Introduction

The intent of the formation of the Helicopter Association of Canada Oil & Gas Committee (OGC) is to help further reduce the accident rate outlined by the IHST, and exposure to risk from members actively involved within the Oil & Gas sector in Canada. It is to be a collective voice, mediator and liaison for the Canadian Helicopter Industry and the Oil & Gas Industry as it applies to all Oil & Gas land operations. This document has been developed and endorsed by HAC, CAPP and CAGC and was also produced in consultation and with the support of the OGP, but does not fully meet the requirements of OGP 420 (Helicopter Guidelines for Land Seismic and Helirig Operations) For variations with OGP 420 refer to an OGP member aviation adviser.

For Example:

- All Onshore Land exploration (2010)
- Pipelines Patrols (2011)
- Offshore Operations (2012)

Heli-Portable Seismic or Heli-Assist Seismic operations have become a common methodology used for acquiring seismic data in today’s helicopter Industry.

The technology and practices in the helicopter industry continues to evolve. This has led to the innovations that improve performance and address safety issues.

The purpose of this Best Practice is to establish a minimum guideline for Helicopter supported operations in the Canadian Helicopter industry that will enable companies to operate in a manner that ensures the safety of all personnel and public engaged in these types of operations.

This document will be reviewed every three years or if a significant change in regulations or major incident or accident occurs. It will then be updated by the HAC OGC executive and special advisors.

This document will identify the following:

- Standard Safe Operating Procedures and criteria of helicopter operators engaged in Oil and Gas Land exploration flights.
- Identification of known hazards and mitigations
- Federal, Provincial and Territorial regulations pertaining to Helicopter Operations engaged in Land Seismic Operations
Acknowledgements

The Helicopter Association of Canada would like to thank the OGP, CAPP and the CAGC for the contributions and participation in the development of HAC OIL & GAS LAND EXPLORATION BEST PRACTICES document for Canadian Helicopter operators.

Acknowledgements for participation on the Oil & Gas committee executive established to prepare this Industry Recommend Best Practice are listed below; the individuals company of employment at the time of contribution is also listed:

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DISCLAIMER

The Oil & Gas committee (“OGC”) Best Practices document for Helicopter Operators (the “IBP”) provides guidance to members of the Helicopter Association of Canada (HAC) wishing to establish or adopt best practices for operating in land seismic operations or members from the above mentioned associations who wish to establish similar helicopter operation best practices.

This Guide is not, and is not intended to be, all inclusive.

The Guide sets out in general principle recommended practices for conducting operations in the Oil & Gas Industry, specifically Land seismic.

While every effort has been made to supply accurate and up to date information, the OGC, HAC and their members assume no responsibility for the accuracy, adequacy, or completeness of any information presented in the Guide and assume no responsibility for any errors or omissions, or outcomes resulting directly or indirectly from the use of the Guide.

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<td>RFM</td>
<td>Rotorcraft Flight Manual</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
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<td>RFP</td>
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<td>SAR</td>
<td>Search And Rescue</td>
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<td>SARP</td>
<td>Standards And Recommended Practices</td>
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<td>SARSAT</td>
<td>Search And rescue Satellite-Aided Tracking</td>
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<td>SECOR</td>
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<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
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<td>SMS</td>
<td>Safety Management System(s)</td>
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<td>14-Feb-10</td>
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<td>SOP</td>
<td>Standard Operating Procedure</td>
<td>M. Collins</td>
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<td>SWL</td>
<td>Safe Working Limit</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
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<td>TC</td>
<td>Transport Canada</td>
<td>M. Collins</td>
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<td>Tail Gate Meeting</td>
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<td>UV</td>
<td>Ultra Violet</td>
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<td>14-Feb-10</td>
<td>N/A</td>
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<td>VFR</td>
<td>Visual Flight Regulations</td>
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<td>VHF</td>
<td>Very High Frequency</td>
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<td>VOR</td>
<td>Very High Frequency Omindirectional Range</td>
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<td>Term</td>
<td>Meaning</td>
<td>Modified By</td>
<td>Date Modified</td>
<td>Previous</td>
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<td>-------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------</td>
<td>---------------</td>
<td>----------</td>
</tr>
<tr>
<td>6-S procedure</td>
<td>Features of landing area: Size, Shape, Surrounds, Surface, Slope, Sun and Stinger-placement (humor in 7 Ss)</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Accountable executive</td>
<td>Person responsible, i.e. responsible for operations or activities authorized under the certificate and accountable on their behalf for meeting the requirements of these Regulations according to CARS</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Aviation Advisor</td>
<td>Person who acts for the Prime Contractor to improve aviation safety</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Bag runner</td>
<td>Person who attaches a seismic bag to a remote hook or carousel when the equipment is being retrieved</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Mechanical Bag runner</td>
<td>Device used to manually retrieve a seismic bag manipulated by the pilot.</td>
<td>R. Gallagher</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Brownout</td>
<td>Environmental conditions where airborne (usually from rotor wash) dust/debris prevents the pilot from seeing the ground clearly</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Carousel</td>
<td>Device that attaches to the bottom of a long line that contains multiple remote hooks; each hook can be controlled independently by the pilot</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Class D</td>
<td>Type of external-load operations where living humans are carried</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Compressor wash</td>
<td>Act of cleaning the compressor section of a turbine engine</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Confined area</td>
<td>Type of landing area where the pilot must avoid obstacles during the landing process</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Coordinator</td>
<td>Person coordinating, by radio, all the people and equipment in the field for the purpose of acquiring seismic data</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Crew resource management</td>
<td>Process of utilizing multiple people to operate the helicopter safely and efficiently</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Day VFR</td>
<td>Environmental conditions with sufficient daylight and visibility to use visual reference for safe flight; see Transport Canada’s Airman’s Information Manual section GEN 1.6 for definition of Day (generally 30 minutes before sunrise to 30 min after sunset); see Transport Canada’s Airman’s Information Manual RAC 2.7.3 for VFR weather minima</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Density altitude</td>
<td>Term to describe altitude above sea level factoring effects of temperature and ambient pressure on true altitude</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Drop zone</td>
<td>A cleared or open area surrounding a shot point where the drill and compressor are placed by the helicopter (what about bag drop?)</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Duty day</td>
<td>Period from when a pilot first begins daily flight duties (may include travel) to when the last duties are complete</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Engineer</td>
<td>Aircraft Maintenance Engineer (AME)</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Essential crew</td>
<td>Pilots, engineers, qualified flight navigators and cabin attendants who are required by local regulation or company rules to be aboard for the carriage of passengers</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Final approach and take off</td>
<td>Area surrounding a take off or landing point, usually includes air space around flight paths for final approach and take off phases of flight</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>First limit indicator</td>
<td>A device to show when a first, among several possible, aircraft limitation is reached</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Flight Simulator</td>
<td>Ground based device that utilizes computer simulation for training pilots outside actual helicopter flying, classified according to different levels of fidelity</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Fly camp</td>
<td>Camp with limited physical access where people and material are commonly transported by air</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Ground effect</td>
<td>Term to describe the improved performance of a helicopter when it hovers close to the ground.</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Hazard registry</td>
<td>Collection of hazard names and descriptions</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------</td>
<td>------------</td>
<td>-----------</td>
<td>-----</td>
</tr>
<tr>
<td>Hostile environment</td>
<td>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</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Hover exit</td>
<td>Event when passengers get on or off the helicopter while it is hovering</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Instrument meteorological conditions</td>
<td>Environmental conditions without visibility to use visual reference for safe flight; see Transport Canada's Airman's Information Manual RAC 2.7.3 for VFR weather minima- Instrument Flight conditions are less than VFR minima</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Job Hazard Assessment</td>
<td>Systematic evaluation of risks, especially risks specific to the job in addition to routine risks</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Line oriented flight training</td>
<td>Flight training while the aircraft is working, similar to on-the-job-training</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Long line</td>
<td>Line or cable, usually 30-70 m in length, to connect the helicopter to the external load</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Management of Change</td>
<td>Systematic process of anticipating and mitigating risk caused by a change in operations</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Non-hostile environment</td>
<td>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</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Pilot competency check</td>
<td>Flight and ground exam by helicopter operator employee to ensure candidate performs to standards defined by helicopter operator</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Pilot in command</td>
<td>The pilot responsible for the safe operation of the helicopter, also known as the Aircraft Commander</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Pilot proficiency check</td>
<td>Flight and ground exam by Transport Canada employee, or person representing Transport Canada to ensure candidate performs to standards defined by Transport Canada</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Recording Crew Manager</td>
<td>Person in charge of the Seismic Recording Crew, also known as the Party Manager</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Risk Assessment</td>
<td>A systematic evaluation of risks, usually routine risks and systemic risks associated with seismic activities in general</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Safe working limit</td>
<td>20% above the maximum load of the helicopter's cargo hook</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Tail Gate Meeting</td>
<td>Informal meeting in the field to discuss issues with participants of an activity, traditionally participants would gather around the tail gate of a pick-up truck</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Toe in</td>
<td>Event when passengers get on or off the helicopter, while the helicopter operates at hover power, and only parts of the skids are in contact with the landing area</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Translational lift</td>
<td>Increased (compared to slower flight) lift caused by the helicopter flying through the air; this can be caused by strong wind when the helicopter is hovering</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Vertical reference</td>
<td>Method for a pilot to be oriented while looking down and not seeing a horizontal reference, commonly used when using a long line to move people and material</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Vne</td>
<td>Never-exceed speed</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Whiteout</td>
<td>Environmental conditions where airborne (usually from rotor wash) snow/ice prevents the pilot from seeing the ground clearly; also a condition where snow/ice on the ground blending with overcast weather causes the pilot to lose reference with the ground and, consequently, situational awareness</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
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</tbody>
</table>

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<th>Service</th>
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<td>Seismic Contractor</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
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<td>Helicopter Operator</td>
<td>M. Collins</td>
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<td>Contractor</td>
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<td>Helicopter Provider</td>
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<td>Aircraft Operator</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
<td>N/A</td>
</tr>
<tr>
<td>Owner</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
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<td>Prime</td>
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<tr>
<td>Air Operator</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
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<tr>
<td>Client</td>
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<tr>
<td>Company</td>
<td>M. Collins</td>
<td>14-Feb-10</td>
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</table>
1. **GENERAL**

### 1.1. Introduction

The Helicopter Association of Canada Oil & Gas Committee defers to the OGP maintenance of comprehensive worldwide database of accident statistics covering all aviation activities performed by the Oil and Gas industry, with a specific focus on helicopter operations as well as IHST/JHSAT Canada data.

