3.1 Flight engineers should receive annual training as per Helicopter Provider training manual to include at least:

1. Loading.
2. Unloading.
3. Passenger Management.
4. First Aid and Fire Fighting (Not to exceed 3 years between training).
5. Crew Resource Management.
6. Refueling.
7. HAZMAT.
8. SMS training.

3.4 Internal & refresher training by Helicopter Provider – Mechanics/Aircraft maintenance engineers

3.4.1 At minimal engineers will attend annual recurrent training programme as established by the Helicopter Provider. Recurrent programme will included at a minimal the following:

1. Aircraft Type.
2. Regulations and Change in Regulations.
3. Equipment fit, appropriate modifications and support equipment/lifting equipment.
4. Human Factors (not to exceed 2 years between training)
5. First aid and fire fighting (not to exceed 3 years between training).
6. SMS training.
7. Company Maintenance Manual

3.5 Internal & refresher training by Helicopter Provider – Ground crew

3.5.1 For the purpose of this section ground crew is defined as: helideck/helipad personnel, load master, signaler/marshaller, refueler, hook-up person, staging and line hands.

3.5.2 This ground personnel may be provided by either the Helicopter Provider or the Seismic Contractor. Their training will need to comply with the minimum standards of both companies.

3.5.3 Ground support crews should be trained as per Helicopter Provider training manual and have documented training records to include an initial course and annual refresher courses which should include the relevant elements from the following:

1. Passenger and landing zone management.
2. Load preparation and handling.
3. Passenger and cargo manifests.
4. Hazardous materials.
5. Operation of doors, cargo hatches, cargo securing, *etc*.
6. Helipad and drop zones housekeeping.
7. Marshalling and other communications with flight crew.
8. Training of standard phraseology for radio communications.
9. Managing static electricity.
10. Correct hook-up procedures and use of external cargo equipment.
11. Aviation hazards, *eg* electrical lines, trees, foreign obstacles, *etc*.
12. Requirement for control under the aircraft:
    a. Actions in the event of an aircraft emergency.
    b. Procedures for positioning a load suspended on a long line.
    c. Use absolute minimum number of people.
13. Required personnel protective equipment and proper use.
14. First aid and fire fighting (not to exceed 3 years between training).
15. Refueling Procedures to include procedures for hot refueling.

16. SMS training.

3.6 Internal & refresher training by Helicopter Provider – Radio operators

3.6.1 Radio operators should be trained as per AMG Section 8.2.5 and:

1. Licensed where applicable.
2. Fluent in the appropriate language(s).
3. Experience of aircraft operations, procedures and aviation radio terminology.
4. Formal training in handling and recording radio transmissions.
5. Procedures and actions required for normal and emergency operations.
6. Flight following, flight watch.
7. Knowledge of weather, able to receive and retransmit weather reports and forecasts.

3.7 Internal & refresher training by Helicopter Provider – Other personnel and visitors on the seismic operations.

3.7.1 All personnel involved in the seismic operation as well as all visitors should receive a basic helicopter safety briefing as part of their arrival induction briefing, regardless of whether they are expected to become passengers or not. This briefing should include as a minimum:

1. Information about the helicopter and where it is used.
2. All helicopter landing, parking and refueling areas are "Restricted" areas.
3. Risks related to approaching a helicopter, especially the rotors running case.

3.7.2 All personnel expected to be passenger at some stage of the operation should receive additional briefing as per AMG Section 9.5, including at least:

1. Approaching, embarking and disembarking aircraft.
2. Additional precautions for irregular terrain.
3. Observe and follow instructions flight crew and ground crew.
4. Stowing securing equipment.
5. Hot loading (rotors-turning) procedures.
6. Use of seat belts.
7. Emergency doors.
8. Emergency/Survival Equipment.
9. Prohibited goods.

3.7.3 Preference is for providing passenger briefing immediately prior to the flight. This may be waived for personnel that regularly joins helicopter flights, but in that case refresher briefing should be given once a month.

3.7.4 A template for passenger briefing is provided in Annex F.

3.8 Minimum staffing – flight crew

3.8.1 Number of Flight crew present and available on the operations should allow performance of the required operations without exceeding the maximum flying periods stipulated for the Flight Crews in section 9.2.

3.8.2 Single/two pilot factors.

Accident studies have shown that over 20% of seismic helicopter accidents could be prevented by having two pilots and in many other high workload environments of aviation, two pilot operations are accepted best practice. Two pilots should therefore be the preferred option. However, due to considerations of payload, aircraft performance and pilot resources, the use of a single pilot may be acceptable for certain operations, subject to a satisfactory risk assessment. The minimum factors to be taken into account when assessing the risk of using a single pilot include the following:

1. Helicopter type
   a. Certified for single pilot in country of use.
   b. Equipped for single pilot long line and vertical ops with remote gauges, load meters, master caution, mirrors, bubble windows or floor windows.
   c. Remote flight following (satellite systems preferred)
2. Pilot training
   a. Simulator or FTD training at a preferred frequency 12 months and not more than 24 months, when available for the aircraft type, completed as a single pilot, covering all emergencies for the type being flown, including tail rotor failure, engine failure, governor failures etc.
   b. Annual operational long line/ vertical reference training completed.
   c. Annual line check completed in addition to annual check flight.
   d. Airborne Decision Making course completed within 2 years by qualified provider or facilitator.
   e. Annual Inadvertent IMC training and competency test completed.
3. Flight environment
   a. Planned and conducted in day, VFR only.
   b. Uncongested airspace – likelihood of air collision minimal, including other aircraft on same task. Radio procedures in place for airspace separation.
   c. Navigation complexity versus navigation equipment in use.
   d. Types and size of landing areas suitable for single pilot crew. No additional lookout required.
   e. Type of flight. Long transits, particularly those including a point of no return and/or in remote hostile areas (*eg* arctic) should have 2 pilots.
4. Fatigue Management
   a. Single pilot flight duty hours applied without extension (See section 9.2)
   b. Satisfactory environmental factors (extreme heat or cold effectively mitigated).

Failure to meet all of the factors listed above should result in a two pilot crew or additional mitigation factors being applied.

3.9 Minimum staffing – Engineers

3.9.1 A minimum manning policy for maintenance staff shall be established during the planning phase and a minimum of one qualified engineer should be present on the operation. One qualified engineer per aircraft is recommended.

3.9.2 For remote operations further engineering staff to be considered.

3.10 Minimum staffing – Ground personnel

3.10.1 Sufficient for efficient operations, allowing Flight crew and engineers to concentrate on their prime duties.

3.11 Minimum staffing – Radio operator

3.11.1 One radio operator to be full time available for flight following duties any time the aircraft are scheduled for operation.

4 Personnel protective equipment

4.1 Recommended PPE for flight crews:

4.1.1 Flying helmets manufactured to appropriate industry standards should be worn by pilots for all external load operations and the company should have a fitting procedure to ensure optimum protection.

4.1.2 Further PPE recommended for flight crews:

1. Fire retardant coveralls.
2. Suitable footwear.
3. Sunglasses.
4. Climate related clothing.
5. Sun cream, barrier cream, insect repellant, *etc.*

4.2 Recommended PPE for engineers and ground crews:

4.2.1 PPE recommended for Engineers and Ground Crews, as appropriate for their role:

1. Fire retardant coveralls.
2. Suitable footwear, safety boots for engineers and other personnel handling heavy loads.
3. Hard hats with chinstraps attached to the helmet itself.
4. Goggles.
5. Hearing protection.
6. Gloves, chemical grade for refueling personnel.
7. Distinctive colored vests should be worn by ground personnel for ease of recognition to designate specific tasks being performed.
8. Climate related clothing.
9. Sun cream, barrier cream, insect repellant, *etc.*

5 Helicopter performance and role equipment standards

5.1 General

5.1.1 Seismic operations generally demand an aircraft to be operated in the low-level, low-speed regime. Furthermore, helicopter assistance is only mobilised in terrain and conditions where cheaper ground/water transport is unable to provide the logistics needed, *ie* over terrain that will be classified as "Hostile" for part of the area. From this, it will be evident that high demands will be put on helicopter performance during seismic operations.

5.1.2 Careful consideration of the aircraft type and configuration should be made during the initial planning and tendering phase of the seismic operation with appropriate input from qualified aviation expertise.

5.1.3 In determining the type of aircraft, its configuration and the operational parameters to be specified for a specific project, the user should first determine the type of operating environment using the following definitions of Hostile and Non-Hostile Environment:

1. Hostile Environment: An environment in which a successful emergency landing cannot be assured, or the occupants of the aircraft can not be adequately protected from the elements, or search and rescue response/capability cannot be provided consistent with the anticipated exposure.
2. Non-Hostile Environment: An environment in which a successful emergency landing can be reasonably assured, and the occupants of the aircraft can be adequately protected from the elements, and search and rescue response/capability can be provided consistent with the anticipated exposure.

5.1.4 The most significant choice to be made is between Single and Twin engine aircraft. The general guidance on this is given below, but a final decision should be based on the risk assessment described in Annex A.

1. A twin engine aircraft able to sustain one engine inoperative (OEI) flight, after jettisoning any external load, is recommended for seismic operations in a predominantly Hostile Environment.
2. Single engine aircraft that have been approved by a qualified aviation advisor may be used in a Non-Hostile Environment, subject to further risk assessment.
3. Where flying over built up or congested areas can not be avoided, twin engined aircraft should be considered, capable of meeting the requirement stated in point 5.2.1 below.

5.1.5 Aircraft to be approved and registered with CAA.

5.1.6 For passenger transport, Performance Class 1 helicopters should be given preference. When not available, Performance Class 2 should be the next selected and if neither available Performance class 3 helicopters can be used subject to risk analysis. Ref. AMG Section 5.1.4 and 5.2 for additional guidance.

5.1.7 External load operations should only be conducted with a helicopter for which an approved Supplement to the aircraft Flight Manual for external load operations exists and which is in compliance with this Supplement.

5.1.8 Helicopters should have engine trend analysis recorded and reviewed on a daily basis by technical staff.

5.1.9 See section 9.2 for detailed performance planning requirements.

5.2 Multi-engine helicopters

5.2.1 In congested, built up areas, the helicopter's One Engine Inoperative (OEI) performance should be such that the Hover Out-of-Ground-Effect (HOGE) is achievable without an external load attached.

5.2.2 The maximum load permissible should be calculated by referencing HOGE performance charts for that density altitude. The aircraft should still be capable of OEI flyaway performance after jettisoning the external load.

5.2.3 In calculating HOGE or one engine inoperative (OEI), no credit should be allowed for forecasted winds of less than 10 knots and no more than half the forecasted wind thereafter.

5.3 Single-engine helicopters

5.3.1 See 5.1.4.2 and 5.1.6 above.

5.3.2 The maximum load permissible should be calculated by referencing HOGE performance charts for that density altitude. Account should be taken of the additional power required to transition to forward flight over and above that required to hover OGE.

5.4 Helicopter equipment fit

5.4.1 All helicopters involved in seismic operations must meet manufacturer's requirements and must have the following items:

1. Fuel low level warning light.
2. Engine-monitoring device (if available for the aircraft type).
3. Appropriate environmental control, including air conditioning for operations in high ambient temperatures and/or heating for cold ambient temperatures (where air conditioning is not practical, consideration must be given to reducing flight times to mitigate fatigue).
4. Where available for aircraft type, Health and Usage Monitoring System – HUMS (vibration and engine parameters) as detailed in AMG 10.3.1.
5. For passenger operations, upper torso restraints are required for all seats.
6. Survival kit applicable to the environment and climate specific conditions within the operating area and scaled to the expected number of passengers.
7. SARSAT ELT/EPIRB within reach of the pilot. Integrated GPS in any emergency beacon is recommended.
8. Bear paws for work in soft terrain regardless of season.
9. Aviation approved GPS receivers.

5.4.2 Additional requirements for external load operations

All helicopters used for external load operations should have the following items:

1. External mirrors, bubble windows or aircraft designed camera, to enable unobstructed view of the cargo hook area.
2. Operable manual and electrical release (cockpit), and external release (hook).
3. For short line operations, protective assemblies between the skids and fuselage to prevent cable interference are recommended.

4. For external load work involving vertical referencing (long line), bubble windows (or equivalent allowing direct vision to load on long line) are to be provided or doors maybe removed if approved for the aircraft type.
5. Remote torque gauge, remote fire warning and caution lights (long line), within view of the pilot while observing the load, if approved for the aircraft model.
6. Specialised navigation equipment for accurately pinpointing the location of the pickup and drop zones and for accurate flight following.
7. A load meter which allows the pilot to check the weight of the external load.
8. Radio communication fit to meet regulatory and local ATC requirements and enable effective 2 way communication with ground crews and flight following. See Section 6.4.