1.1.1. Periodic review of this database highlights land exploration operations in support as the area that continues to incur the 2nd highest accident rates of all of the roles performed in support of oil and gas exploration and production.

1.1.2. The purpose of this document is to promote effective management of helicopter operations in support of land exploration surveys from front end through drilling and recording 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.

1.1.3. Annex A provides guidance on the general subject of Risk Management and Risk Reduction. In this Annex A the Risk Assessment Matrix (RAM) is defined, 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 or reference to an HAC OGC Committee member.

1.2.2. Throughout this document, three Parties will be assumed to be involved in the operations: the Company, i.e. the owner company that commissions the work, the Geophysical Contractor (contractor), i.e. the seismic contractor that executes the survey and the Helicopter Provider, i.e. the company that provides the helicopter and related personnel under a direct contract with Company or as a sub-contractor to the 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.

### 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 Transport Canada (TC) 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.

### 1.4. Safety Management Systems (SMS)

Transport Canada requires aircraft operators to have Safety Management Systems. The Oil and Gas Industry strongly recommends that Safety Cases be in place, for contracts of duration of more than one year or involving more than 50 flying hours per month the minimum required for any operation is a documented Risk Assessment.
In all, SMS is now being introduced in all related aviation operations, 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 below, while it is expected that more will be developed in due time.

1.5. **Recommended minimum requirement for SMS**

As explained above, the introduction of formal SMS in Canada for aviation matters is in the implementation stage. The recommended minimum elements are to be in place are:

1.5.1 Helicopter Company to have documented systems and plans in place, compliant with TC SMS (March 2009)

1.5.2 ENFORM COR or SECOR may be required on behalf of the Geophysical or contracting companies.

1.5.3 An Aviation Risk Assessment (Annex A) as part of the project plan is to cover all aspects of helicopter support to the operations, in particular it should contain written and procedures agreed by the three Parties, for Safety critical parts of the operations such as:
   a. Flight planning and flight authorization, changes in flight plans.
   b. Passenger transport.
   c. Cargo transport, loading, external load operations.
   d. Refueling operations.
   E. Equipment Standards
   F. Emergency Response Plan

1.5.4 The Project plan can be a document jointly developed and owned by the three Parties. An alternative is that the Project Management Plan is owned by the Seismic Contractor and supplemented by interface documentation, addressing:
   a. Gaps, contradictions or differences between the three systems e.g.:
   b. Standards applicable, which one prevails.
   c. Any activities where more than one Party has to play a role e.g.:
      i. Flight planning.
      ii. Emergency response.
      iii. Provision of fuel, PPE, equipment, training etc.
   iv. Use of equipment for specific tasks – e.g. 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’ organization, the interrelationships and lines of command during the operation. In particular, this must address the roles and responsibilities for the activities listed under b) i through v above.

1.5.5 All aviation and related aspects of the operation to be subject to a formal process of risk management, i.e. Hazard identification register, supported by a mitigation plan, assessment and implementing controls to mitigate and minimize the risks to ALARP. (As Low As Reasonably Practical)

1.5.6 Agreed processes to be followed by all Parties with respect to:
   a. Meeting schedule and communications.
b. Inspections and supervision.
c. Incident reporting and investigation.
d. Management of Change (MOC) Logistic and Field Operations Process
e. Training / Orientation
f. Rules of Engagement/ work procedures
H. Hazard Management

2.0. Risk Assessment

2.1 Formal Risk Assessment

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

2.1.1 Prime Contractor should conduct an initial risk assessment of the project, as outlined in annex A, highlighting helicopter specific hazards addressing the risk present in the operation.

2.1.2 The Helicopter Provider should perform the same risk assessment outlined in annex A. At minimum a helicopter risk assessment shall be completed and documented.

2.1.3 The prime contractor should evaluate the risk assessments provided by the helicopter provider to assess the risk control measures proposed.

2.1.4 The prime contractor and helicopter provider should jointly develop and review a full risk assessment as part of the process of developing a project plan before the start of operations.

2.1.5 During the operations, the site supervisor and onsite helicopter provider or their designate, 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.

2.1.6 Documentation of deviations from agreed accepted risk levels should be identified, written with suitable mitigation measures and acknowledged by the prime contractor and helicopter provider.

Annex A Provides further guidance on the process of risk management.
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 Safety Management System (SMS) of an operation with helicopters.
3.0. Personnel Qualifications, Training and staffing levels

3.1. Flight crew qualifications and experience

It is recommended that Pilots flying on programs have a minimum of 1000 hours PIC flight experience as the Aircraft Commander in helicopters. Should the 1000 hr requirement not be met then a proof of competency shall be demonstrated and documented as below.

3.1.1. It is recommended that additional experience requirements are stipulated for Flight crews as follows:

1. Mountain Experience: A mountain course to demonstrate competency as outlined in section 15.0. If operational flying environment requires operating in mountains terrain.

2. External Load Experience: 300 hrs or demonstrated competency to safe level in vertical reference operations listed below.

* Longline proficiency will be documented in the risk assessment presented to the client during the hazard assessment. Aircrew selection will be based on competency demonstrated and outlined below.

Competency Requirements:

The evaluation of the competencies is left to Operators. The Operator will certify their pilots’ competency and be held accountable to the Customers for discrepancies. The Operators are to develop effective evaluation procedures which clearly demonstrate pilot competency for the required knowledge and skill based on Industry Best Practices.

3.1.2 EXTERNAL LOAD

Aim

Demonstrate a pilots understanding of and competency at External Load operations. Specifically, to develop and evaluate a pilot’s theoretical and practical knowledge of rigging various loads. Also to evaluate practical skills at flying loads with precision placement on long lines utilizing vertical reference. The pilot shall demonstrate the competency for weight/balance control and performance planning.

Long Line / Vertical reference

The helicopter is out of ground effect, line length is 50 ft (15m) or greater, and the primary flight reference is vertical reference.

A test load is to be lifted from the ground without the load being dragged or swung, then flown for a circuit at appropriate airspeed for the load or Vne, then placed back on the ground with in a predetermined area, while maintaining smooth coordinated flight. This exercise must be repeatable on the initial evaluation 4/5 times with a tolerance of + 5ft (1.5m) on the target area, and zero tolerance for load placement velocity. (Gently place load on target)
3.1.3 CLASS D EXTERNAL LOAD

Aim

Demonstrate and evaluate the pilot’s theoretical understanding and practical skill at conducting Class D External Load operations. (As outlined in CARS and per HAC Class D Best Practices)

Industry Best Practice

Pilots shall meet Industry Best Practice for Precision Long Line, Hover Exit, and Mountain Flying. (If applicable). Pilots conducting Class D operations are required to meet the standards prescribed by Operators approved Class D - training program, as outlined in the Company Operations Manual and S.O.P’s if applicable. And, shall comply with, and be competent with all requirements as set out in CAR 702.21, and 722.21 and CASS 722.76, (6), (a) & (c)

- MOC process should be utilized by the prime contractor when class D (HETS) is being planned or considered.

3.1.4 HOVER EXIT

Aim

Ensure competency in Hover Exit operations as outlined in the Operators Company Operations Manual and applicable Customer training procedures manual.

Industry Best Practice

Ensure pilots competency at Hover Emplaning / Deplaning operations on the following while in a 3 ft (0.9m) hover, with one skid in contact with the ground, and with the aircraft toed in, while maintaining smooth coordinated control. Ensure theoretical knowledge of procedures and limitations for Hover Exit operations as set out in Operators Company Operations Manual; in particular fire-crew briefing prior to conducting Hover Exit maneuvers. Ensure competence with all requirements as set out in CAR 702.19, and CASS 722.19. (See Appendix “C”)

3.1.5 CONFINED AREA OPERATIONS

Aim

Determine a pilots understanding and skill in Confined Area Operations, by ensuring competency at confined area reconnaissance, steep approach procedures, precision hover exercises, max performance take off profiles, and rejected take off procedures. Assessment of constructed helipad structures including factors that may result in the rejection of a helipad.

Industry Best Practice

Evaluate accuracy of confined area reconnaissance utilizing the 6 – $ procedures, and eye level pass if applicable. Confirm the pilot uses sound judgment and Pilot Decision making skills during the reconnaissance portion, and evaluate early recognition of main rotor and tail rotor clearance.

Evaluate pilots’ ability at performing a steep approach procedure as outlined in Operators training syllabus, with emphasis on theoretical understanding of Ground Effect and Translational Lift and the effects of each on rotorcraft performance.
Evaluate pilots’ skill at precision hover techniques including turns around the mast, nose, and tail while maintaining smooth coordinated control. Evaluate skills at max performance take off and rejected take off procedures as outlined in the Operators training syllabus.
### 3.1.6 MOUNTAIN FLYING

**Aim**
Demonstrate the pilot’s knowledge and practical skills of flying in mountainous environment, while using sound judgment and ensuring safety of flight.

**Industry Best Practice**
The company certifies the pilot has met the standard for mountain flying in accordance with HAC Mountain Flying Training Guidelines.


### 3.1.7 Minimum Engineering Staffing

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

For remote or heavy maintenance functions further engineering support staff should be considered.
3.2. **Internal training and refresher training by Helicopter Provider**

3.2.1 **Flight crew**

3.2.1.1 Initial and recurrent training is a vital factor in flight safety and must be carried out to ensure that professional standards are set and maintained.

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

3.2.1.3 Where available for the type of aircraft, the Helicopter Provider should establish a simulator training program, using approved Synthetic Training Devices for all Flight crew at a preferred frequency of 12 months and not less than once per 24 months.

3.2.1.4 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.

3.2.1.5 While it is recognized 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 Pilot Decision Making (PDM) for single piloted aircraft, including practice of CRM/PDM 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.

3.2.1.6 Flight crew recurrent training and flight checks will be conducted as per Transport Canada requirements. It is recommended that annual flight training should be a minimum of 5 hours, which can include flight simulators/FTD, to demonstrate PPC/PCC competency.

3.2.1.7 It is recommended that recurrent training include at least the following.

1. **Ground:**
   b). Applicable Transport Canada regulations and changes.
   d). First Aid (not to exceed 3 years).
   e). Fire fighting (not to exceed 3 years).
   f). Aircraft emergency procedures.
   g). Appropriate Geographical Location i.e. Jungle, Mountain, desert and High density altitudes
   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
3.2.1.8 Flight:
   a) Aircraft Emergency Procedures to include:
      i. Low Vis avoidance and recovery from Inadvertent IMC: including recovery from unusual attitude and techniques.
      ii. Role and Environment Specific i.e. brownout and whiteout avoidance and recovery.
   b) Standard Operating Procedures.
   c) Role Specific i.e. vertical reference/long-line.
   d) Confined/Restricted Area Operations.
   e) Environment Specific where applicable i.e. high altitude, jungle, mountain, winter operations

3.2.2 Mechanics/Aircraft maintenance engineers
3.2.2.1 At minimal engineers will attend annual recurrent training program as established by the Helicopter Provider. Recurrent program will included at a minimal the following:
   a) Aircraft Type.
   b) Regulations and Change in Regulations.
   c) Equipment fit, appropriate modifications and support equipment/lifting equipment.
   d) Human Factors. (Not to exceed 2 years)
   e) First aid and fire fighting. (Not to exceed 3 years).
   f) SMS training.
   g) Company Maintenance Manual

3.2.3 Ground crew
3.2.3.1 For the purpose of this section ground crew is defined as: staging personnel, load master, Refueler, co-ordinator, drillers and their helpers, mechanic, Drill and recording staging and line hands (Powder man).
3.2.3.2 This ground personnel may be provided by either the Helicopter Provider or the Contractor. Their training will need to comply with the minimum standards of both companies.
3.2.3.3 Helicopter Ground support personnel should be trained as per the following training criteria and have documented training records to include an initial course and 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.
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.
10. Correct hook-up procedures and use of external cargo equipment.
11. Aviation hazards i.e. 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).
15. Refueling Procedures to include procedures for hot refueling.
16. SMS training.
17. Any additional site specific training.

3.2.4 Radio Operators

3.2.4.1 Radio operators using VHF-AM radios should be trained as per Industry Canada radio operator’s license:

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.
6. Flight following, flight watch.
7. Knowledge of weather, able to receive and retransmit weather reports and forecasts.
3.2.5 Other personnel and visitors on the seismic operations.

3.2.5.1 All personnel involved in the Oil & Gas Exploration 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.

3.2.5.2 All personnel expected to be passenger at some stage of the operation should receive additional briefing 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.

3.2.5.3 Initial briefing will be provided to passengers immediately prior to the first flight. This may be waived for personnel that regularly joins helicopter flights but not to exceed 30 days, but in that case a refresher briefing should be given any time a change in personnel is required.

3.2.6.4 A template for passenger briefing is provided in Annex F.
3.3. Minimum Staffing

3.3.1 Flight crew

3.3.1.1 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.

3.3.1.2 Single/two pilot factors.

For passenger carrying flights in high workload environments, two pilot operations are accepted best practice. However, due to considerations of payload, aircraft performance and pilot resources, proximity to the ground and associated time constraints when conducting vertical reference operations; the use of a single pilot may be proposed subject to a satisfactory risk assessment. Factors taken into account when assessing the risk of using a single pilot includes the following bullets and should be considered as the acceptable requirements when completing the risk assessment:

- Helicopter type
  - Certified for single pilot in country of use.
  - Equipped for single pilot long line and vertical reference operations with remote gauges, load meters, master caution, mirrors, bubble windows or floor windows.
- Remote flight following (AFF Satellite systems preferred)
- Pilot training
  - 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.
  - Annual operational long line/ vertical reference training completed.
  - Annual line check completed in addition to annual check flight.
  - Airborne Decision Making course completed within 2 years by qualified provider or facilitator.
  - Annual Inadvertent IMC training and competency test completed.
- Flight environment
  - Planned and conducted in day, VFR only.
  - Uncongested airspace – likelihood of air collision minimal, including other aircraft on same task. Radio procedures in place for airspace separation.
  - Navigation complexity versus navigation equipment in use.
  - Types and size of landing areas suitable for single pilot crew. No additional lookout required.
- Type of flight. Long transits, particularly those including a point of no return and/or in remote hostile areas (e.g. arctic) should have 2 pilots.
- Fatigue Management
  - Single pilot flight duty hours applied without extension (See section 9.2)
o 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.
3.3.2 **Engineers**

3.3.2.1 A minimum manning policy for maintenance staff shall be established during the planning phase as per table listed sec 3.1

3.3.2.2 For remote operations further engineering staff to be considered.

3.3.3 **Ground personnel**

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

3.3.4 **Radio operator (Flight Watch)**

3.3.4.1 A radio operator to be 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 operations, the helmet should be worn as per the manufacturer's specifications.

4.1.2. Further Task specific PPE recommended for flight crews where appropriate:

1. Fire retardant coveralls.
2. Appropriate hearing protection rated for the noise environment.
3. Suitable footwear.
4. Climate related clothing.
5. Appropriate eye protection
6. Gloves for fueling operations

4.2. **Recommended PPE for Engineers (AME) and Ground crews:**

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

1. Fire retardant coveralls.
2. Suitable footwear, CSA approved safety boots for engineers and other personnel handling heavy suspended 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/hard hats with X pattern on top should be worn by ground personnel for ease of recognition by the pilot and 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

Oil & Gas operations generally demand an aircraft to be operated in the low-level, low-speed regime. 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 provider.

5.1.1. 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 experts.

5.1.2. 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.

ICAO definition of a “safe forced landing”. An “unavoidable landing or ditching with a reasonable expectancy of no injury to persons in the aircraft or on the surface”

5.1.3. 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 met the terms of the risk assessment when being used in hostile environments.

3. Where flying over built up or congested areas cannot be avoided, twin engine aircraft should be considered, capable of meeting the requirement stated in point 5.2.1 below.

5.1.4. Aircraft to be approved and registered with applicable aviation authority i.e. Transport Canada, FAA (NAFTA), CAA, etc...
5.1.5. ICAO Performance Class

**CERTIFICATION - CATEGORISATION OPERATIONS - CLASSIFICATION (ICAO)**

ICAO Annex 6 Part III at amendment 23 took a purist view of performance; either engine failure accountability or the requirement for a safe-forced-landing, were a feature of SARPs in all Performance Classes. Development of performance standards in Europe has resulted in exposure being accepted against a Risk Assessment - this will result in a concomitant amendment to Annex 6 Part III. The description of the ICAO Standard contained in this section relies upon the current (amendment 23 - without exposure) status.

**ICAO Performance Class 1 (PC1)**

Performance Class 1 operations are those with performance such that, in the event of failure of the critical power unit, the helicopter is able to safely continue the flight to an appropriate landing area, unless the failure occurs prior to reaching the Take-Off Decision Point or after passing the Landing Decision Point in which cases the helicopter must be able to land within the designated area.

**ICAO Performance Class 2 (PC2)**

Performance Class 2 operations are those with performance such that, in the event of critical power unit failure, performance is available to enable the helicopter to safely continue the flight, except when the failure occurs early during the take-off manoeuvre or late in the landing manoeuvre, in which cases a forced landing may be required.

**ICAO Performance Class 3 (PC3)**

Performance Class 3 operations are those with performance such that, in the event of a power unit failure at any time during the flight, a forced landing will be required.

**Conditions Affecting PC2 & 3**

ICAO conditions the use of PC 2 and 3 with the following Standard:

“Performance Class 3 helicopters shall only be operated in conditions of weather and light, and over such routes and diversions therefrom, that permit a safe forced landing to be executed in the event of engine failure. The conditions of this paragraph apply also to performance Class 2 helicopters prior to the defined point after take-off and after the defined point before landing.”