5.4.3 Requirement for duplicate inspections.

After any disturbance or disassembly of a control system or vital point of an aircraft, most but not all Regulators call for independent inspections to be made and certified by two appropriately qualified persons, before the next flight. Such duplicate inspections are strongly recommended. If the pilots are used as duplicate inspectors, a formal training qualification should be in place with recurrent training and consideration should be given to the pilots rest periods if they are required to assist the maintenance task. Ref. also to AMG 4.5.2.

5.4.4 Aircraft Minimum Equipment List (MEL) or Minimum Departure Standard (MDS).

1. The Helicopter Provider should have a MEL or MDS for the aircraft type. Where a MEL or MDS is not available, full equipment serviceability will be required. Ref. also to AMG 4.5.3.
2. The MEL or MDS may allow repair of certain defects to be deferred, while aircraft operation may be continued. Such Deferred Defects should:
   a. Not affect the airworthiness of the helicopter.
   b. Be entered in the aircraft's technical logbook and deferred defects list.
   c. Be signed off by the Senior Engineer/Technician onsite and Pilot-in-Command.
   d. Be reported to the Party Chief and Company On Site Representative or Aviation Advisor.

5.5 Helicopter role equipment – maintenance and inspection

5.5.1 There must be a formal programme implemented for the maintenance and inspection of slings, cargo hooks, cargo nets and any device involved in lifting of external loads including carrousels and long line tools. Detailed guidance is given in Annex C. Refer also to 2.2.1, point 3.b.iv-v and 3.d.

5.6 Helicopter ground equipment

5.6.1 Ground equipment applicable to the operation and mission (*eg* ground handling equipment, A.P.U., tie downs, compressor washing, *etc*)

6 Base camp ground infrastructure and equipment requirements

6.1 Location

6.1.1 Where possible, the siting of a base camp should allow for the bulk delivery of large quantities of aviation fuel; sites located adjacent to arterial communications such as roads, or rivers navigable by flat-bottomed barges, are ideal.

6.1.2 The alignment of landing strips and aircraft operating areas must take account of the prevailing wind and the need to avoid over-flying populated areas during take-off and approach to landing. Government or mission airstrips can be used to good effect;

6.1.3 Local topography affects the aviation aspects of base camp selection and for this reason the following locations should be avoided:

1. Valley and bowl locations, which present obstacles on take-off and unacceptably steep approaches. Early morning mist is slow to clear from such sites in jungle areas and may, especially in mountainous areas, give rise to excessive turbulence.
2. Un-grassed areas that are likely to give rise to excessive dust during dry periods.
3. Sites close to population centres, which could cause undue nuisance to local population and/or risk exposure.
4. Sites which cannot easily and economically be made secure. The local security situation should be fully assessed. While this aspect affects the entire seismic operation, aircraft and Flight crew are particularly sensitive to threats such as sabotage and hijacking and tampering with fuel supplies.
5. Low lying areas susceptible to flooding which can affect aviation fuel storage, aviation fuel quality control and aircraft maintenance. Mosquito nuisance may affect evening and night maintenance.
6. Power lines and other high obstacles such as towers, are a particular hazard, especially near the heavily utilised base camp helipad. Therefore and depending on the proximity of these cables, the position of the base camp helipad must be considered with regard to approach and departure routes. Where power lines or high obstacles are present in any seismic area the following is recommended:
    a. All power lines and other high obstacles such as towers etc. (or at least those within 500m of any helipad) should be clearly marked on hazards map.
    b. Every pilot joining an operation for the first time should be fully briefed and area airborne familiarisation checked on the position of overhead cables and other hazards, with pilots' topographical maps marked accordingly. All maps should be checked for validity on subsequent periods of duty.
    c. Where appropriate and in particular for power lines/high obstacles close to the base camp, efforts should be made to get these marked (marker balls, flashing lights) by the owner of these installations.

6.2 General layout

6.2.1 A prime requirement is that pedestrian and vehicular traffic should be separated from helicopters when they are parked, being refueled, maneuvered or operated. Helicopter landing, parking and refueling areas should be declared "Restricted Area", with authorized access only. Warning notices, advising personnel not to proceed beyond appropriate points should be prominently displayed and, if necessary, a traffic-flow control system introduced to halt vehicles during helicopter arrivals and departures.

6.2.2 An area adjacent to the Party Chief or flight planner office should be allocated to a logistics office/radio room.

6.2.3 It is strongly recommended that the flight planner's office should be located so as to have a clear view of the helicopter dispatching area.

6.3 Helipads

6.3.1 In areas where land acquisition is difficult or politically sensitive, the take-off space required for both single and twin engine helicopters must, in order to maximize the payload/fuel uplift from the base camp, without prejudicing the protection afforded by such aircraft, be considered. It must be borne in mind that although base camps may be considered as temporary, the helibase will function as the air hub in support of up to 500 personnel working on the seismic lines. In complete contrast to the size restricted line helipads, with their associated risk and which may be used for fewer than 10 helicopter support flights within as many days, a base camp helipad may need to accommodate up to 50 helicopter movements throughout each operational day for several months.

Take-offs and landings at base camps should comply with public transport criteria.

1. All Helicopter Providers involved in the operation must be consulted in the design, location and construction of any new helipads.
2. A procedure for the Chief Pilot (or appointed delegate) to sign of for all new helipads before operational use should be implemented.
3. Landing areas must be kept clean and clear of anything that can be affected by the rotor wash of the aircraft (garbage, plywood, corrugated iron, plastic sheets, etc). and clear of all obstructions to allow for maneuvering of helicopters.
4. Landing areas must be clear of all obstructions to allow for maneuvering of helicopters. All wires, ropes, antennas, etc., are to be well-marked and never erected near the landing area or approaches to the landing area.
5. Keep the approach and departure paths into Helipad clear of people, vehicles and obstacles and allow for possible changes in paths as the wind changes. Wind direction indicators should be set up at all frequently used Helipad.
6. Pilots should be able to approach or depart the Helipad with external loads without flying over people, equipment, vehicles, camp structures or 3rd party buildings.
7. Dust and snow environments must be controlled to avoid white-out/brown-out conditions.
8. Helipad size should be large enough to enable the engineer access to the tail and main rotors with a work stand or ladder on the helipad hard surface.
9. Adjacent helipads should be no closer than one full length of the longest helicopter.

6.3.2 FATO/rejected take off area

1. The safe operation of helicopters to public transport standards requires consideration of aircraft performance during all stages of a flight. To achieve the required level of safety for take-off and landing, extensive clearance and careful preparation of sites may be necessary.
2. For helicopter operations, the requirement is for a sufficient length of level, flat ground clear of all obstructions and capable of bearing the helicopter for a running landing in the event of an engine failure before a designated critical point in the take-off sequence. (This is calculated from the performance section of the

flight manual as a horizontal distance and appropriate to ambient conditions.) The minimum length required for the specific type of helicopter at maximum weight for the ambient conditions can be obtained from the aircraft operator. Whenever two or more helicopter types are operated, the length of the rejected take-off area should be calculated to accommodate the most restrictive type. The minimum width of a helicopter rejected take-off area should be 2.5 times the length overall of the largest helicopter with its rotors turning.

3. To cover the case of an engine failure after the critical point mentioned, when the take-off would be continued on the one remaining engine for a twin engine helicopter, the take-off flight path must be cleared to a gradient in accordance with the performance section of the flight manual. Advice may be obtained from either the aircraft operator or company aviation advisor. A slope of 1:20 for 1200m horizontally may be used but only as a guideline.

6.3.3 Helicopter parking areas and hangarage

1. A designated parking area for each helicopter may be required. The parking area should be flat, with electrical supply for tools and flood lighting available, together with easy access to supply of clean, salt free water. Non-slip metalled or concrete surface maybe an option. Dust control along roads accessing parking area or beside parking area, may be considered when necessary.
2. Depending on the local climate, remoteness and type of on site maintenance work anticipated, the construction of a (temporary) hangar should be considered.

6.3.4 Helipad lighting

1. Adequate lighting should be provided at the helipad and helicopter parking areas to allow inspection, preparation and loading of the helicopter in the hours of darkness. Subject to the security risk assessment for the area, peripheral security lighting should be considered and placed in a way that people approaching the aircraft will be clearly visible from a distance.
2. The provision of helipad aviation lighting will depend on the decision by Company's management on the requirement for a night evacuation capability from the base camp; normal flying operations will invariably take place only by day under Visual Flight Rules (DAY/VFR). It is emphasized that a night capability should never be assumed in the seismic environment.

6.4. Communications and navigation beacons

6.4.1 The minimum requirement is for duplicated equipment to ensure that helicopters, when airborne, are never out of contact with either the base camp or the local Air Traffic Control network. In many areas of the world, where such a network is basic, if it exists at all, the onus will be either of the Parties to provide appropriate coverage.

6.4.2 For logistic and local advisory information VHF (air band) base equipment is appropriate and, provided the area can be covered by line of sight propagation; the alternate set may also be VHF. If, however, continuous cover cannot be guaranteed then a VHF Repeater maybe a viable option, but otherwise long range HF equipment will need to be provided. Satellite voice communication, if provided by the flight tracking system can also serve as alternate communication system. "Dial in" systems, such as mobile telephones, however, are not considered adequate for this purpose.

6.4.3 A designated radio frequency should be assigned to the helicopter and ground crew for flight operations.

6.4.4 In remote areas, a third method of communication needs to be considered for use in the event of an emergency, *eg* satellite telephone, in particular if the other communication systems may not provide contact if the aircraft is on the ground. In this case a "Dial in" system may be acceptable, although preference should be given to systems requiring a minimum of action and know how to be used.

6.4.5 Unless the helicopter(s) is equipped with a GPS receiver or reliable navigation aids are available in the area, a Non Directional Beacon (NDB) tuned to a frequency in the aviation band and approved by the local regulatory authority with a usable range sufficient to cover the operating area, is strongly recommended.

6.5 Accommodation

6.5.1 Operations office

A flight planning/briefing area, with suitable wall space for the display of topographical charts, Notices to airman (NOTAMs), meteorological information and current operational notices is essential. Desk space should be appropriate to the number of aircraft. Shelf space will be required for Operations and Flight Manuals and there should be easy access to the radio room. A quite rest area for Flight crew, with reasonably comfortable seating, should also be provided; when base camps are very temporary this facility may be combined with the operations area.

6.5.2 Maintenance facilities and workshops

Technical support facilities are essential. Maintenance at base camps will normally be restricted to line maintenance with major inspections carried out at the Helicopter Provider's main base. As part of the contract award process the line-support facility requirements are to be detailed. It will, however, be necessary to provide the following as a minimum:-

1. A secure store for aircraft spare parts, complete with rack and bin facilities, appropriate to the numbers of aircraft on site. This may require air-conditioning, depending on which spares and consumables will be stored on site.
2. A secure and fireproof storage for oils, greases and flammable liquids.
3. A well ventilated battery-charging bay; in the unlikely event of both lead-acid and nickel-cadmium batteries being serviced, then two separate areas will be required.
4. An engineers' rest area with comfortable seating and, if overnight accommodation is distant or inconvenient, nearby washing facilities. This could be combined with an area for the completion and storage of technical records and maintenance manuals.

6.5.3 Sleeping Quarters

To comply with recognised Flight Time Limitation maxima and to avoid the hazard represented by short-term fatigue, Flight crew sleeping accommodation must be quiet and comfortable, furnished to a reasonable standard, well ventilated with climate control and with the facility to control levels of light.

Single accommodation must be provided for Flight crews. Where rooms have to be shared it is strongly recommended not to mix seismic and aircraft operator crews.

Engineering personnel will be required to work unusual hours and their accommodation should also be equally and suitably appointed and separate from other groups.

7 Line landing sites and drop zones remote from base camp (staging)

7.1 Points 1 through to 7 presented in 6.3.1 (Base Camp Helipad) equally apply to helipads constructed away from the base camp, but more temporary arrangements will be acceptable for temporary line helipads.

7.2 Unless otherwise defined by risk analysis, a clear area should be established with a minimum size of 50 by 50 meters (165 feet) for the landing/hook-up area when descending below tree top level.

7.3 An example for establishment of a clearing or helipad in overgrown vegetation or tall trees is attached at Annex G.

7.4 Often in densely spaced forests, trees are protected by each other against the wind and tend to lean against each other. After making a clearing in such a forest, trees which have lost such support, fall inward shortly after the clearing is made. This must be taken into account when clearing helipads in virgin jungle and similar forests. Preference is to clear the helipads one or two months ahead to allow the clearing to stabilize.

Personnel should be trained to not dwell near the tree line and shelters, fly camps, *etc* that are often built close to such helipads, must be set inside the tree line.

7.5 It is recommended that line helipads be assigned a number for identification. This number should be displayed by using white painted logs or similar with at least 1 m size so as to be clearly visible from the air. Leading zeros should not be used and underlining should be used to avoid confusion between the numbers 6 and 9.

7.6 Where line helipads need to be used for landing a hard standing area should be provided of a suitable size for the type of helicopter in use. This landing ground should not have a slope of more than 3 degrees. The immediate surroundings of this landing area should be free of slopes or obstacles that would present a risk to the helicopter or personnel approaching the helicopter.

7.7 It may be necessary to build a landing pad using wooden planks. Clear construction criteria should be developed for this by the Helicopter Provider and agreed at the contract planning stage and such wooden landing pads must be subject to regular inspections (monthly for soft wood, three monthly for tropical hardwood).

7.8 Drop Zones (DZ) for long line operations without descending below tree level should:

7.8.1 Have a clear opening of 30m × 30m at tree top level.

7.8.2 Have a clear base area of not less than 5m × 5m, maximum slope 5 degrees and free obstacles and snag hazards. The area should provide safe footing for ground staff working there.

8 Aviation fuel management and fire safety

8.1 Fuel management

Comprehensive guidance on fuel management , compliant with AMG Section 7, is provided as Annex D.

8.2 Fire safety

Comprehensive guidance on fire safety, compliant with the AMG Section 11.7, is provided as Annex E.

9 Flight operations safety

9.1 General

9.1.1 A daily planning meeting must be held to discuss the operations. The pilots should participate at these meetings. It is recommended such meetings are held in the evening, allowing more preparation time for the next day's activities.

9.1.2 A map of the operating area should be maintained up to date, showing:

1. Geography and topography of the area.
2. Infrastructure, roads, airports, *etc*.
3. The seismic programme and all prepared landing sites/helipads.
4. All identified hazards, such as power lines, high towers, *etc*.

This map should be available in the aircraft, radio room and flight planning office. If a flight tracking system is used, the same map should be used as background on the monitor screen.

9.1.3 For longer distance transit, the use of agreed safe flight routes/corridors is strongly recommended. These should avoid built up areas, large bodies of water, high altitude terrain and other identified hazards. In jungle covered areas, it is recommended that safe flight routes follow the main rivers, even if this constitutes an increase in flight distance. Note that adherence to such agreed corridors may eventually reduce search and rescue (SAR) efforts and improve the chances of successful SAR.

9.1.4 For multi destination flights in medium and heavy helicopters, the use of a cabin attendant/load master should be considered to:

1. Operate doors and cargo hatches, avoiding the need for the pilots to do this.
2. Ensure passenger discipline (seat belt, *etc*).
3. Manage internal cargo.

Refer to section 3.2.2. for training requirements for such a cabin attendant.

9.1.5 A documented procedure should be available for flight planning and authorization and changes in flight plans. (Ref 2.2.1.2). As a minimum this procedure should describe:

1. Who has the authority to issue flight plans and/or to modify these.
2. Written format to be used for flight plans, original to be issued to pilot and copy retained by flight planner and copies to radio room and engineer.
3. Flight plans to be discussed with pilot before take off.
4. Pilot will have the ultimate authority in deciding whether to execute a flight as proposed in the plan or not.

9.2 Performance planning

9.2.1 As part of the contract planning, performance calculations are to be completed based on a map analysis of the operational area, using maximum and minimum expected temperatures and altitudes and recorded on the risk assessment at Annex A

9.2.2 Prior to the start of operational flights and each time the operational area changes, an aerial reconnaissance of proposed landing and working sites is to be completed, to validate the performance figures established on the risk assessment and identify additional hazards.

9.2.3 On a daily basis performance calculations (HOGE and OEI as applicable) and loads sheets are to be completed and documented, using actual weights, forecast temperatures and planned operating altitudes. If any individual flights fall outside of those calculations, the performance calculations should be revised.

9.3 Flight and duty times for flight crews

9.3.1 Rest breaks should be of a minimum duration of 30 minutes, under comfortable conditions. Hot refueling does not constitute a rest break for the Flight crew.

9.3.2 A rest period of at least 10 consecutive hours should be made available following each flight period.

9.3.3 A minimum of 24 consecutive hours free of all duty during should be made available any seven consecutive days.

9.3.4 For all operations, a duty day should not exceed 14 hours inclusive of all elements of travel, preparation planning, briefing and safety meeting.

9.3.5 For single pilot operations the following limits must be observed:

1. Three (3) hours maximum flight time between rest breaks.
2. Maximum of 8 hours flight time per day.
3. Maximum of 6 hours external load flight time per day.
4. Maximum of 42 hours flight time in any consecutive 7 days period.
5. Maximum of 100 hours flight time in any consecutive 28 days period.
6. Maximum of 1000 hours in any consecutive 365 days period.
7. A further risk assessment must be conducted to determine a further reduction of maximum flight times in case of high frequency, repetitive external load operations. For further guidance see Annex H.

9.3.6 For two-crew operations the following limits should be observed, provided two qualified pilots share this duty:

1. Five (5) hours maximum flight time between rest breaks.
2. Maximum of 10 hours flight time per day.
3. Maximum of 8 hours external load flight time per day.
4. Maximum of 60 hours flight time for any consecutive 7 days period.
5. Maximum of 120 hours flight time for any consecutive 28 days period
6. Maximum of 1200 hours in any consecutive 365 days period.

9.3.7 In addition to applying the limitations stated above, operators are encouraged to develop detailed fatigue management plans that address the wide variety of fatiguing factors that can be encountered during remote seismic operations. These programmes are gaining more and more acceptance in the aviation industry and further guidance on fatigue management programmes can be found in Annex H.

9.4 Adverse weather

9.4.1 All operations shall be in strict compliance with the regulatory guidance, Appendix 6 of the AMG, the Helicopter Provider and Company's standards for weather, whichever is the most stringent.

9.4.2 Prior to each flight period a reliable weather forecast for the entire operational area covering the period of operation should be obtained. In remote areas, consideration should be given to all surrounding sources such as nearby airports, *etc*. The Seismic Contractor should use its resources (in field personnel) to assist in continually monitoring weather conditions in the area and have a system in place to communicate changes to pilot.

9.4.3 Changing and marginal weather conditions in the low-level flight regime must be taken into consideration in the planning for seismic activities.

9.4.4 When more stringent requirements are not provided, a ceiling of 600 feet and visibility of 3 nautical miles (NM) must be utilized as the minimum weather criteria for helicopter seismic operations.

9.5 Fuel planning

9.5.1 Minimum fuel reserves of 15 minutes airtime shall be maintained at all times. Operating regions with limited suitable landing areas or fuel support will require that higher fuel reserves be taken into account during flight planning. CAA and/or operator minimum fuel standards requiring higher fuel reserves shall be adhered to.

9.6 Flight following

9.6.1 Pilot to report take off with total number of people aboard and fuel endurance and to report just prior to landing.

9.6.2 Positive flight following must be maintained with the helicopter when airborne, either by the ground support crew or designated flight following personnel, with as a minimum a position report every 15 minutes.

Continuous communication between Flight crew and ground radio operator, rather than a formal position report, will be acceptable, provided the procedure is formal, including the obligation of ground operators of keeping up-dated records of aircraft position.

9.6.3 The use of a Satellite/GPS based tracking system for the helicopter for flight following is strongly recommended.

9.6.4 Confirmation that the aircraft is airborne at the first flight of the day and landing confirmed at the end of the day's operations at the helicopter's over night location should be coordinated and recorded in the flight logs.

10 Passenger transport

10.1 Passengers must not be carried in conjunction with external load operations and only essential crew should be carried in the aircraft. Essential crew are defined as pilots, flight engineers, qualified flight navigators and cabin attendants, when required by local regulation or company rules for the carriage of passengers. All essential crew must be qualified and current in accordance with the training requirements detailed in Section 3. Seismic ground crews are not to be considered as essential crew and should be treated as passengers.

10.2 If passengers are carried during seismic operations, the following conditions must apply:

1. Aircraft must be equipped with seats and seat belts. Provision of upper-torso restraints is required.
2. The aircraft operator must be authorized by the regulatory authority to carry passengers.
3. Passengers must be properly briefed on emergency procedures prior to flight.
4. Passengers must wear clothing and footwear appropriate to the environment and regardless of flight time.
5. A passenger manifest must be prepared prior to each flight. For flights landing at remote helipads (not the base camp), no passenger manifest will be required, but the pilot must report the number of passengers on take off and ground staff must communicate passenger list to base camp immediately after departure.
6. Cabin attendant recommended as per 9.1.4.
7. Avoid loading cargo in passenger compartment when carrying passengers, but if any cargo must be carried at any time in the passenger cabin, it must be securely strapped down.
8. Any sharp tools such as axes or machetes must be placed in a suitable container that can be securely strapped down if carried in the cabin.
9. Dual controls must be removed and the pedals either disconnected or blocked before passengers are carried in the co-pilots seat.

10.3 A list of prohibited items should be prominently displayed at regular passenger check in locations.

10.4 In some areas, baggage or even body searches by authorized security staff may have to be considered.

11 Load/cargo transport

11.1 Load control

11.1.1 All loads should have accurate weights provided before the loads are carried. In the event standard repetitive loads are used, the contents of the standard load must be accurately established before the start of the operations

11.2 External load operation planning factors

11.2.1 The Helicopter Provider must have a company training syllabus and Standard Operating Procedures outlining the conduct of external load operations. These should include the use of bag runners, carousels, short and long lines, hooks as well as any other device being used for external load operations. These should also include minimum requirements applicable when flying with no load attached to the long line, such as minimum weights to be attached, safe transit speeds, maximum angle of bank and handling characteristics.

11.3 Sling special procedures

11.3.1 Operators must have in place procedures for positioning or detaching the long line whenever the aircraft is shut down. Following the shutdown, the long line should be placed (stretched out) in front of the aircraft so as to be visible to the pilot. The same procedures should also be used for those situations where the aircraft lands with the line still attached (such as refueling).

11.3.2 To mitigate risk of unintentional departure with a line attached all takeoff procedures should include coming to a stabilized hover at 10 feet and check the hook for an attached line prior to continuing any further transition. Marking the first three feet or more of the line with a phosphorescent sleeve will increase its visibility to the pilot.

11.3.3 Transit with a short line without a load attached must not be conducted. Best practice is to consider a short line to be part of the load; dropping or picking up the load is done by releasing / attaching the short line to the cargo hook.

11.4 Internal cargo

11.4.1 Cargo carried inside the passenger compartment must be adequately secured using cargo nets and tie down straps without obstructing normal or emergency exits.

11.5 Externally attached cargo basket/container

11.5.1 Cargo carried inside an externally attached cargo / container basket must be adequately secured using cargo nets and tie down straps without obstructing normal or emergency exits. Some provision must be provided to ensure the load in the basket on the opposite side of the pilot is secured (*eg* small mirror installed on the doorframe).

11.6 Transportation of hazardous materials

11.6.1 All hazardous materials should be carried in accordance with requirements provided by the local authority, or as specified by IATA / ICAO (in the absence of local requirements).

11.6.2 Helicopter Provider must have approved procedures and personnel trained to ICAO and IATA (or equivalent) standards in the event dangerous goods are to be transported.

11.6.3 If hazardous materials are carried, the Pilot-In-Command must be provided with a Shipper's Declaration of Dangerous Goods form (or equivalent) in accordance with aforementioned procedures.

11.6.4 Passengers must not be carried in conjunction with explosives.

11.6.5 Explosives and detonators should normally not be transported together.

However, small quantities of non-mass detonating caps (100 or less) can be carried inside the aircraft provided they are packaged in an approved Faraday cage blast absorbing container. In such circumstances a jettisonable external load of explosives may be carried.

It is the OGP position that detonators and high explosives can be carried as internal load in a single flight and that this may often be safer than the execution of two separate flights, provided:

1. Non mass detonating caps.
2. Stable high explosives.
3. Detonators inside a Faraday cage.
4. Proper separation (not less than 0.5 m) between the two products, with the detonators in a blast absorbing container.
5. Quantities not to exceed 100 detonators and 200 kg high explosives.

11.6.6 Small quantities of non-mass detonating caps and high explosives can be carried together as an external load provided they are packaged in an approved container (day box).