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. For operations carrying more than 9 passengers, Performance Class 3 helicopters are not recommended.

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 regularly scheduled 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. and 5.1.7 and 5.1.8 above.

5.3.2. The maximum load permissible should be calculated by referencing HOGE performance charts for that density altitude.

5.4. **Helicopter equipment fit**

5.4.1 **All helicopters used**

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
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**

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

External mirrors, bubble windows or aircraft designed camera, to enable unobstructed view of the cargo hook area.

Operable manual and electrical release (cockpit) and external release (hook).
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.

Remote first limit indicator, remote fire warning and caution lights (long line), within view of the pilot while observing the load, if approved for the aircraft model

Specialized navigation equipment for accurately pinpointing the location of the pickup and drop zones and for accurate flight following.

A load meter which allows the pilot to check the weight of the external load.

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.

5.4.3.1 After any disturbance or dis-assembly 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.

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

5.4.4.1 The Helicopter Provider should have a MEL or MDS for the aircraft type. Where a MEL or MDS is not available, full airworthiness equipment serviceability will be required as it applies to the RFM and CARS

5.4.4.2 The MEL or MDS may allow repair of certain defects to be deferred, while aircraft operation may be continued. Such Deferred Defects should:

Not affect the airworthiness of the helicopter.

Be entered in the aircraft’s technical logbook and deferred defects list.

Be signed off by the Senior Engineer and Pilot-in-Command.

Be reported to the Party Manager and Company on Site Representative, when serviceability of the aircraft is likely to affected

5.5. Helicopter Role equipment – maintenance and inspection

5.5.1. There must be a written program for the maintenance and inspection of slings, cargo hooks, nets and any device involved in lifting of external loads including carrousels and long line tools as outlined in Annex B.

5.6. Helicopter Ground equipment

5.6.1. Ground equipment applicable to the operation and mission (e.g. ground handling equipment, apu, tie downs, compressor washing etc.)
6. **BASE CAMP GROUND INFRASTRUCTURE AND EQUIPMENT REQUIREMENTS**

6.1. **Location**

6.1.1. Where possible, the location of a base camp should allow for the bulk delivery of large quantities of aviation fuel; sites located adjacent to arterial infrastructure such as roads, or rivers navigable by 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 and private 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 familiarization checked on the position of overhead cables and other hazards, with pilots' topographical maps marked accordingly in conjunction with annex A should be posted for ease of use by flight crew.

   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 should be allocated to a logistics planning.

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

6.3. Staging’s

6.3.1 Staging and Camp

Take-offs and landings at staging and 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 formal documented QA procedure to sign off 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 in staging or camp

6.3.2.1 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.

6.3.2.2 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.

6.3.2.3 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 should be clear 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

6.3.3.1 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. Area should be free of mud and snow to allow AME access to underside of helicopter. Dust control along roads accessing parking area or beside parking area, may be considered when necessary.
6.3.4 Staging and Camp lighting

6.3.4.1 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.

6.3.4.2 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 Satellite voice communication, if provided by the flight tracking system can also serve as alternate communication system.

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, e.g. 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.

6.5. Accommodation

6.5.1 Operations office

An operations trailer is recommended for programs. Shelf space for Operations and Flight Manuals should be available. A quiet rest area for Flight crew, with reasonably comfortable seating, should also be provided;

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.
6.5.3 **Sleeping Quarters**

To comply with recognized Flight Time Limitation maxima and to avoid the hazard represented by short-term fatigue, 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 Pilots and Engineers.

Single accommodation consideration should also be given to HETS 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. **HELI-PADS (LZ)**

7.1 Detailed reference for Helipad construction can be found at:

https://www.cagc.ca/_files/practices/pdf/Heliportable_BP.pdf

**THE PILOT HAS THE FINAL DECISION IN ACCEPTING OR REJECTING A LANDING ZONE**
8. AVIATION FUEL MANAGEMENT AND FIRE SAFETY

8.1 Comprehensive guidance on fuel management and fire safety is provided as Annex D. CSA Standard B836-05

9. FLIGHT OPERATIONS SAFETY

9.1. General

9.1.1. A daily planning meeting must be held to discuss the operations. The pilots must 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, road, airports etc.
   3. The seismic program and all prepared landing sites / helipads.
   4. All identified hazards, such as power lines, high towers etc.

9.1.3. This map should be available to the flight crew if a flight tracking system is used, the same map should be used as background on the monitor screen if compatible

9.1.4. 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. Note that adherence to such agreed corridors may eventually reduce search and rescue (SAR) efforts and improve the chances of successful SAR

9.1.5. For all flights, passengers shall be trained in the use of:
   1. Operate doors and cargo hatches, avoiding the need for the pilots to do this.
   2. Insure passenger discipline (Seat belts etc.).
   3. Manage internal cargo.

*Documentation outlining passenger manifests should be available for flight planning. As a minimum this procedure should describe: Who is onboard and where the flight is going within a specified time.

9.2. Performance Planning

9.2.1. As part of the job 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. Performance Planning is 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 those calculations, they 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. It is recommended that a maximum tour length of 21 days followed by a time off period of no less than 14 days is strongly recommended. Variance from this requires a documented Management of Change (MOC) process by the helicopter provider.

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 continuous maximum flight time between rest breaks. A 30 min rest break will reset this period.
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 programs are gaining more and more acceptance in the aviation industry and further guidance on fatigue management programs can be found in Annex H.

9.4. Adverse weather

9.4.1. All operations shall be in strict compliance with the regulatory guidance, and adverse weather procedures taking longline operations 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 500 feet (156 m) and visibility of 1 nautical mile (NM) (1800m) must be utilized as the minimum weather criteria for helicopter operations. This can be verified by using a “Weather Check” flight limited to essential crew.

9.5. Fuel planning

9.5.1. Transport Canada minimum fuel reserves of 20 minutes airtime shall be maintained at all times and are there for emergency use only. Operating regions with limited suitable landing areas or fuel support will require that higher fuel reserves be taken into account during flight planning.

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, 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. 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.

7. 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.

8. 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 such as Dangerous Goods should be prominently displayed at regular passenger check in locations in staging or other.

11. LOAD/CARGO TRANSPORT

Load control

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.
11.1. **External load operation planning factors**

11.1.1. 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, and handling characteristics.

11.2. **Sling special procedures**

11.2.1. Operators must have in place procedures for positioning or detaching the long line whenever the aircraft is shut down. The same procedures should also be used for those situations where the aircraft lands with the line still attached (such as refueling).

11.2.2. To mitigate risk of unintentional departure with a line attached all takeoff procedures should include coming to a stabilized hover 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.

11.2.3. 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.

11.2.4. To mitigate against potential rotor strikes, consideration should be given to adequately provide clearance given terrain restrictions. The length of longline required should be established during the Aviation Risk Assessment (ARA) or by the pilot prior to commencing flight operations.

11.3. **Internal cargo**

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

11.4. **Externally attached Cargo/Utility/Ski basket**

11.4.1. 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 (e.g. small mirror installed on the doorframe).

11.5. **Transportation of Hazardous materials**

11.5.1. 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).

11.5.2. 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.

11.5.3. 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.

11.5.4. Passengers will not be carried in conjunction with explosives.

11.5.5. Explosives and detonators will not be transported internally.
11.5.6. 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).

11.5.7. Provided that the detonators are carried inside approved containers ensuring Faraday cage (type 10 FLY MAG) protection, it is considered safer to continue radio communications and flight following than to impose radio silence.

11.5.8. Bulk high explosives should be carried as external load.

11.5.9. Kerosene lamps/stoves, small petrol engines, chainsaws etc. can not be carried internally with passengers, it is recommended that they be transported in the utility basket.

12. EMERGENCY RESPONSE PROCEDURES

12.1 Responsibilities

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 Prime Contractor 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 i.e. chip-light, hydraulic, low fuel.
7. Medevac and SAR (Search and Rescue) Procedures.
8. Decision/Approval matrix for Medevac and SAR.
10. Means to coordinate with local emergency agencies on location response.
11. Establish roles and responsibilities.
12. Dropped load procedures.
15. Forest Fire Fighting (1 Bambi Buckets min). Reference Owner/Prime fire protection plan.
16. Mutual Aid procedures

12.2. Alternative call out

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 authorities.

12.3 Crash Response
The Owner/Prime will provide crash equipment in the base camp or staging areas, in addition to firefighting equipment. This equipment should be kept in a Heli-portable crash box, suitable for rapid aerial deployment rapid loading or slinging for transport to a remote crash site and should be flyable by the smallest helicopter selected for the job as outlined in the ERP. Crash equipment should include:

1. Fireman type axe
2. Large axe
3. Heavy duty hacksaw with 4 spare blades
4. Grab hook with long handle or 30 meters of 10mm non plastic rope Harness knife with sheath
5. Heavy duty crowbar of 1 meter length
6. 24 inch (61 cm) bolt cutters
7. 2 Pairs flameproof gloves
8. 2 Torches (flashlights) with spare batteries
9. 10 Inch adjustable spanner/wrench
10. 2 Fire blankets
11. Wire cutting pliers
12. 1 Set assorted screwdrivers
13. metal ladder (8 ft minimum)

13. THIRD PARTY CONSIDERATIONS

13.1. 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 (e.g. 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

Requests for assistance

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

The Parties should consider developing a protocol to be used in case emergency assistance needs to be provided to 3rd parties (SAR, Medevac, HETS, and Fire Fighting). The preferred option is for such emergency assistance to be coordinated through and to be requested by the local authorities. i.e RCMP, PEP, etc...
Airborne transport of patients should be subject to qualified medical advice.

**Requests for fuel**

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

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

**Assistance in case of aviation emergency**

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.
HETS (HELIICOPTER EXTERNAL TRANSPORT SYSTEM)

14.1 Helicopter Class D (Rescue) External Loads

702.21 (1) Subject to subsection (2), no air operator shall operate a helicopter to carry a helicopter Class D external load unless

(a) the helicopter is a multi-engined helicopter that meets the transport category engine-isolation requirements of Chapter 529 of the Airworthiness Manual and that is capable of hovering with one engine inoperative at the existing weight and altitude;

(b) The air operator is authorized to do so in its air operator certificate; and

(c) The air operator complies with the Commercial Air Service Standards.

(2) An air operator may operate a helicopter other than a helicopter described in paragraph (1)(a) to carry a helicopter Class D external load if the air operator

(a) is authorized to do so in its air operator certificate; and

(b) Complies with the Commercial Air Service Standards.

722.21 Helicopter Class D External Loads

(1) The standards for authorization to operate a helicopter to carry a Class D helicopter external load are:

(a) The helicopter is equipped to permit direct radio intercommunication among crew members;

(b) The personnel carrying device is airworthiness approved for the carriage of human external loads;

(c) The load is jettisonable if it extends below the landing gear;

(d) The air operator has applicable one engine inoperative performance charts for the operating weight and density altitude at which the Class D external load operation is to be conducted. Performance charts may take account of windspeed providing windspeed is 10 knots or more;

(e) The air operator's Company Operations Manual includes operational requirements, operational procedures and air operator employee qualification and training requirements.

(2) The standards for authorization to operate a helicopter to carry a Class D helicopter external load using a single-engine helicopter or a multi-engine helicopter unable to comply with one engine inoperative requirements are:
(a) Where the load does not extend below the landing gear:

(i) the helicopter is equipped to permit direct electronic or visual communication among crew members;(amended 1998/09/01; previous version)

(ii) The personnel carrying device is airworthiness approved for the carriage of human external loads;

(iii) The helicopter is turbine powered and equipped, where approved for the type, with an auto-ignition system and a detector system to warn flight crew members of excessive ferrous material in the engine(s);

(iv) Only flight crew members and persons essential during flight are carried; and

(v) The air operator’s Company Operations Manual includes operational requirements, operational procedures and air operator employee qualification and training requirements;

(b) Where the load extends below the landing gear:

(i) The helicopter is equipped to permit direct radio intercommunication among crew members;

(ii) The personnel carrying device is airworthiness approved for the carriage of human external loads;

(iii) The load is jettisonable;

(iv) The helicopter is turbine powered and equipped, where approved for the type, with an auto-ignition system and a detector system to warn flight crew members of excessive ferrous material in the engine(s);

(v) Only flight crew members and persons essential during flight are carried;

(vi) Persons are transported externally between geographical points only to the nearest suitable landing site;

(vii) The authorization is for the purpose of law enforcement operations, forest fire suppression operations, urban fire fighting operations or rescue operations;

(viii) the air operator has a formal written agreement from the user of the service and the agreement stipulates that only suitably trained and qualified persons will be assigned; and

(ix) The air operator’s Company Operations Manual includes operational requirements, operational procedures and air operator employee qualification and training requirements.
(3) Authorization may be granted for deviation from the standards of 722.21(1) and (2) for the Production of Commercial Motion Pictures and Television filming provided:

(a) The aircraft is operated within approved limitations;

(b) A coordinated plan for each complete operation is developed;

(c) All persons involved are knowledgeable of equipment to be used and pre-flight briefed; and

(d) Only flight crew members and persons essential during flight are carried.

(4) Where helicopter Class D External Load Operations are to be conducted for the purpose of providing a rescue service the following standards shall apply.

14.1.1 Pilot Experience

Pilots-in-command for rescue service operations shall have achieved:

(i) at least 2,000 hours total helicopter pilot flight time;

(ii) at least 200 hours on the aircraft type which the pilot is to fly on initial assignment to rescue operations and at least 25 hours on types to be used thereafter;

(iii) at least 1,000 hours experience in the operational area if rescue services are to be conducted in Designated Mountainous Areas 1 or 2 as defined in the Designated Airspace Handbook (TP 1820); and

(iv) have completed training for Class D load operations in accordance with section 722.76.

(b) Rescue Service Operations Control
14.2 MOU (Memorandum of Understanding)

A close working relationship is required between the air operator and the emergency response user organization to ensure coordinated proficiency and mission safety. Terms of reference shall be documented in a written agreement and will define the following:

(i) responsibility of pilot-in-command and rescue specialist(s);

(ii) required operational capabilities and scope of operation;

(iii) coordinated rescue mission standard operating procedures;

(iv) mission authorization and control process, including communication procedures; and

(v) coordinated air operator and emergency response user agency training program on at least an annual basis.

722.76 Training Program

(6) Aerial Work Training

(a) Pilot training shall be provided where the aerial work requires particular flight manoeuvres, aircraft performance considerations or knowledge of equipment to safely conduct the operation. Training shall include, as applicable:

(i) training related to contents and requirements of flight manual supplements or airworthiness approvals;

(ii) Pre-flight inspection requirements of aerial work equipment

(iii) Procedures for handling malfunctions and emergencies related to the aerial work equipment;

(iv) Operational preparation procedures related to reconnaissance of aerial work areas before low level flight operations;

(v) Operational restrictions; and

(vi) Flight training and practice in required flight maneuvers.

(c) Training - Class D External Loads

An approved initial and annual recurrent training program is required for pilots assigned to Class D External Load Operations. The training program shall include:

(i) instruction on the applicable flight manual supplement or airworthiness approvals, including
weight and balance calculation procedures, method of loading, rigging and attaching the external load and pre-flight procedures;

(ii) Instruction on operational requirements, including calculation of one engine inoperative performance as applicable, co-ordination communications procedures and operational restrictions;

(iii) steps to be taken before commencing Class D load operations, including flight and ground crew briefings and instructions and pre-flight inspection requirements; and

(iv) Flight training with representative Class D loads including, as applicable to the load attachment configuration:

(A) Precision hovering in and out of ground effect, including vertical reference maneuvering;

(B) Pick-up, departure, approach and delivery of Class D loads;

(C) Simulated emergencies and malfunction procedures with representative Class D loads.
15.0 Mountain Flying Requirements

15.1 Mountain Flying Training Guidelines

The following are the HAC recommended guidelines for Mountain Flying Training. Since operational parameters of mountain flying vary considerably from one operation to another, these guidelines do not purport to be complete nor are they universally applicable.

Individual operators remain responsible for tailoring their company policies and training methodology used to achieve these training objectives, to the experience and aptitude of individual pilots, the type of equipment operated, the prevailing geographical and climatic conditions of the local operational environment and other particulars, proper to each operator and/or the local training environment.

The ensuing training program may be incorporated into the air operator’s operations manual. Also, to facilitate field verification of pilot competency, Chief pilot or his delegate may wish to certify initial and recurrent Mountain Flying Training in the pilot’s log book.

15.1.1 Mountain Flying Initial Training Criteria

Ground School should address:

- Topography and formations
- Weather and wind
- Density altitude vs helicopter performance
- Reconnaissance, approach and departure techniques
  (side hill pads, mountain top sites and operations from ridges)
- Hazards and illusions
- Physiological and psychological factors

15.1.2 Flight Training Competency

- Emergency procedures
- Precision handling techniques
- Confined area operations
- Illusion recognition techniques
- Reconnaissance, approach and departure techniques
  (side hill pads, mountain top sites and operations from ridges)
- Slinging operations
- Wind effects
- Snow operations
- Contour flying
- Density altitude vs helicopter performance
- Reconnaissance, approach and departure techniques
  (side hill pads, mountain top sites and operations from ridges)
- Hazards and illusions
- Physiological and psychological factors
## ANNEX A  RISK ASSESSMENT

### Helicopter Seismic Support Risk Analysis

<table>
<thead>
<tr>
<th>Client</th>
<th>Contact Name</th>
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<tbody>
<tr>
<td>Project Title</td>
<td>Start Date</td>
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<tr>
<td>Location</td>
<td>Est End Date</td>
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<tr>
<td>Aircraft Operator</td>
<td>Contact Name</td>
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<tr>
<td>Total Size (km)</td>
<td>Proposed Aircraft Types</td>
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<td>No. of Section</td>
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</tbody>
</table>

**Scope of Work:**

**Remarks (list any general comments regarding this risk analysis):**
### Support Specifications

1. 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) | 0 |

Special Requirements for this project:

Remarks:
## Operating Conditions

(complete one for each block)