11.6.7 Provided that the detonators are carried in their original packaging and inside approved containers ensuring Faraday cage protection, it is considered safer to continue radio communications and flight following than to impose radio silence.

11.6.8 Bulk high explosives should be carried as external load. Where flights carrying high explosives as external loads need to be over water, it is strongly recommended that a non floating product is used that self destructs within a reasonable time when in contact with water (1 year).

11.6.9 Kerosene lamps/stoves, small petrol engines, chainsaws etc. should have no fuel in their tanks during transport.

12 Emergency response procedures

12.1 The Helicopter Provider, Seismic Contractor and, where applicable, the Company, should establish an emergency response plan using all available resources in the event of an incident during the course of seismic operations. Emergency Response Procedures/Plans should be in line with the AMG Section 12 and OGP 317 and include at a minimal the following:

1. Established quick flow chart for downed aircraft, injured or lost personnel and Medevac callouts.
2. Aircraft overdue.
3. Loss of communications.
4. Established procedures upon receiving a May-Day/distress transmission.
5. Aircraft Accident/Downed Aircraft.
6. Establish procedures for precautionary landing, *ie* chip-light, hydraulic, low fuel.
7. Medevac and SAR (Search and Rescue) Procedures.
8. Decision/approval matrix for Medevac and SAR.
9. Ground Crew Responsibilities.
10. Means to coordinate with local emergency agencies on location response.
11. Establish roles and responsibilities.
12. Dropped load procedures.
13. Emergency Response Procedures practice/drill.
14. Hijack procedures.
15. Jungle/forest penetration procedures.

12.2 This includes call-out procedures within the local aviation community and local emergency responders and must also consider establishing a response team within the seismic crew in the event of a delayed response from local author

13 Third party considerations

13.1 Avoiding undue risk or nuisance to 3rd parties

13.1.1 In planning and executing the operations, the Parties should do their utmost to avoid risk or nuisance to 3rd parties, which as a minimum should include:

1. Risk avoidance:
   a. Avoid over flying built up or populated areas, in particular with external loads.
   b. Coordination with other local aviation activities, such as crop spraying.
   c. Keeping 3rd parties (in particular children) at a safe distance.
   d. Where landings need to be made on grounds with public access (*eg* for emergency purposes), ensure the area is made safe beforehand, or have extra crew in the aircraft to be deployed quickly around the aircraft.
2. Nuisance avoidance:
   a. Adequate distance between base camps and regularly used helipads (staging areas) and population.
   b. Avoid disturbing any farm live stock .

13.2 Requests for assistance

13.2.1 As a matter of policy, no assistance should be provided to 3rd parties, other than in case of life and limb threatening emergency situations.

13.2.2 The Parties should consider developing a protocol to be used in case emergency assistance needs to be provided to 3rd parties (SAR, Medevac). The preferred option is for such emergency assistance to be coordinated through and to be requested by the local authorities.

13.2.3 Airborne transport of patients should be subject to qualified medical advise.

13.3 Requests for fuel

13.3.1 Fuel from own stock should normally not be provided to 3rd parties.

13.3.2 In case fuel from own stock needs to be provided to 3rd parties for emergency reasons only, such delivery should be subject to a hold harmless declaration to be signed by the 3rd party.

13.4 Assistance in case of aviation emergency

13.4.1 Requests for SAR and similar assistance in case of an aviation emergency in the area, if received from the local authorities or other aircraft operators, should be honored forthwith, in line with aviation industry practice.

Annex A – Risk assessment

A.1 OGP helicopter seismic support risk analysis

Client		Contact Name	
Project Title		Start Date	
Location		Est End Date	
Aircraft Operator		Contact Name	
Total Size(km)		Proposed aircraft types	
No. of Section			
Scope of Work			
Remarks *(list any general comments regarding this risk analysis)*			

Support Specifications (complete one for each project section)

Block Name		
Support Type (bags, drills, personnel)		
Seismic survey lines	Direction	
	Spacing	
	Average Length	
	Total line length (km)	
	Spacing	
	Average Length	
	Total Control line length (km)	
Total line kilometres this block (km)		
Special Requirements for this project		
Remarks		

Operating Conditions (complete one for each block)

Project Name		
Weather	Prevailing wind Direction	
	Avg. wind speed (knots)	
	Mean min temp (∫C)	
	Mean max temp (∫C)	
	Remarks	
Elevation Feet MSL	Minimum	
	Median (this value is required)	
	Maximum	

Helicopter main staging area	
Location (lat/long)	
Security/Proximity to population centre	
Obstacles and power lines in vicinity	
Size of helicopter landing/parking area	
Surface of landing/parking area (Dust, snow, mud, prepared surface etc)	
Proximity to buildings, fuel storage etc	
FATO/Rejected take off area size	
Approach and departure lane restrictions and slope	
Helipad lighting and maintenance work lights	
On site maintenance facilities	
Site accommodation	
Crew Sleeping Quarters (Hotel or on site)	
Fuel Supplier Name	
Fuel Storage/Delivery method	
(tanker, buried tanks, bladder, drums?)	
Fuel Filtration/Quality Control	
Flight Following System (Satellite/Radio etc)	
Primary and Alternate Communication	
Planned Communication Time interval	

Line helipads	
Minimum size	
Surface	

Drop zones	
Minimum size	

Local aviation facilities	
Nearest Airport Name and Identifier	
Distance from Main Staging Area	
Air Traffic Services/Control on site	
Navaids; VOR, NDB, ILS, DME, GPS	
Services (Crash, fire, rescue, hangar)	

Terrain

Block Name

Terrain Gradient (m/km)	% of block	Surface	% of block		
Flat (< 10)		Water			
Gentle (11-50)		Desert			
Undulating (51-150)		Scrub			
Steep (>150)		Pastoral			
Total (must be100)		Wooded		Tree height	
		Jungle		Canopy height	
		Total Hostile Environment (%)			

Notes:

The international Civilian Aviation Organization (ICAO) defines a hostile environment as an environment in which:

1. A safe forced landing canot be accomplished because the surface is inadequate (inadequate surface would include moderate & steep slopes and trees); or
2. The helicopter occupants cannot be adequately protectedfrom the elements; or
3. Search and rescue response capability is not provided consistent with anticipated exposure; or
4. There is an unacceptable risk of endangering persons or property on the ground.

ICAO definition of a 'safe forced lainding': An ìunavoidable landing or ditching with a reasonable expenctance of no injury to persons in the aircraft or on the surface.

Aircraft and crew details (complete one for each block)

Block Name					
Aircraft Type					
Registration					
Expected hours to be flown on task					
Hazards	None	Few	Moderate	Many	Remarks
Powerlines					
Towers/Masts					
Known bird Activity					
Known aircraft activity					
Urban areas					
Farm houses					
Airstrips					
Blasting areas					
Restricted/Danger areas					
Politically sensitive areas					
Other hazards/comments:					
Expected hours to be flown on task					
Total airframe time @ start of task					
Engine hours remaining (L/R)					
Continuing airworthiness programme in place?					
Any major components on time extensions?					
List major components that will expire during task					
Projected maintenance during task					
Number of pilots on each flight					
Number of additional crew on each flight					
Number of pilots on site					
Local security officer/observer required?					
Number of maintenance personnel on site					
Remarks					

Aircraft performance planning

Project Name		
Aircraft Type		
Empty weight in task configuration (lb or kg)		
Crew and additional equip.weight (incl. survival gear)		
Operating Empty Weight (lb or kg)		
Max take-off weight (lb or kg)		
Max fuel load (this figure may exceed capacity)		
Planned fuel load (lb or kg)		
Take-off weight (OEW + fuel load) (lb or kg)		
Transit time to task area (hours - one way)		
Fuel burn rate during transit (lb or kg per hour)		
HOGE Performance		HOGE available at max intended operating weight
HOGE at lowest altitude of intended location (Density Alt @ Average Seasonal OAT) (lb or kg)		Yes / No
HOGE at Mid altitude (ASL) of intended Location (Density alt @ Average Seasonal OAT) (lb or kg)		Yes / No
HOGE at Highest altitude (ASL) of intended Location (Density Alt @ Average Seasonal OAT) (lb or kg)		Yes / No
OEI Performance for Twins		OEI HOGE available at max intended operating weight
OEI HOGE at lowest altitude (Density Altitude @ Avge seasonal OAT)		Yes / No
OEI HOGE at mid altitude (Density Altitude @ Avge seasonal OAT)		Yes / No
OEI HOGE at highest altitude (Density Altitude @ Avge seasonal OAT)		Yes / No
Reserve fuel weight required upon landing (lb or kg)		
Remarks:		

Note: Hover Out of Ground Effect (HOGE) Performance:
In calculating HOGE or one engine inoperative (OEI), planned performance should be based on zero wind conditions, ambient temperature, based on the seasonal average for the area, and density altitude for the lowest level – mid Level – and highest level of the intended work sites. Account should be taken of the additional power required to transition to forward flight over and above that required to hover OGE.

A.2 Consideration of single or multi engine helicopter type

Choice of helicopter type for seismic support operations is dependant on a number of factors, but should include the exposure to risk in the event of an engine failure.

The risk in the event of an engine failure can be summarized in the following table:

	Non Hostile Terrain	Hostile Terrain
Single Engine Helo		
Twin engine without OEI HOGE		
Twin engine with OEI HOGE		

Total % Hostile terrain (From Part 1 Section 2)	

Mitigation factors that apply to this operation:

1	New FAA/JAA 27/29 Certification Aircraft type	
2	No passenger flights. Cargo/load only	
3	Routing to avoid hostile terrain	
4	HUMS/Engine Vibration Monitoring (EVMS) daily monitoring	
5	Fuel quality assurance completed daily	
6		
7		

Helicopter Type for operation

Type	Role

A.3 General hazards risk matrix

Complete this part for all types of aircraft

Hazards not directly related to engine failure (e.g. Controlled Flight Into Terrain (CFIT), bird strike, etc.) must be considered in any risk analysis regardless of survey size or aircraft type. The information collated in the previous pages are to be used in assigning an appropriate severity and exposure factors by assessing the presence or absence of the hazards listed below.

Hazards: not listed in any particular order; add more to the list as appropriate; number each hazard which is present for the block being considered

		✓
1	Steep mountainous terrain	
2	Ridge crossings at sharp angles (i.e. greater than 45 degrees)	
3	Persistent strong winds particularly when combined with significant terrain relief	
4	High elevation (i.e. above 8000 feet)	
5	Rapidly variable local weather conditions (eg. fog, low cloud, low visibility)	
6	Significant population of birds	
7	Busy air traffic environment	
8	Limited local SAR resources	
9	Primitive refueling facilities (eg. drums)	
10	Primitive maintenance facilities (eg. no hangar or on-site personnel; poor parts availability)	
11	Significant number of man-made obstructions (eg. towers, cables); built-up or populated areas; activities on the ground (eg. blasting)	
12	Environmental factors relating to crew workload and fatigue (eg. very cold or very hot and humid)	
13	Environmental factors relating to aircraft maintenance and condition (eg. salty marine air; dusty, sandy conditions)	
14	Poor accommodations to obtain suitable rest; limited available diet	
15	Limited flight crew experience on type in similar conditions	
16	Foreign operational difficulties (eg. language, customs, etc.)	
17	Time constraints; anticipated client pressure to complete survey	
18	Potential interpersonal conflict between field crew members	
19	Poor personal security at operating base	
20	Security concerns in operating area while airborne	
21	Significant local health risks (eg. malaria)	
22	Operating near international boundaries with hostile neighboring territories	
23	Requirement to carry local observer (often military)	
24	No rejected take off area at base site.	
25	Local/regulatory constraints on landing/drop zone size, below recommended.	
26	Obstructions on take-off and approach paths	
27	Lack of NAVAIDS	
28	Lack of alternate landing areas	
29	Other Hazards not identified above:	

Severity: based on the presence of the above hazards

5	Assigned when 15 or more of the hazards listed are present
4	Assigned when 11 to 14 of the hazards listed are present
3	Assigned when 7 to 10 of the hazards listed are present
2	Assigned when 3 to 6 of the hazards listed are present.
1	Assigned when less than 3 of the hazards listed are present

Note: The above hazards may be weighted as considered appropriate (i.e. if there are a large number of one type of hazard it could be counted twice.)

Exposure/Likelihood

5	Assigned for long duration (greater than six weeks) single pilot operations with no rotations planned and only one pilot on the site.
4	Assigned for long duration single pilot operations with no rotations planned but more than one pilot on site.
3	Assigned for short duration single pilot operations.
2	Assigned for long duration two pilot operations with no rotations planned.
1	Assigned for short duration two pilot operations.

For each Survey Block and aircraft Type, enter appropriate figures from above in the table below to determine the Risk Factor.

Block Name	Aircraft Type	Severity	Likelihood	Risk Factor

Use of the matrix

The matrix is presented below, complete with suggested methods of reducing risk factors. The following index is then to be used to determine the risk management required for the proposed survey.

Risk factor	Operation conditions
16-25	Operation not to proceed as currently planned. Consultation between Aviation Manager, Field Operations Manager and Chief Pilot/Senior Field Pilot required to significantly amend plans.
9-16	Operation may proceed upon approval by Aviation Manager and/or Chief Pilot of amendments to current plan or other factors which mitigate identified risks.
1-9	Operation may proceed as currently planned.

Risk matrix - general hazards

Exposure/Likelihood \ Severity	5	4	3	2	1
5	25	20	15	10	5
4	20	16	12	8	4
3	15	12	9	6	3
2	10	8	6	4	2
1	5	4	3	2	1

Methods of reducing risk factors – general hazards

Exposure/Likelihood

1	Two pilot operations preferred to single pilot operations.
2	Reduced planned flight duration and or number of daily flights.
3	Assign more than one pilot to a given single pilot survey.
4	Increased frequency of pilot rotation with overlapping periods to facilitate transitions.
5	Increased frequency of scheduled rest days

Severity

1	Helmets with visors, full harness, clothing.
2	Aircraft selection for airfield conditions; air conditioning.
3	Increased terrain clearance.
4	Airfield, main base and landing zone selection; for better surface, approach paths and facilities; possible improved environmental conditions.

Annex B – Maintenance and inspection of lifting equipment

B.1 Marking and records:

B.1.1 All slings and straps should be tagged or marked to show:

1. A reference number
2. Safe working limit
3. Date of next formal inspection.

B.1.2 All other lifting items should be stamped or marked to show: a reference number, and SWL.

B.1.3 If it is not practical to mark the required items, a suitable color code should be used.

B.1.4 An appropriate maintenance programme should be developed for all items, which provides for appropriate testing, inspections, and records to be traceable to each lifting device. A useful tool for this is a 'sling register' in which a full inventory is kept of all slings and other lifting equipment as well as the type of attachments and shackles etc. In use, documenting age, date put into service, inspection and replacement cycle and dates and, where appropriate, maximum wear allowed.

B.2 Inspection schedule:

B.2.1 All lifting equipment (cables, straps, baskets, swivels, clevises, carousels, bag runners, *etc*) Should to be visually inspected by appropriately qualified personnel on a daily basis when in use. Equipment that remains overnight in the field should be inspected on first occasion on return to base camp or staging area. The ground crews should make a record of performing these inspections, but this record does not need to provide details of the inspections and what was inspected, other than recording equipment, which was taken out of service.

B.2.2 All lifting equipment should be formally inspected by company authorized personnel on an annual basis and detailed records maintained for that inspection. For equipment in constant use, it is recommended these inspections be done every 6 months.

B.2.3 Any signs of wear, fraying, corrosion, kinks, or deterioration should result in those items being rejected for further use. Discoloration of synthetic materials should be investigated as this could be a sign of chemical contamination or overheating, causing weakening of the materials.

B.3 Design and initial testing:

B.3.1 Safe working limit (SWL): the SWL of any item of external lifting equipment should be 20% above the maximum lifting capacity of the cargo hook.

B.3.2 Designed breaking strength: wire rope, straps, slings, shackles, and swivels should have a design breaking strength of 6 times SWL.

B.3 3 The actual load on a sling will depend on the configuration in which it is used. Only for single (vertical) sling configuration will the load on the sling equal the weight of the load attached. Even then, the effective weight of the load will increase during acceleration and banking. Slings with a diagonal or slant configuration (*eg* a four point attachment to a basket) will be subject to significantly larger forces than the mere weight of the load. This must be taken into account in the design of multi point sling configurations.

B.4 Proof testing

B.4.1 After manufacture, all items should be proof tested to twice the SWL.

B.4.2 Test certificates are to be retained until the item is scrapped.

B.5 Steel cable, synthetic (e.g. Kevlar, spectra, amsteel blue), or wire rope slings:

B.5.1 Each cable should have the swaging collar embossed with the length, diameter and rated strength of the line.

B.5.2 Inspect the cable according to the manufacturer's recommended programme prior to use for broken strands, bird caging or kinks, or chemical contamination.

B.5.3 Slings should be inspected in accordance with a suitable servicing schedule that documents current and traceable load test certification.

B.5.4 Nylon straps or netting: only certified straps and netting may be used to connect the load to the steel cable. Nylon or polypropenol ropes should not be used in place of the steel cable, due to the hazards associated with stretch and elastic failure when carrying loads.

B.6 Shackles and swivels

B.6.1 The shackles and swivels used to connect the cable to the aircraft are to conform to specific flight manual supplements regarding the diameter of the shackle rings and their use with respective hook types on the aircraft.

B.6.2 Shackles and swivels will be serviceable with no evidence of corrosion or excessive wear.

B.7 Unserviceable lifting equipment

B.7.1 Unserviceable lifting equipment should have a quarantine area separate from serviceable equipment.

B.7.2 Unserviceable equipment should be tagged, and clearly marked as unserviceable.

Annex C – Fire safety

C.1 General

C.1.1 Suitable firefighting equipment should be provided at fuel storage, refueling, staging and base camp landing areas. It may not be practical to provide such equipment at the line helipads, but where remote refueling and fuel handling is performed essential firefighting equipment should be available.

C.1.2 A designated firefighting team should be established for these areas. This team should be given suitable fire fighting training with regular refresher training and emergency exercises. At least one trained firefighter should be present and ready for action during refueling operations, starting of helicopter engines and landing / take off.

C.1.3 Where fuel storage and refueling areas are adjacent, there is no need for duplicate equipment, provided the equipment is suitably located and mobile.

C.2 Firefighter equipment

C.2.1 Firefighters should have the following equipment:

1. Firefighter helmet, suit and boots, suitable for quick donning.
2. Emergency equipment as listed under 12.3.

C.3 Fire extinguishing equipment

C.3.1 Examples of the required equipment can be found in CAP 437 for helidecks; ICAO Annex 14 for airports, airstrips, heliports and helidecks; and The National Fire Protection Association 'NFPA41 Standard for Heliports'.

C.3.2 Some of the above may not be practical for temporary installations, such as staging areas or even seismic base camps.

C.3.3 The preferred fire extinguishing system for fuel storage, refueling and landing/take off areas is water based foam (AFFF). Hoses should be of suitable length to cover the area. Pumps should preferably be spark proof of a similar rating to fuel pumps. Pumps should have adequate delivery capacity (at least 5.5 $l/m^2/min$) and throw (at least 10m). Nozzles should allow dual use, *ie* (foam) jet and fire wall. Water supply should be adequate to sustain continuous delivery for at least 10 minutes.

A very practical system consists of a carted water pump and foam mixing assembly. On the intake side this should be connected to a pressurized water system or have a non collapsing intake hose which can be inserted into a water supply (tank, pond, river). On the outlet side 15 - 50 m delivery hose can be used, depending on pump output pressure.

C.3.3 In addition to the above, at least two 12kg dry powder or CO_2 (ABC) portable fire extinguishers should be available for use on small, incipient fires.

C.3.3 Where no adequate water supply is available and for more temporary locations, the use of portable fire extinguishers is acceptable.

1. Portable fire extinguishers can only fight incipient, small fires and a 'burn down policy' should be adopted for larger fires.
2. For protection of the Helicopter (refueling, landing/take off) an additional capacity of portable dry powder, CO_2 and/or foam extinguisher(s) should be provided of at least:

   a. 50kg dry powder, or

b. 90kg CO_2, or

c. 90 L foam (AFFF)

C.3.4 A trained firefighter should be stand by during:

1. Starting of the engines.
2. Refueling of the aircraft.

C.3.5 Further considerations:

1. At least two 12kg ABC fire extinguishers will be provided at remote refueling locations.
2. Refueling should normally be done with the engines shut down. Observing a 30 minutes cool down period before refueling is recommended.
3. All personal not involved in the fuelling operation, including helicopter passengers, should remain clear of the fuelling location by at least 30 meters.
4. Extinguishers located in enclosed compartments will be readily accessible, and their location will be clearly marked in letters at least five (5) cm high.
5. Extinguishers will be located upwind from the helicopter being fuelled.
6. Smoking or any other source of ignition is prohibited within 30 meters of any area designated as a helicopter fuelling location.
7. All personnel involved in fuelling operations will be given formal training by their respective companies concerning the use of the extinguishing equipment and the type of fires that may be encountered.
8. An emergency safe-exit route from the fuelling location should be available to the fuelling crew at all times.

Annex D – Fuel management

D.1 General

D.1.1 The correct grade of dry, uncontaminated fuel is essential to safe flight operations. Stringent handling procedures and contamination checks must be followed at each stage of movement of the fuel from the refinery to the helicopter in order to reduce the risk of fuel contamination due to water, dirt, or sediment.

D.1.2 The preferred source of helicopter fuel would be a CAA approved airport close by the operations. However, for many operations this will not be a viable option and fuel will have to be procured from a supplier/refinery and stored in the base camp or staging area.

D.1.3 All fuel and supporting fire suppression systems, including those provided by airports or fixed base operators, should have annual safety, technical and quality assurance reviews by appropriate competent and qualified authority or organization and reviews every six-months by the Helicopter Provider. Records of such reviews and any remedial actions taken should be maintained.

D.1.4 The Helicopter Provider should provide formal procedures detailing all necessary equipment checks and fuel system quality control.

D.1.5 Only authorized and duly trained personnel will be allowed to enter the fuel storage area and to operate refueling or fuel transfer equipment. This authorized/trained personnel may also conduct the quality control checks described in this section, but subject to supervision by the Pilot-in-Command. All other personnel should remain clear of the fuelling area when fuelling operations are in progress, unless the authorized personnel requests assistance.

D.1.6 The Pilot-in-Command is responsible for the quality of fuel loaded into the aircraft.

D.1.7 The most common and also most dangerous contamination of fuel is water. Water can block engine fuel filters and hence cause sudden engine failure. Presence of water can also lead to development of bacteria and fungi in the fuel. These can also result in fuel filter blockage. Hence the water contamination checks described below should be followed rigorously (*ie* in all stages of fuel handling and supply as well as the regular checks on the fuel inside the tanks of the aircraft).

D.1.8 In humid climates with large swings in temperature, water condensation might occur inside the aircraftís fuel tanks. Topping up the fuel tanks at the end of the day may be a valid mitigation measure in such areas, but puts constraints on the first flight plans the next morning.

D.1.9 Most fuel providers now include anti bacterial and fungi inhibitors in their products. Where this is not the case (enquire with fuel provider) the use of such products could be considered in hot, humid climates.

D.2 Site selection

D.2.1 The fuelling area is to be checked in accordance with the following requirements on initial set up:

1. Helicopter fuel storage areas must be separate from other types of fuel stocks.
2. Terrain must be kept clear of any flammable materials such as brush, undergrowth or debris and not susceptible to flooding. The site should be as free of dust and debris as possible.
3. Helicopter fuel storage and refueling areas must be as far as possible from all other personnel, equipment and living quarters. The minimum distance from

the fuel storage tank or drum stacks to living quarters is 100 meters.

4. Refueling must be conducted at least 15 meters from non-essential personnel and any source of ignition.
5. The tank designated for helicopter fuelling must be at least 15 meters from the center of the helicopter unless using drums.
6. Where drums are being used, move empty fuel drums far enough from the helicopter to ensure they are not dislodged by down wash from the helicopter rotors.