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<thead>
<tr>
<th>Project Name</th>
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<tbody>
<tr>
<td><strong>Weather</strong></td>
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<tr>
<td><strong>Project Name</strong></td>
<td><strong>Prevailing wind Direction</strong></td>
<td><strong>Avg. wind speed (knots)</strong></td>
<td><strong>Mean min temp (°C)</strong></td>
<td><strong>Mean max temp (°C)</strong></td>
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<td><strong>Remarks</strong></td>
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<td><strong>Elevation</strong></td>
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<td><strong>Maximum</strong></td>
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<td><strong>Feet MSL</strong></td>
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<td><strong>Helicopter Main Staging Area</strong></td>
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<td><strong>Location</strong></td>
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<td><strong>Security/Proximity to population centre</strong></td>
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<td><strong>Obstacles and power lines in vicinity</strong></td>
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<td><strong>Size of helicopter landing/parking area</strong></td>
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<td><strong>Surface of landing/parking area (Dust, snow, mud, prepared surface etc)</strong></td>
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<td><strong>Proximity to buildings, fuel storage etc.</strong></td>
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<td><strong>FATO/Rejected take off area size</strong></td>
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<td><strong>Approach and departure lane restrictions and slope</strong></td>
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<td><strong>Helipad lighting and maintenance work lights</strong></td>
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<td><strong>On site maintenance facilities</strong></td>
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<td><strong>Site accommodation</strong></td>
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<td><strong>Crew Sleeping Quarters (Hotel or on site)</strong></td>
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<td><strong>Fuel Supplier Name</strong></td>
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<td><strong>Fuel Storage / Delivery method</strong></td>
<td>(tanker, buried tanks, bladder, drums?)</td>
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<td><strong>Fuel Filtration / Quality Control</strong></td>
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<td><strong>Flight Following System (Satellite/Radio etc)</strong></td>
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<td><strong>Primary and Alternate Communication</strong></td>
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<td>Planned Communication Time interval</td>
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<td><strong>Line Helipads</strong></td>
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</table>

| **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) |   |

<table>
<thead>
<tr>
<th>Terrain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block Name</strong></td>
</tr>
<tr>
<td>Flat ( &lt; 10)</td>
</tr>
<tr>
<td>Gentle (11-50)</td>
</tr>
<tr>
<td>Undulating (51-150)</td>
</tr>
<tr>
<td>Steep (&gt;150)</td>
</tr>
<tr>
<td>Total (must be 100)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>%</strong></td>
</tr>
<tr>
<td>Total Hostile Environment</td>
</tr>
</tbody>
</table>

**Notes:**

The international Civilian Aviation Organization (ICAO) defines a Hostile environment as an environment in which:
1. A safe forced landing cannot be accomplished because the surface is inadequate (Inadequate surface would include moderate & steep slopes and Trees); or

2. The helicopter occupants cannot be adequately protected from 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 landing”: An “unavoidable landing or ditching with a reasonable expectancy of no injury to persons in the aircraft or on the surface.

<table>
<thead>
<tr>
<th>Hazards</th>
<th>None</th>
<th>Few</th>
<th>Moderate</th>
<th>Many</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Powerlines</td>
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<tr>
<td>Towers/Masts</td>
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<tr>
<td>Known bird Activity</td>
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<tr>
<td>Known aircraft activity</td>
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<tr>
<td>Urban areas</td>
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<tr>
<td>Farm houses</td>
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<tr>
<td>Airstrips</td>
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<td>Blasting areas</td>
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<tr>
<td>Restricted/Danger areas</td>
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<tr>
<td>Politically sensitive areas</td>
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<tr>
<td>Other hazards/comments</td>
<td></td>
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</tbody>
</table>


<table>
<thead>
<tr>
<th>Block Name</th>
<th>Aircraft Type</th>
<th>Registration</th>
<th>Expected hours to be flown on task</th>
<th>Total airframe time @ start of task</th>
<th>Engine hours remaining (L/R)</th>
<th>Continuing airworthiness program in place?</th>
<th>Any major components on time extensions?</th>
<th>List major components that will expire during task</th>
<th>Projected maintenance during task</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Number of pilots on each flight</td>
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<tr>
<td>Number of additional crew on each flight</td>
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<tr>
<td>Number of pilots on site</td>
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<tr>
<td>Local security officer/observer required?</td>
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<tr>
<td>Number of maintenance personnel on site</td>
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<tr>
<td>Remarks:</td>
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<tr>
<td>Aircraft Performance Planning</td>
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</tr>
</tbody>
</table>

| 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) | 0 |
| Max take-off weight (lb or kg) | |
| Max fuel load (this figure may exceed capacity) | 0 |
| Planned fuel load (lb or kg) | |
| Take-off weight (OEW + fuel load) (lb or kg) | 0 |
| Transit time to task area (hours - one way) | |
| Fuel burn rate during transit (lb or kg per hour) | |

**HOGE Performance**

<table>
<thead>
<tr>
<th>HOGE available at max intended operating</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOGE at lowest altitude of intended location (Density Alt @ Average Seasonal OAT) (lb or kg)</td>
<td></td>
</tr>
<tr>
<td>HOGE at Mid altitude (ASL) of intended Location (Density Alt @ Average Seasonal OAT) (lb or kg)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>HOGE at Highest altitude (ASL) of intended Location (Density Alt @ Average Seasonal OAT) (lb or kg)</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

**OEI Performance for Twins**

<table>
<thead>
<tr>
<th>OEI HOGE available at max intended operating</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEI HOGE at lowest altitude (Density Altitude @ Avge seasonal OAT)</td>
<td></td>
</tr>
<tr>
<td>OEI HOGE at mid altitude (Density Altitude @ Avge seasonal OAT)</td>
<td>Yes/No</td>
</tr>
<tr>
<td>OEI HOGE at highest altitude (Density Altitude @ Avge seasonal OAT)</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>
### Reserve fuel weight required upon landing (lb or kg)

<table>
<thead>
<tr>
<th>Remarks:</th>
</tr>
</thead>
</table>

**Notes:**

1. 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.
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:

<table>
<thead>
<tr>
<th></th>
<th>Non Hostile Terrain</th>
<th>Hostile Terrain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Engine Helicopter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twin engine without OEI HOGE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Twin engine with OEI HOGE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

Helicopter Type for operation

<table>
<thead>
<tr>
<th>Type</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Hazard not directly related to engine failure (eg. 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**

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

**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**
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.

<table>
<thead>
<tr>
<th>Block Name</th>
<th>Aircraft Type</th>
<th>Severity</th>
<th>Likelihood</th>
<th>Risk Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>0</td>
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</tbody>
</table>
## Risk Matrix

**Risk Assessment Matrix**

<table>
<thead>
<tr>
<th>Probability</th>
<th>5A</th>
<th>10B</th>
<th>15C</th>
<th>20D</th>
<th>25E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has occurred frequently. (Occurs on order of one or more per year and likely to reoccur in within one year) within Operation</td>
<td>5</td>
<td></td>
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<td></td>
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<tr>
<td>Has occurred infrequently. (Occurs on order of less than once per year and is likely to reoccur within 5 years)</td>
<td>4</td>
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<tr>
<td>Or Has happened at the location or more than once per year in operations</td>
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<tr>
<td>Has occurred rarely. (Known to have happened, but a statistically credible frequency cannot be determined)</td>
<td>3</td>
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<tr>
<td>Or Has happen within helicopter industry or more than once within specific theatre of operations</td>
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<tr>
<td>Postulated event. (Has been planned for, and may be possible, but not known to have occurred)</td>
<td>2</td>
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<tr>
<td>Or Heard of in Industry or within similar helicopter operations</td>
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<tr>
<td>Mishap almost impossible</td>
<td>1</td>
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<tr>
<td>Or Never heard of within Industry</td>
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</tbody>
</table>

### Severity

<table>
<thead>
<tr>
<th>Severity Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>No damage or injury or adverse consequences</td>
</tr>
<tr>
<td>2B</td>
<td>Personnel - First aid injury, no disability or lost time.</td>
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<tr>
<td></td>
<td>Public - Minor impact,</td>
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<td>Environment - Contained release.</td>
</tr>
<tr>
<td></td>
<td>Equipment - Minor damage, potential organizational slowdown/ potential downtime.</td>
</tr>
<tr>
<td>3C</td>
<td>Personnel - Lost time injury, no disability.</td>
</tr>
<tr>
<td></td>
<td>Public - Greater than minor impact, loss of confidence/ some injury potential.</td>
</tr>
<tr>
<td></td>
<td>Environment - Small uncontained release.</td>
</tr>
<tr>
<td></td>
<td>Equipment - Minor Damage, leads to organizational slowdown/ minor downtime.</td>
</tr>
<tr>
<td>4D</td>
<td>Personnel - Disability/ Severe injury</td>
</tr>
<tr>
<td></td>
<td>Public - Exposed to a hazard that could or will produce injuries.</td>
</tr>
<tr>
<td></td>
<td>Environment - Moderate to uncontained release.</td>
</tr>
<tr>
<td></td>
<td>Equipment - Major damage, results in major slowdown/ downtime.</td>
</tr>
<tr>
<td>5E</td>
<td>Personnel - Fatal, life threatening.</td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>RISK FACTOR</th>
<th>OPERATION CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-25</td>
<td>Operation <strong>not</strong> to proceed as currently planned. Consultation between Operations Manager or Chief Pilot, Prime OSR, RCM required to significantly amend plans.</td>
</tr>
<tr>
<td>9-16</td>
<td>Operation may proceed upon approval by the Operations Manager or Chief Pilot, Prime OSR, RCM or Aviation Advisor of amendments to current plan or other factors which mitigate identified risks.</td>
</tr>
<tr>
<td>1-9</td>
<td>Operation may proceed as currently planned.</td>
</tr>
</tbody>
</table>
### Methods of Reducing Risk Factors - General Hazards

#### Exposure
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, and 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 program 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 ANY equipment, that 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 (e.g. 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 program 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.

B.7.3 Equipment owner must have a lockout and tag out procedure for defective equipment that is safety critical or being used for flight operations.