D.3 Storage

D.3.1 Fuel storage and equipment should comply with the following:

1. Only stainless steel (preferred option), epoxy coated steel, aluminum or glass-lined aluminum, or fuel grade bladder type tanks will be accepted for helicopter fuel storage.
2. The tanks will allow for expansion (2% of full capacity) and will be fitted with vents to allow for temperature changes without tank distortion or entry of moisture/contamination.
3. Tanks will have a drainable sump / low point. Fuel delivery piping will be mounted such that a small amount of fuel will always be left in the tank and can only be drained off through this sump.
4. Tank bottoms will be supported to avoid distortion in the metal that may trap moisture/debris.
5. Tanks will contain only a single grade of fuel.
6. Tanks will be clearly marked with the grade of fuel stored.
7. The inside of tanks will be clean and free of all foreign matter.
8. Tanks will be marked with placards in accordance with all applicable government regulations.
9. All tank valve outlets will have dust covers.
10. All manhole covers and valves will be locked to prevent fuel theft or contamination by unauthorized persons.
11. Fuel leaks, of any amount, are unacceptable and will be contained and fixed immediately. Refueling operations will be prohibited until all leaks are fixed and any spills cleaned up.
12. Local Governmental regulations should be consulted to determine if secondary containment is required for fuel tanks be they either ground, trailer, or truck mounted.
13. Where fuel bladders are used they should:
    a. Be of fuel grade quality.
    b. Not have been used in the past for storage of water or fuels different from the one stored.
    c. Be maintained, cleaned and inspected in accordance with manufacturerís specifications.
    d. Be surrounded by secondary containment that can receive no less than 100% of total fuel capacity.

e. Covered by a roof or tarpaulin to prevent water ingress in secondary containment, where appropriate for the climate.
f. Be protected from contact with chemicals and not subject to any dying or painting.

D.4 Drum storage

D.4.1 Storage of helicopter fuel in drums is the least preferred method due to inherent risks of reduced quality control, fuel contamination and security. Extreme caution should be used when fuelling from drums due to the possible presence of moisture and/or sediment. Drum storage and handling should comply with the following:

1. Only epoxy coated steel drums should be used.
2. All drums should be in good condition, sealed at the refinery and with all required labels and placards attached, including the fill date.
3. All drums will be stored within secondary containment providing full sealing to avoid small spillage to enter the ground and able to contain the full content of several drums.
4. Drums will be stored horizontally with the bungs at the 9 and 3 o'clock positions, with the bung end tilted slightly lower than the opposite end (non-opening), to prevent moisture/rust formation inside the bung end of the barrel.
5. If exposed to weather and there is a need to have a drums in vertical position (*eg* before use), drums should be kept at a slight tilt to avoid rainwater build-up within the rim.
6. The drum should have been filled within one-year prior to use.
7. Helicopter fuel drums will be stored separately from other types of stock.
8. Provide sufficient supports beneath the first tier of drum stock to prevent the drums from settling into the soil or resting in water puddles that may cause corrosion.
9. Chock all drum stocks on both ends of the stack to prevent them from rolling.
10. Contaminated, suspected, or substandard drums will be rejected, labeled and quarantined separate from acceptable stock and their contents will be disposed of in an acceptable manner. This will include drums that are used for collecting the fuel drained for sampling purposes. The standard marking for a contaminated drum is an "X" marked on the bung end.

D.5 Fuel transport to & storage at remote forward staging points

D.5.1 Where flight operations need to be conducted a significant distance from base camp or other bulk fuel depot, forward staging of fuel can be very efficient in reducing flight time and hence exposure.

D.5.2 Fuel can be carried to forward staging depots in drums or small (heli-portable) bladders.

1. Preference is to only use drums as received from the refinery.
2. Re-use of drums will be subject to approval from the local Aviation Advisor.
3. Filling of small bladders or re-used drums should be performed with exactly the

same procedures and precautions (including test sampling) as used for refueling the aircraft.

4. It is recommended that, after filling, frangible "witness" seals be applied on transport tanks, to allow verification that contents have not been tampered with.
5. Fuel dispensed into small bladders or re-used drums should be used within one month.

D.5.3 Forward staged fuel should be stored with the same precautions as applicable to the bulk storage depot. Requirement for secondary containment may be waived for short term storage (subject to local government regulations!).

D.6 Fuel provision, quality control and contamination checks

D.6.1 When fuel is taken from a supplier / refinery or delivered to the fuel storage, the following must be performed before this fuel is accepted and transferred to the storage:

1. The fuel must be documented and this documentation must be checked to ensure the fuel received:
   a. Is of the correct grade and type.
   b. Will not reach its expiry date (one year from manufacturing) before use.
2. If delivered by tanker, the tank must be allowed to settle for 1 hour for each 1 foot of fuel depth.
3. After settling, enough fuel must be pumped out of the tank and disposed of in reject storage to ensure the transfer pump and piping is filled with fresh fuel.
4. A 2 liter sample must be taken into a clean glass recipient with screw top, marked with date and origin and:
   a. Visually inspected for color, clarity and contamination.
   b. Tested for water in suspension with approved water testing paste or capsules.
   c. Stored with the documentation of the fuel batch delivered, until this batch has been consumed.
5. After filling, the storage tanks must be allowed to settle 1 hour for each 1 foot of fuel depth before any fuel is delivered to the helicopter.

D.6.2 All required fuel samples as noted in the paragraphs below should be taken into a clean glass recipient with screw top, marked with date and origin and:

1. Visually inspected for color, clarity and contamination.
2. Tested for water in suspension with approved water testing capsules or kits. Water testing paste is not effective at detecting water in suspension.
3. Retained until flights are completed for that day.

D.6.3 Prior to the first flight of each day, the helicopter fuel tank sumps must be drained and sampled into one container (½ liter minimum sample size, unless specified differently by the airframe or water detection device manufacturer).

D.6.4 Prior to the first refueling of each day, samples must be taken from the fuel delivery system:

1. Each fuel tank sump (2.0 liters).
2. Each fuel filter and monitor (2.0 liters).
3. Each fuel nozzle, prior to first refueling of the day (2.0 liters).

D.7 Fuel dispensing

D.7.1 Fuel dispensing equipment and procedures should comply with the following:

1. All helicopter fuel dispensing equipment will comply with the latest applicable codes and standards for the dispensing of aviation fuel.
2. All hoses will be either API 1529 or EN 1361 approved for into aircraft jet fuel.
3. All helicopter fuel dispensing equipment, hoses, hose couplers, pumps, filters/separators, nozzles and grounding/bonding equipment will be maintained in top quality condition, according to all manufacturersí instructions.
4. The helicopter fuelling equipment will not be used for dispensing other types of fuel and will be stored in a separate location from fuelling equipment used for other purposes.
5. Short loops or kinks in the fuelling hose should be avoided. Any lacerations, cracks or leaks in the fuel hose are unacceptable and refueling operations must cease until repairs and/or replacements are done.
6. If a separate fuel pump and filter assembly is used, it will be positioned within a spill containment devise.
7. Fuel pumps will be
   a. Approved for and inherently safe for use with fuel, not providing any form of ignition source.
      i. Electrical pumps are preferred.
      ii. Diesel operated pumps are acceptable, provided the exhaust is insulated and fitted with a spark arrester.
   b. Located at least three meters from the helicopter.
   c. Incorporate bypass/overpressure control systems to avoid excessive pressure build-up in the delivery hose.
   d. Metered to a maximum of 50 gallons per minute.
   e. Equipped with a remote operated emergency shut down switch.
8. All fuel delivery systems, including portable systems, will be fitted with filtration of the water blocking (Go-No-Go) type, which locks fuel flow when water is present.
9. At least one accepted filter unit will be located downstream from the fuel pump. An accepted standard for the filtering units will be meeting with the specifications of API 1583.
10. All fuel filter cartridges will be of five microns or less.
11. Fuel filter canisters should be clearly marked with the next date of change or inspection cycle, and data recorded in an appropriate inspection record.
12. Fuel filters will be operated within the manufacturerís minimum/maximum flow rates.
13. All filters should be replaced at nominated pressure differentials as annotated on the filter housing or as recommended by the manufacturer, but as a minimum will be replaced annually. Changes will be recorded and attached to filter housings.
14. All filters will be equipped with pressure gauges on both sides or the Gammon style single gauge, to allow monitoring of the pressure differential across the filter.

15. All helicopter fuel nozzles will be equipped with dust caps and bonding clips or jacks. The nozzle should be kept off the ground and facing downward to preclude water contamination with a drip tray below it.
16. Suspend fuel operations immediately when a lightning discharge hazard exists.

D.7.2 In addition to the points listed above, the following should apply to refueling from drums or small transportable bladders:

1. Each drum of fuel should be sampled and tested with water detector capsules or an approved paste to confirm no water contamination is present and visually inspected for proper color, transparency and contamination.
2. Pumps used for drum refueling should be equipped with water blocking filtration system.
3. Pump standpipes should extend no closer than 50 mm (2 inches) of the drum or bladder bottom.
4. Before fueling the aircraft, a small amount of fuel should be pumped into a container to remove any contaminants from the hose and nozzle.
5. Wherever possible, drums and small bladders should be left to settle for 3 hours after transport or moving them to the refueling location, before use.
6. The drum or bladder should be positioned as far as possible from the aircraft.

D.8 Bonding and grounding

D.8.1 To minimize the fire hazard from static or stray electricity on the helicopter or fuelling equipment, all equipment will be properly grounded to earth before fuelling operations or the transferring of fuel from one storage tank to another.

1. All bonding and grounding cables should provide an easy path for the electricity to flow to the earth through a conductive lead, such as braided copper cable.
2. All grounding rods will be driven into the earth at least several centimeters (this applies to winter operations as well when possible) otherwise bonding will be conducted.
3. Cables, clips and plugs used for bonding and grounding will be inspected and tested for continuity checks should be done annually or after relocation of base camp.
4. Resistance through any bonding or grounding circuit should be less then 10 ohm.
5. All connection points and grounding plugs should be clean and unpainted.
6. If the helicopter is without a bonding jack, attach the bonding clip at the end of the nozzle bond wire to the tank filter cap before the tank filler cap is opened to ensure that there is no difference in potential between the two elements. Maintain this contact until the flow of fuel has stopped and the filler cap replaced.

D.8.2 When fuelling from drums, the following precautions will be taken:

1. Ground the drum to a grounding rod.
2. Ground the helicopter to the same grounding rod.
3. Bond the drum or tank and nozzle to the helicopter before opening the filler cap
4. Disconnection should be in the reverse order, upon completion of fuelling.

Annex E – Passenger briefing template

Helicopter safety briefing

Topics discussed:

☐	Danger areas of rotors and turbine exhaust	☐	No loose objects, clothing, hats, etc.
☐	Never approach from rear	☐	No objects above shoulder height
☐	Boarding and exiting procedures	☐	Carry equipment horizontally
☐	Wait for signal from pilot	☐	Cargo must be carried, not thrown
☐	Crouched position in pilot's view	☐	Bear scares – storage area
☐	Turning rotors relative to slope of ground	☐	Hook and hook-up demonstration
☐	Emergency procedures	☐	Manual release knob
☐	Location of fire extinguisher	☐	Load beam, Keeper, and Clevis
☐	First aid kit/survival gear	☐	Local climate hazards (heat/cold/wind/chill factor etc.)
☐	Use of seat belts	☐	Prohibited goods
☐	Location and function of Emergency Locator Transmitter	☐	Need to keep 3rd parties at a distance
☐	Adhere to 'No Smoking' and 'Fasten Seatbelt' signs	☐	Additional ___________________
☐	Landing areas free of debris	☐	Additional ___________________
☐	Risk of dirt/objects into eyes, prop/rotor wash	☐	Additional ___________________
☐	On disembarking, move away from aircraft to safe distance	☐	Additional ___________________
☐	No crowding	☐	Additional ___________________

Job hazard analysis:

1	Pre-job meeting minutes	____ ____ ____ ____ ____
2	Potential hazards	____ ____ ____ ____ ____
3	Hazard mitigation & control	____ ____ ____ ____ ____

Those in attendance/flight manifest (those flying should check box next to name)

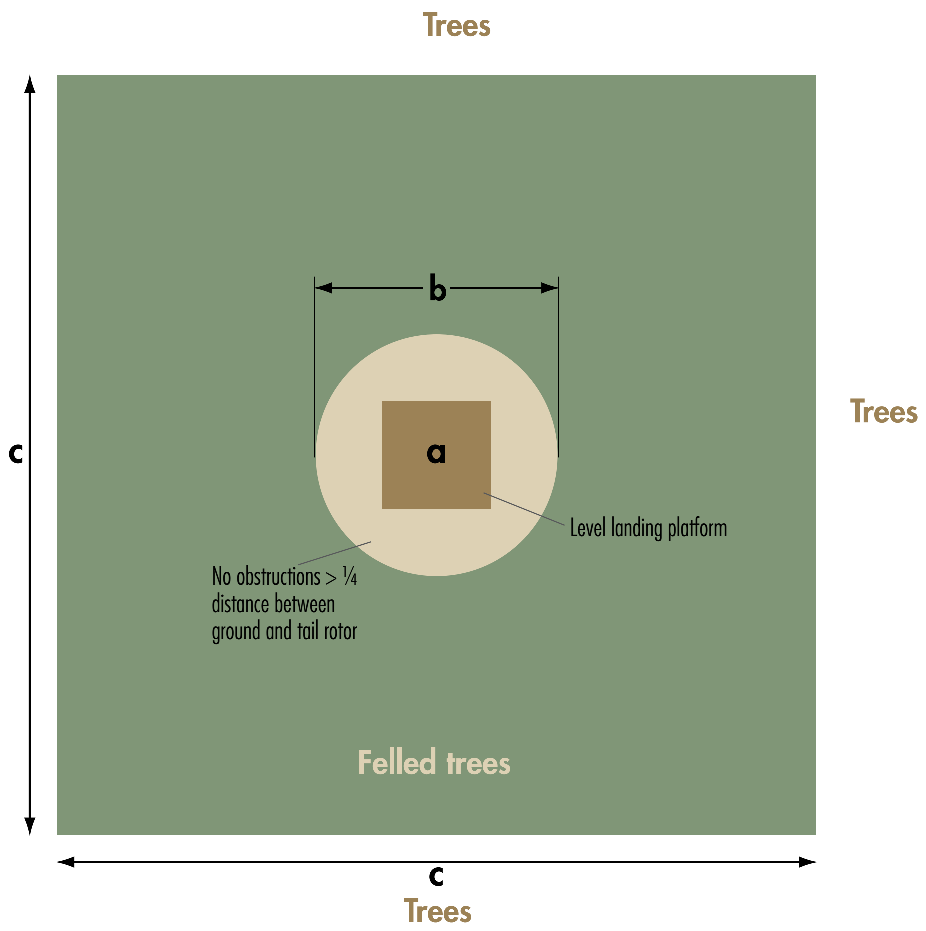
Wgt	Print name	Signature	Wgt	Print name	Signature

Weight and Balance control

Actual Passenger weight total:	
Configuration # in effect:	
Weight/Balance OK:	

Annex F – Line helipad diagram and considerations

Dimensions for use in tall growth vegetation/trees for clearings and helipads



Dimensions:

a: sides the width of undercarriage + 2m, provided the pilot can see the gear
b: diameter equal to total length of helicopter, including rotor blades
c: sides 3 x total length of helicopter including rotor blades or 50m, whichever is greater

F.1 Landing areas and clearings

These dimensions quoted above will have the most relevance to operations in forested or jungle areas where the cost and time impact of felling trees and clearing large tracts of vegetation is greatest.

In areas where the terrain is hospitable, an increase in the level of safety may be achievable at a reasonable cost by increasing the dimensions of the cleared area. Long line systems for the carriage of external loads may also prove beneficial by dramatically reducing the size of many clearings. However, full size clearings and landing pads will still be required for the movement of passengers and internal cargo. The intervals along lines at which helipads will be required will depend on such factors as the type of seismic recording equipment used and the expectations of the labor force.

F.2 Line helipads in desert areas

While the selection of a suitable landing area adjacent to the seismic line is unlikely to present great problems, precautions must be taken to prevent damage to helicopter engines and rotor blades due to sand erosion. Invariably, the helicopters will be specified with suitable sand reduction modifications. However, some preparation may be required at temporary landing sites; a simple remedy would be to suppress the sand with water.

Note: Erosion of helicopter engine compressor turbine blades can be dramatic if suitable precautions are not taken.

F.3 Line helipads in mountainous areas

Seismic parties in areas of mountainous terrain will often require the support of helicopters. The performance specification of the helicopters must be such that it is suitable for mountain operations. Mountain flying, particularly at high altitudes, presents a pilot with special problems, demanding a close study of the aircraft limitations and performance graphs and interpretation of local wind and turbulence effects caused by topographical features.

When undulations in the terrain are relatively smooth, or where the wind velocity is low, a laminar air flow can be expected, giving a gentle up-draught on the windward slope of a hill or mountain and a corresponding down-draught on the leeward side. Where the terrain contours are abrupt or jagged or the wind velocity high, the effects are less predictable, as a turbulent airflow will occur, both over and around the obstructions; whirls and eddies will produce local effect reversals of wind direction as well as vertical air currents.

A phenomenon known as standing waves may occur when the wind direction is roughly perpendicular to a mountain range, resulting in strong vertical air currents at intervals downwind of the range. To ensure the safety of transit flights, it may be necessary for the pilot to select a route and altitude that would not appear to be the most direct.

Disorientation and a feeling of vertigo is a potential hazard of mountain flying where the route involves flights over knife-edge ridges or approaches to pinnacles. Inexperienced pilots are prone to these effects which only serves to emphasize the need for selection of a suitably experienced operator.

It should be anticipated that there will be occasions where the choice of the landing site will be dictated by topographical features and therefore not ideally located on the line. It is essential that the helicopter operator be involved in the selection of landing sites.

Hill-top and ridge locations may present obvious landing sites and are often selected. However, these locations present their own problems due to turbulence, wind shear effect and inaccessibility due to low cloud. Consideration should be given to the down-time due to these factors.

When operating to any landing site in mountainous terrain, the pilot will require, at all times during the approach and take-off phase, an escape route to be flown in the event of encountering, for example, down-draughting air. Time spent in planning the location of landing sites, preferably including an airborne survey, will rarely be wasted; locations can usually be found which fulfill the aviation safety requirements and involve the minimum of rock and vegetation clearance.

F.4 Line helipads in forest or jungle areas

The work involved in clearing trees, primary or secondary forest/jungle, even to 1m level is considerable and the removal of tree trunks is unlikely to be achieved with the resources of a helicopter supported seismic party. In order to achieve a flat area, clear of immediate obstructions allowing transition between the hover and forward flight, it will often be convenient, especially in areas prone to flooding, to construct a raised helipad. However, the rate of decay and destruction by insects of softwoods in tropical climates should not be underestimated. Whenever raised wooden helipads are used, the following procedure is recommended:

1. Upon first construction: inspection and release to service by the senior pilot (that will also include a check of the entire clearing for correct dimensions and freedom from obstructions).
2. Two months from construction: inspection by a ground party who may be brought in by helicopter provided the pilot is briefed and able to keep the helicopter light on the undercarriage. Subject to findings during this check, the landing site may be released to service for a further month.
3. Three months from construction: complete rebuild of elevated helicopter landing platform and pre-release inspection.

For more permanent landing sites consideration should be given to using hardwood planks; the structure, which will also be subject to a three month inspection interval, may be repaired on condition. Should the seismic campaign run into a drilling campaign, then all pads to be used by rig support aircraft should be constructed of hardwood. Used engine oil has been found effective as a hardwood preservative, and using this method, no deterioration was noticed after eight months. However, should oil be used as a preservative then due attention will have to be paid to ensure the environment is not contaminated during the application of the oil.

When short sling loads are to be handled in standard clearings, it is essential that an area free of obstruction, of approximately 5 meters square and above the level of stumps/felled trees, be made available. Although the landing area may be used for this purpose, in order that loads may be prepositioned without prejudicing the ability to land a helicopter with passenger or internal loads, it has been found convenient to prepare secondary pads, displaced at least 5 meters from the main landing area.

Fly camps should be set up well inside the tree line so as not to intrude into the cleared area. This serves to avoid the danger from falling trees rendered unstable by the clearing process, and to distance tarpaulins and other loose camp equipment from the rotor downwash, which may lift items into blades or engine intakes with disastrous results. It will also protect personnel from the danger of flying debris in the event of a helicopter crash landing at the helipad.

It is also essential to brief personnel not to set up the fly camp in the area directly under the approach and overshoot flight path since in the event of an engine malfunction during sling operations the pilot will release the load to gain additional performance from the helicopter.

Annex G – Generic hazards & controls inventory

The appendices present an inventory of known hazards in land helicopter supported geophysical operations. They also incorporate suggested controls that may be used to reduce the potential risks presented by these hazards. The inventory captures industry experience on causes of accidents in the past and should be consulted when compiling the formal Hazard Register for the HSE-MS of an operation with helicopters.

The words 'hazard' and 'risk' are used loosely in association with the widest possible meaning of ëanything with a potential to cause harmí.

Risks (before and after controls are applied) must be assessed on a case-by-case basis, as they will depend on the type and location of an operation.

Common ground is generally not addressed. The focus is on specific land helicopter support-related hazards. However, to err on the safe side, some hazards common to other types of operations are included.

Also, most general aviation hazards, such as mechanical failures of the aircraft or pilot error etc. are not included.

G.1 Environmental hazards & suggested controls

Weather

Hazard description	Suggested controls
Adverse weather conditions that may affect helicopter operations include: • Low clouds, fog, rain or snow reducing visibility, risk of: — Collision with obstacles. — Getting lost during VFR flights. • Freezing temperatures that may result in: — slippery walkways, — ice accumulation on the aircraft. — ice accumulation can also be the cause of breaking antenna wires etc. — adversely affect engine performance (failure to start). • Strong winds, especially around hilltop helipads can: — Affect the flight path of the helicopter. — Cause trees at edges of forest (helipads, rivers etc) to fall. — Cause dust or light objects in the air (FOD) • Glare from low or reflected sun: — Can be blinding to pilot — May make a helipad difficult to locate	• Plan operations taking into account prevailing weather conditions and the extremes that can be expected in the course of the operations. • Ensure availability of regular, reliable weather forecasts and advanced warning system for adverse conditions. • Avoid weather conditions that are outside the operating envelope of the aircraft in use. Availability and map of emergency landing locations. • Incorporate weather conditions in Manual Of Permitted Operations and Emergency Response Plan. • The Pilot has the obligation and must have the authority to suspend or modify operations, without further approval from management, in case of adverse weather. • Avoid presence of personnel at edge of helipads cut in jungle, as trees may fall inwards. Place camps, shelters etc well inside the forest. • Keep landing pad at least one tree height away from tree line. • Minimize flying below tree line. • Avoid dry dusty helipads, spray with water or treat/cover otherwise. • Housekeeping: no loose light materials near helipad or flight path. • Take into account when positioning helipads and related direction of approach path. • Avoid strongly reflecting surfaces near landing locations

Lightning

Hazard description	Suggested controls
• Aircraft may be stuck by lightning, presenting risk of — instrument failure — ? • Lightning in the open is an extremely dangerous condition. It may strike personnel (usually fatal) or equipment (massive damage) • Personnel present on open helipads during a thunderstorm are extremely exposed. • Sources of heat (engines, human bodies), ionized (exhaust) gases and radiation (radio antennaís) attract lightning. • Lightning strikes may cause electrical or electronic systems to fail. • Lightning strikes may cause trees to fall.	• Thunderstorm activity monitoring and avoidance during flight. • Ground personnel to adhere to lightning precautions, such as: — Take shelter in protective building or vehicle — Stay away from high, exposed ground. — Switch off radio transmitters; disconnect aerials/antennaís, throw away metal objects. — Stop small engines, such as small generators. — Not shelter below trees, find open ground and crouch there or enter deeper in the forest

Turbulence

Hazard description	Suggested controls
• Turbulence may occur during hot weather or in instable clouds. • Generally more pronounced near the ground ('low altitude turbulence'). • Risk of: — Injury to pilot or passengers — Damage to aircraft — Loosing external cargo — airsickness	• Monitor weather, avoid flying through unstable cloud cover. • In hot areas, give preference to flying early in the day • Avoid low altitude flying during hot periods of the day

Tides, waves, flooding

Hazard description	Suggested controls
• Floating landing areas may be affected by tides and waves, risk of: — movements of landing platform — tilting platform, if partly grounded during low tide • Flooding may affect helipads near river banks or in low valleys. Risk of: — standing water making landing impossible — soft helipad due to water saturation — access to helipad may be blocked	• Position in sheltered water • Position in sufficiently deep water, avoiding grounding during low tide/water levels. • Locate HP's on dry, high ground • Use logs for pad construction

Exposure

Hazard description	Suggested controls
Helicopter operations may entail (extreme) exposure to: • Cold (affects ability to perform tasks, hypothermia) Impact will be aggravated by wind (chill factor). • Heat (exhaustion, heat stroke). • Sunlight, the reflection off water effectively doubles this exposure (sunburn, eye damage/snow blindness, skin cancer).	• Ensure helicopter windows etc can be adequately closed. • Cabin heating when required • Cabin ventilation in hot climate • Sunglasses, UV absorbing window materials etc.

Wildlife

Hazard description	Suggested controls
• Birds in flight, risk of collision • Snakes • Scorpions • Insects • African bees • May affect personnel on the ground, but may also get into the aircraft and present a risk to passengers and pilots inside. • Noise may disturb wildlife	• Avoid positioning helipads near high concentrations of birds • Map out locations with high concentrations of birds and make pilots aware of these locations. • Housekeeping: avoid birds of pray or scavengers being attracted to helipads • Common protective measures against insects. • Eliminate bee hives. • Avoid cargo being put on bare ground, use elevated platforms • Avoid overflyingf protected areas etc.