B.8 **Load rigging**

**Sling load operations**

One of the features of the helicopter, which sets it aside from other aircraft, is the ability to transport many different types of loads suspended from a cargo hook. This unique transportation method allows the helicopter to deliver cargo where even it cannot land, and to perform highly specialized tasks such as water bucketing, logging, and aerial construction. It is essential that to carry out safe slinging operations, the pilot and ground personnel involved be thoroughly conversant with the techniques required.

For the purpose of this exercise and indeed, for any slinging that you do operationally, carefully select the routes that you will fly to ensure that you do not overfly built-up areas to minimize the danger to persons or property. Your instructor will review with you Sections 602.16 and 602.23 of the Canadian Aviation Regulations prior to the conduct of this exercise.

**13.2. Pre-flight checks**

Prior to conducting any slinging operations you should carry out the following checks in addition to your normal pre-flight inspection:

1. check the cargo hook is correctly fitted and undamaged, and that all suspension, electrical and mechanical cables are secure and there is no evidence of fraying or chafing;

2. check that the normal release mechanism is fully functional by physically checking that the hook opens when the release is activated;

3. check that the emergency release system is functional by physically checking that the hook operates when the emergency release is activated;

4. inspect all slings, straps, and nets for general condition. Frayed and worn equipment could present a hazard in flight. Ensure that the available equipment is capable of safely carrying the weight of the planned load; and
5. inspect your mirror and position it so that you can see comfortably from your seat.

Having satisfied yourself that all helicopter and sling equipment is serviceable, you may brief any ground personnel that you may have assisting you. This type of operation requires a qualified ground crew, appropriated equipment and a good coordination of the team. It is important that you clearly establish what signals you will use during the operation, including the actions of both the ground crew and you, should an emergency occur during the hook-up or load release phases. Standard hand signals to be used during slinging are shown in the following diagram.
All external loads may be categorized as one of: high density, low density or aerodynamic. The high-density load will be stable while the low density will be decidedly unstable; the aerodynamic load may exhibit both characteristics. You should study the load to determine which description best suits it, and then estimate how it will likely fly.
SAFETY PRECAUTIONS

A study of helicopter accidents in Canada will reveal that many are associated with slinging operations. Most are preventable. Plan the slinging you undertake, estimate the flying characteristics of the load, and fly with accuracy and precision. Never let the oscillations of the load reach a magnitude that endangers you and the helicopter; far better to jettison the load than to lose the helicopter. In the event of any emergency in flight jettison the load.

UNUSUAL LOADS

Over the years, you will be asked to sling different loads. In the diagrams below are several ideas, which have worked over the years. Most loads should be comparable to one of the following:

Figure 28-2: Barrel Lifts

Rope barrel slung.
Tow of these can be used to give a load of six barrels.

Swivel
... through eye of short end.

Swivel
Or

Swivel

Drum for small items or water.

Long end over barrel, through loop then back over barrel and...

Wrap rope around twice then through eye of short end.
Figure 28-3: Sling Lifts

Figure 28-4: Sling Lifts

Figure 28-5: Swivel

*Note: Plywood should always be tied in a bundle or the top couple of sheets nailed together, or it may catch the wind and fly apart like a deck of playing cards.
13.3. OPERATIONAL TIPS

Figure 28-6: Swivel

1. **Always** use a swivel.
2. If possible operate from level, large areas.
3. Keep area clear of debris; hats, scarves, tarps, boards, etc.
4. Resist the urge for more speed.
5. Empty barrels are a poor load, FULL barrels are good one.
6. On aerodynamic loads spoil the lift with a tree or barrel.
7. In #6, the heavier the load the better it flies.
9. On approach, control the rate of descent carefully.
10. Plan the best fuel load according to the sling operation.
11. Clear area after delivery of load as quickly as possible; remember the crew on the ground have no protection from the downwash.
Figure 28-7: Wind Vane on Load

Better stability if attached to top of load if possible.

Figure 28-8: Wind Vane on Load

Wrap rope around twice

Figure 28-9: Lifting Pipe

Heavy pipe pivots here

Should be longer than pipe

Swaged eyes with eyelets to allow replacement of ends

Sling to help outside so tension pulls sling tight; hook into topmost pipe
Figure 28-10: Lifting Pallets

- Allows for quick turnaround however some pallets have no overhang so...
- Since nothing is preventing bars from sliding inward, a come along or chain binders must go over load to pull bars outward

Bagged items such as cement must be bound with banding to hold the load together. If limited labour is available, nets may be a better solution.

Figure 28-11: Lifting Poles

- Clove hitch
- Pick up and set down like this
B.9 USE OF SPECIAL EQUIPMENT

Standards Applicable to the Supply of Helicopter-Transportable Seismic Equipment

This standard applies to the suppliers of helicopter-transportable equipment and to the equipment that they supply. This equipment includes all assembled equipment (assemblies) intended to be directly connected to a helicopter or to a lanyard as a sling-load and includes:

1. Automatic bag runners;

2. Geophone bags and associated equipment;

3. Helicopter-portable drills and Compressors;

4. Helicopter-portable power units;

5. Helicopter-portable data acquisition cabinets; dog house and recording shack.

6. Any other equipment related to flight operations that can be connected to a helicopter by hook or lanyard.
This standard is intended to ensure that the equipment supplied is constructed, maintained, repaired and employed in a manner that assures the safe and effective transportation of equipment.

1. The supplier shall, on delivery of the equipment to the project site, provide to the site manager documentary evidence that: Identifies each assembly or major component by a unique identifier; Lists each assembly supplied by its common description and its unique identifier; and is certified by the signature of an authorized representative of the supplier that the equipment supplied is released for service. The name of the authorized person shall be legible, the certification shall be dated and the conditions for continued certification and duration of certification specified.

2. The supplier shall ensure that each assembly remains in serviceable condition during use in accordance with the certification. Where serviceability cannot be assured, the assembly shall be removed from service.

3. The Prime Contractor reserves the right to inspect and audit the methods, systems and procedures employed by the supplier to:
   - Certify supplied equipment;
   - Inspect, maintain and repair any assembly;
   - Manage and control each assembly and its components.

4. The Prime Contractor reserves the right to specify a particular assembly by manufacturer or model and to require the repair or removal from service of any assembly not judged to be suitable for task or not in condition to effectively or safely fulfill any requirement.

   Each bag assembly shall attach a metal ring onto its closure lanyard to facilitate the attachment of the bag assembly to a carousel bag deployment mechanism.

5. All components of a system (the automatic bag runners and bag assemblies are examples of a system) shall be comprised of compatible components. Where assemblies are employed in combination, no combination of assemblies shall impair the operation of the system.

6. The supplier shall, on request, provide documentary evidence that the supplied equipment is capable of safely and effectively fulfilling its function.
<table>
<thead>
<tr>
<th>ANNEX C</th>
<th>FIRE SAFETY</th>
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<tbody>
<tr>
<td>C 1</td>
<td>GENERAL</td>
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<tr>
<td>C.1.1</td>
<td>As per Transport Canada ASC 2006-029 the use of CSA B836-05 is to be used.</td>
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ANNEX D  FUEL MANAGEMENT

D.1  GENERAL

D.1.1  As per Transport Canada ASC 2006-029 the use of CSA B836-05 is to be used.
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 & Controls:
   
   __________________________________________________________

THOSE IN ATTENDANCE / FLIGHT MANIFEST (Those flying CHECK BOX next to name) ✔

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OGC IBP | Revision Date: Feb 2010 DRAFT
<table>
<thead>
<tr>
<th>Weight and Balance control</th>
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<tr>
<td>Actual Passenger weight TOTAL:</td>
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<td>Weight/Balance OK:</td>
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OGC IBP | Revision Date: Feb 2010 DRAFT
ANNEX F LINE HELIPAD DIAGRAM AND CONSIDERATIONS

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

TREES

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 2 x total length of helicopter including rotor blades or 35m, whichever is greater

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.
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.

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 updraught 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. The helicopter pilot and or provider should be consulted during Heli-pad construction.

LINE HELIPADS IN FOREST 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...

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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 ‘anything with a potential to cause harm’.

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.