G.2 Operational hazards & suggested controls

Operating envelope

Hazard description	Suggested controls
All helicopters have limits in terms of: • range • capacity • lifting • altitude	• Lifting capacity is function of air density, which in turn is influenced by temperature and altitude. • Determine the safe working envelope of the helicopter. • Deploy within safe operating envelope of helicopter. • Beware of ìimprovisationî and unplanned, ill-considered use. • Develop Manual of Permitted Operations • Develop load tables as function of temperature and altitude

Aircraft integrity

Hazard description	Suggested controls
Mechanical failure	It is self evident that adequate maintenance and repair are essential. Aircraft maintenance as such etc is a specialist and large subject, not addressed here and normally covered in aircraft manuals etc. However, the following must be noted as provisions that must be considered for land helicopter support operations: • Hangar • Storage of spare parts, some of which may need air-conditioning • A frame or other lifting device • Rolling jack to move aircraft • Stock of essential spare parts and supply line of these from manufacturer.
Foreign Object Damage (FOD)	Dirt or loose objects may be sucked into the air inlets of the engines or collide with and damage the rotors or other aircraft parts. To avoid FOD: • housekeeping around landing areas • packaging of certain types of cargo (such as cement bags) in sealed plastic bags or containers. • Mark high points visibly and/or with stroboscope lights • Position landing points on flat ground, without high obstacles near by, allowing a safe flight path.
Collision with obstacles. • Higher ground or obstacles near landing point • Overhead power lines, antennas • High buildings • Terrain • Other aircraft	• Provide map of obstacles, such as power lines and antennas, towers etc. • Mark power lines with balls • Flight control, notification/coordination with other aircraft operators (crop spraying, recreational and other small aircraft, military aircraft and exercises etc.)

Passenger transport

Hazard description	Suggested controls
Passenger transport risks: • walking into (tail) rotor • carrying objects that may damage rotors or aircraft • boarding or disembarking at wrong moment • incorrect behavior inside aircraft • entanglement with skids • delivery to wrong location, leading to a need for unplanned, extra flights • Loose clothing, helmets without straps	• Training of all personnel • Pre-flight briefings • Load masters at heliports and inside aircraft

Internal cargo transport

Hazard description	Suggested controls
Cargo transport risks: • poorly secured loads inside aircraft • manual lifting and handling • damage to cargo due to incorrect handling • delivery to wrong location, leading to a need for unplanned, extra flights	• Training • Load masters at heliports and inside aircraft • Color coding/labels for destination

Slings and nets, external cargo operations etc

Hazard description	Suggested controls
Slings, nets and baskets or bag catchers are often used for external load operations. Failure of such equipment can result in uncontrolled motion/fall of cargo.	• Selection of appropriate equipment, regular inspection, color code and tag to facilitate inspection. • Training of personnel and load masters: — do not stand on ropes, — do not attach to body or wrap around body parts. — Do not stand under suspended loads, keep from under flight path. — Careful handling of equipment and slings, avoiding damaging these — Take suspect or damaged equipment or slings immediately out of service • House keeping.
• Operation of external cargo, entails risk of: — Falling cargo — Slings may get entangled with rotors — Persons getting entangled or pinched. — Overloading — Entanglement with objects on the ground	• Training • Restrict work to qualified, designated personnel. • Avoid flying over populated areas etc. • Drop long line ahead of landing pad and keep in full sight of pilot. • Avoid/remove objects on the ground with which slings/nets can get entangled

Dangerous cargo

Hazard description	Suggested controls
IATA lists a vast number of 'Dangerous goods' to which restrictions apply. Typical dangerous goods encountered in land Geophysical operations:	• Follow IATA regulations • Training • Load masters at heliports and inside aircraft • Correct packaging.
Explosives: • premature detonation, especially if detonators close to high explosives. • Detonators may be triggered by radio waves, electrical fields, static electricity. • Loss of external load of explosives — risk to 3rd parties — risk to reputation — material must be recovered and this can be difficult.	Select suitable products (non mass detonating detonators, shock proof high explosives etc.) • Carry separately • Detonators inside closed Faraday cages. — Avoid imposing radio silence! — Avoid static build up through: detonators as internal cargo or transport in metal baskets etc. • If transported over water or tidal swamps, consider non floating explosives, which will be easier to recover and will not spread in an uncontrolled manner. Self destructing/decomposing explosives are also preferred.
Batteries	• Consider use of sealed batteries (but with the correct type charger!). • Place in wooden boxes • Ensure batteries are kept upright • Preferably transport as external cargo
Small petrol engines: these often have fixed petrol tank attached to them, which may contain sufficient petrol to cause risk.	• Drain petrol tanks of small engines (generators, chain saws) before transport., especially if carried as internal cargo.
Cement: cement dust can cause serious and acute damage to engine and moving parts	• Package in strong plastic bags and avoid puncturing of these
Raw meat and fish	• Raw meat produced blood, which is a corrosive substance that can damage the aircraft and contaminate other cargo • Package raw meat in sealed plastic bags or containers.
Fuels	Transport as external cargo.

Local activities

Hazard description	Suggested controls
• Noise, nuisance or even scaring local population • Startling cattle • Recreational activities, such as: — Parachute jumping — Ultra light aircraft — Hang gliding — Kite flying	
Errors in Persons on Board administration.	Ensure passenger lists and boarding records are prepared and kept on the ground
Transport of data recorded requires particular attention. Data, be it on paper or some recording medium can easily be damaged beyond repair through rough handling, extreme temperatures or humidity. Data is not only a very valuable cargo, but if lost, the re-acquisition of the data involves further exposure.	• Back up data before transport. • Separate shipment (and storage) of original and back up data. • Waterproof packaging, preferably in floating containers. • Only as internal cargo

Refueling

Hazard description	Suggested controls
• Refueling operations entail the risk of: — Spills — Fire and explosion. — Fuel contamination (water) — Fuelling aircraft with contaminated fuel.	• Sound procedures. • Eliminate all ignition sources, no smoking. • Use non-sparking equipment and ground metallic nozzles before use. • Ground aircraft or at least provide electrical connection between nozzle and aircraft before refueling starts • Use fit for purpose fuel containers, hoses and pumps. • Spill containment equipment.

Static electricity

Hazard description	Suggested controls
• Helicopters and external cargo will build up significant static electricity charges. • Fuelling into tanks can produce static electricity which may then result in sparks, causing fire or explosion.	• Touch down aircraft before boarding/ disembarking • Allow external cargo to touch the ground before handling it. • Specially designed tank inlets. • Grounding of nozzles.

Objects into eyes

Hazard description	Suggested controls
Rotor wash can blow dust and small sharp objects into the face of near by personnel	• Suitable eye protection. • Keep adequate distance. • Eye wash stations.

Annex H – Fatigue management programmes

A documented plan should be implemented for a Fatigue Management Plan (FMP) by the Helicopter Provider. Due to the nature of land seismic and helirig flying, specifically heli-portable operations, pilot workload is high. To adequately address fatigue issues of repetitive lifting operations and multiple landings, it is important that all operators identify areas where crew may need additional guidance to insure adequate rest and thus mitigate against acute and chronic fatigue arising from these types of activities.

A fatigue management plan will help to address these concerns as they relate to the operators specific pilots and engineers. The operator will identify areas where controls need to be implemented or a variance granted to better suit a particular programme, or geographic area, thus allowing greater operational flexibility while still maintaining safety sensitive issues that arise from flight duty/workload and their effects on fatigue. It should be submitted to the Aviation Advisors during operational planning. This plan should include all air crew (both pilots and engineers) and any safety sensitive support crews (fuel truck drivers, loadmasters, etc…)

Fatigue can be defined as increasing difficulty in performing physical or mental activities. Signs of fatigue include tiredness even after sleep, psychological disturbances, loss of energy and inability to concentrate. Fatigue can lead to incidents because pilots and engineers may not be alert and may be less able to respond to changing circumstances. As well as these immediate problems, fatigue can lead to long term health problems.

Acute fatigue is caused by immediate episodes of sleep deprivation, *ie* because of long periods of wakefulness from excessively long shifts which can compound into chronic fatigue (daily, weekly, monthly and in extreme cases annually) without adequate daytime rest.

Ongoing sleep disruption can lead to sleep debt and chronic sleep deprivation, placing individuals in a state of increased risk to themselves, their passengers and the general public. It results in:

- Unpleasant muscular weariness
- Tiredness in everyday activities
- Reduced coordination and alertness

If sleep deprivation continues, work performance can deteriorate even further (chronic fatigue). As a number of helicopter accidents are directly related to human performance issues, establishing an effective fatigue management plan should be a priority.

Causes of fatigue can result from features of the work and workplace and from features of a pilots/engineers life outside work. Levels of work-related fatigue are similar for different individuals performing the same tasks. Work-related fatigue can and should be measured and managed at an organizational level. Non-work related causes vary considerably between individuals. Nonworking related fatigue is best managed at an individual level. This is where training and education programmes should be considered by the Helicopter Provider to further allow personnel to recognize individual symptoms and areas that may contribute to either acute or chronic fatigue outside the work place.

Fatigue management programmes should aim to achieve the following:

- Reduce fatigue and improve the on-duty alertness of pilots, engineers and other safety sensitive positions.
- Reflect the nature of the operations conducted by the company including anticipated and existing conditions.

Programme development: primary steps

Create a Fatigue Management Development Committee, which should include pilots/engineers and management. Helicopter providers should ensure that pilots and engineers are consulted in the development and implementation of fatigue management programmes, including the making of changes to such programmes. The Fatigue Management Plan should address the following:

The inter-related causes of fatigue including:

- The time of day that work takes place
- Stress
- Circadian rhythms
- Sleep debt
- Corporate culture
- Job requirements
- PPE or lack of (adequate hearing protection, comfortable seating, *etc*)
- Exposure
- Individual health
- Nutrition
- Hydration
- Life style choices
- Physical and mental activity
- The length of time spent at work and in work related duties
- The type and duration of a work task and the environment in which it is performed (longline operations require intense levels of concentration for short periods of time)
- The quantity and quality of rest obtained prior to and after a work period
- Activities outside of work, such as second jobs and family commitments and life style
- Individual factors such as sleeping disorders.
- Define programme objectives
- Conduct a needs assessment.

Programme development: core components

- Pre approve tentative schedules to meet operational, environmental, and travel considerations.
- Provide core training as outlined above to all personnel involved or affected by these types of operations.

- Include a fatigue component in incident investigation procedures

Programme development: company specific component

- Build a programme outline that reflects the above initiatives that are within the control of the helicopter provider its clients and contractors.
- Implement controls and counter measures to control identified fatigue risk factors that would be under the control of the Helicopter Provider, its clients and contractors.
- Implement Fatigue Management Programme in consultation with the client Aviation Advisor and Helicopter Provider.
- Evaluate Fatigue Management Programme
  - Plan should be routinely evaluated against current operational needs, personnel changes, environmental changes, or significant changes in normal operations.

Fatigue management Helicopter Provider training programs should consider, but not be limited to, the following:

- The risks associated with this particular form of flying.
- Pilot/Engineer work scheduling practices, including relief arrangements to cover absences.
- Training specific to sleep and its effect on fatigue including nutrition, lifestyle choices, *etc*
- On-the-job alertness strategies,
- Rest environments provided by the employer (*ie* sleeping facilities).
- Work environments, (environmental conditions hot and high, heat, or excessive cold and effects on performance in the cockpit or maintenance facility or lack there of).
- Working under unusual, unpredictable or emergency operating conditions. Working outside of normal flight regimes, operational pressures *ie* weather, environmental constraints, client pressures *etc*.

The FMP should include the above as minimum initiatives throughout the plan. It should combine and utilize appropriate scheduling of crews as well as implementation of fatigue reducing factors such as worksite climate controlled rest facilities, adequately equipped aircraft that enhance pilot comfort and reduce workload to mitigate the associated risks of fatigue.

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- To work on behalf of the world's oil and gas producing companies to promote responsible and profitable operations

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- To represent the interests of oil and gas producing companies to international regulators and legislative bodies
- To liaise with other industry associations globally and provide a forum for sharing experiences, debating emerging issues and establishing common ground to promote cooperation, consistency and effectiveness
- To facilitate continuous improvement in HSE, CSR, engineering and operations

Objectives

- To improve understanding of our industry by being visible, accessible and a reliable source of information
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- To improve the collection, analysis and dissemination of data on HSE performance
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