A  ENVIRONMENTAL HAZARDS & SUGGESTED CONTROLS

Weather

<table>
<thead>
<tr>
<th>Hazard description</th>
<th>Suggested controls</th>
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<tbody>
<tr>
<td>Adverse weather conditions that may affect helicopter operations include:</td>
<td>Plan operations taking into account prevailing weather conditions and the extremes that can be expected in the course of the operations.</td>
</tr>
<tr>
<td>• Low clouds, fog, rain or snow reducing visibility, risk of:</td>
<td>Ensure availability of regular, reliable weather forecasts and advanced warning system for adverse conditions.</td>
</tr>
<tr>
<td>o Collision with obstacles.</td>
<td>Avoid weather conditions that are outside the operating envelope of the aircraft in use. Availability and map of emergency landing locations.</td>
</tr>
<tr>
<td>• Freezing temperatures that may result in:</td>
<td>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.</td>
</tr>
<tr>
<td>o slippery walkways,</td>
<td>Avoid presence of personnel at edge of helipads cut in jungle, as trees may fall inwards. Place camps, shelters etc well inside the forest.</td>
</tr>
<tr>
<td>o ice accumulation on the aircraft.</td>
<td>Keep landing pad at least one tree height away from tree line.</td>
</tr>
<tr>
<td>o ice accumulation can also be the cause of breaking antenna wires etc.</td>
<td>Minimize flying below tree line.</td>
</tr>
<tr>
<td>o adversely affect engine performance (failure to start).</td>
<td>Avoid dry dusty helipads, spray with water or treat/cover otherwise.</td>
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<tr>
<td>• Strong winds, especially around hilltop helipads can:</td>
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</tr>
<tr>
<td>o Affect the flight path of the helicopter.</td>
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<tr>
<td>o Cause trees at edges of forest (helipads, rivers etc)</td>
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<tr>
<td>to fall.</td>
<td>Housekeeping: no loose light materials near helipad or flight path.</td>
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<tr>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td>- Cause dust or light objects in the air (FOD)</td>
<td>Take into account when positioning helipads and related direction of approach path.</td>
</tr>
<tr>
<td>- Glare from low or reflected sun:</td>
<td>Avoid strongly reflecting surfaces near landing locations</td>
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<tr>
<td>- Can be blinding to pilot</td>
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<tr>
<td>- May make a helipad difficult to locate</td>
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## Lightning

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

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<thead>
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<th>Hazard description</th>
<th>Suggested controls</th>
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<tbody>
<tr>
<td>Turbulence may occur during hot weather or in unstable clouds.</td>
<td>Monitor weather, avoid flying through unstable cloud cover.</td>
</tr>
<tr>
<td>Generally more pronounced near the ground (“low altitude turbulence”).</td>
<td>In hot areas, give preference to flying early in the day</td>
</tr>
<tr>
<td>Risk of:</td>
<td>Avoid low altitude flying during hot periods of the day</td>
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<tr>
<td>- Injury to pilot or passengers</td>
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<tr>
<td>- Damage to aircraft</td>
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<tr>
<td>- Loosing external cargo</td>
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<tr>
<td>- airsickness</td>
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## Tides, waves, flooding

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

<table>
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<tr>
<th>Hazard description</th>
<th>Suggested controls</th>
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</thead>
</table>
| 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

<table>
<thead>
<tr>
<th>Hazard description</th>
<th>Suggested controls</th>
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</table>
| Birds in flight, risk of collision | 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 |
| • Snakes  
• Scorpions  
• Insects  
• African bees | Common protective measures against insects.  
Eliminate bee hives.  
Avoid cargo being put on bare ground, use elevated platforms |
| Noise may disturb wildlife | Avoid overflying protected areas etc. |
### B OPERATIONAL HAZARDS & SUGGESTED CONTROLS

#### Operating envelope

<table>
<thead>
<tr>
<th>Hazard description</th>
<th>Suggested controls</th>
</tr>
</thead>
</table>
| 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 “improvisation” and unplanned, ill-considered use.  
Develop Manual of Permitted Operations  
Develop load tables as function of temperature and altitude |

#### Aircraft integrity

<table>
<thead>
<tr>
<th>Hazard description</th>
<th>Suggested controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical failure</td>
<td></td>
</tr>
</tbody>
</table>
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.  
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. |
| Foreign Object Damage (FOD) |  
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.  
Provide map of obstacles, such as power lines and |
| Collision with obstacles.  
  - Higher ground or obstacles near landing point |
<table>
<thead>
<tr>
<th>Hazard description</th>
<th>Suggested controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passenger transport risks:</td>
<td>Training of all personnel</td>
</tr>
<tr>
<td>walking into (tail) rotor</td>
<td>Pre-flight briefings</td>
</tr>
<tr>
<td>carrying objects that may damage rotors or aircraft</td>
<td>Load masters at heliports and inside aircraft</td>
</tr>
<tr>
<td>boarding or disembarking at wrong moment</td>
<td></td>
</tr>
<tr>
<td>incorrect behavior inside aircraft</td>
<td></td>
</tr>
<tr>
<td>entanglement with skids</td>
<td></td>
</tr>
<tr>
<td>delivery to wrong location, leading to a need for</td>
<td></td>
</tr>
<tr>
<td>unplanned, extra flights</td>
<td></td>
</tr>
<tr>
<td>Loose clothing, helmets without straps</td>
<td></td>
</tr>
<tr>
<td>Cargo transport risks:</td>
<td>Training</td>
</tr>
<tr>
<td>poorly secured loads inside aircraft</td>
<td>Load masters at heliports and inside aircraft</td>
</tr>
<tr>
<td>manual lifting and handling</td>
<td>Color coding / labels for destination</td>
</tr>
<tr>
<td>damage to cargo due to incorrect handling</td>
<td></td>
</tr>
<tr>
<td>delivery to wrong location, leading to a need for</td>
<td></td>
</tr>
<tr>
<td>unplanned, extra flights</td>
<td></td>
</tr>
</tbody>
</table>

---

**Passenger transport**

**Hazard description**

- Overhead power lines, antennas
- High buildings
- Terrain
- Other aircraft
- 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.)

**Internal cargo transport**

**Hazard description**

- Delivery 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

**Suggested controls**

- Training
- Load masters at heliports and inside aircraft
- Color coding / labels for destination
### Slings and nets, external cargo operations etc

<table>
<thead>
<tr>
<th>Hazard description</th>
<th>Suggested controls</th>
</tr>
</thead>
</table>
| 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 |
| **Operation of external cargo, entails risk of:**                                  | 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 |
<table>
<thead>
<tr>
<th><strong>Dangerous cargo</strong></th>
<th><strong>Suggested controls</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hazard description</strong></td>
<td><strong>Suggested controls</strong></td>
</tr>
<tr>
<td>IATA lists a vast number of “Dangerous goods” to which restrictions apply.</td>
<td>Follow IATA regulations</td>
</tr>
<tr>
<td></td>
<td>Training</td>
</tr>
<tr>
<td></td>
<td>Load masters at heliports and inside aircraft</td>
</tr>
<tr>
<td></td>
<td>Correct packaging.</td>
</tr>
<tr>
<td><strong>Typical Dangerous goods encountered in land Geophysical operations:</strong></td>
<td></td>
</tr>
<tr>
<td>Explosives:</td>
<td>Select suitable products (non mass detonating detonators, shock proof high explosives etc.)</td>
</tr>
<tr>
<td>1. premature detonation, especially if detonators close to high explosives.</td>
<td>1. Carry separately</td>
</tr>
<tr>
<td>2. Detonators may be triggered by radio waves, electrical fields, static electricity.</td>
<td>2. Detonators inside closed Faraday cages.</td>
</tr>
<tr>
<td>3. Loss of external load of explosives</td>
<td>• Avoid imposing radio silence!</td>
</tr>
<tr>
<td>o risk to 3rd parties</td>
<td>• Avoid static build up through: detonators as internal cargo or transport in metal baskets etc.</td>
</tr>
<tr>
<td>o risk to reputation</td>
<td>3. 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.</td>
</tr>
<tr>
<td>o material must be recovered and this can be difficult.</td>
<td></td>
</tr>
<tr>
<td><strong>Batteries</strong></td>
<td>Consider use of sealed batteries (but with the correct type charger!).</td>
</tr>
<tr>
<td></td>
<td>Place in wooden boxes</td>
</tr>
<tr>
<td></td>
<td>Ensure batteries are kept upright</td>
</tr>
<tr>
<td></td>
<td>Preferably transport as external cargo</td>
</tr>
<tr>
<td><strong>Small petrol engines:</strong></td>
<td>Drain petrol tanks of small engines (generators, chain saws) before transport., especially if carried as internal cargo.</td>
</tr>
<tr>
<td>These often have fixed petrol tank attached to them, which may contain sufficient petrol to cause risk.</td>
<td></td>
</tr>
<tr>
<td><strong>Cement:</strong></td>
<td>Package in strong plastic bags and avoid puncturing of these</td>
</tr>
<tr>
<td>Cement dust can cause serious and acute damage to engine and moving parts</td>
<td></td>
</tr>
<tr>
<td><strong>Raw meat and fish</strong></td>
<td>Package raw meat in sealed plastic bags or containers.</td>
</tr>
<tr>
<td>Raw meat produced blood, which is a corrosive substance that can damage the aircraft and contaminate other cargo</td>
<td></td>
</tr>
<tr>
<td>Fuels</td>
<td>Transport as external cargo.</td>
</tr>
</tbody>
</table>
### Local activities

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

### Refueling

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

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

### Objects into eyes

<table>
<thead>
<tr>
<th>Hazard description</th>
<th>Suggested controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotor wash can blow dust and small sharp objects into the face of near by personnel.</td>
<td>• Suitable eye protection.</td>
</tr>
<tr>
<td></td>
<td>• keep adequate distance.</td>
</tr>
<tr>
<td></td>
<td>Eye wash stations.</td>
</tr>
</tbody>
</table>
ANNEX H  FATIGUE MANAGEMENT PROGRAMS

As per Transport Canada:

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 program, 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, i.e. 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; and
- 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 programs 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 programs 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.

Program 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 programs, including the making of changes to such programs. 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

Define program objectives

Conduct a needs assessment.

Program 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

Program Development: Company Specific Component

Build a program 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 Program

In consultation with the client Aviation Advisor and Helicopter Provider.

Evaluate Fatigue management Program

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 (i.e. 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 i.e. 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.
ANNEX I AVIATION SERVICES CONTRACT

In attempt to formalize and table expectations for Aviation Services, A Template has been made available to allow the Prime, Geophysical Contactor and the helicopter operator to submit a Request for Proposal (RFP) where cost breakdown and expectations are clearly defined.

Still in Process; to be added at a later date.