FLIGHT SAFETY FOUNDATION

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Basic Aviation Risk Standard

Utility and Energy Implementation Guidelines

Version 3, November 2024

Benefactor BARS Member Organizations

BARS Member Organizations

"Awareness and understanding of risk, whatever the task, is everybody's responsibility. Within aviation activities, it is vital that all personnel understand the critical control management of major risks involved within the task. It is only by mitigating those risks, that we can achieve safer operations."

Hassan Shahidi, President and CEO, Flight Safety Foundation

Contents

Glossary of Terms and Abbreviations

Term	Definition
Above Ground Level (AGL)	The height above the natural ground level within a 50 ft radius of the aircraft position at any point over the Earth.
Above Mean Sea Level (AMSL)	The height above a datum based on the average sea level around the Earth.
Accountability	The obligation or willingness to accept responsibility for the execution or performance of an assigned function, duty, task or action; implies being answerable (i.e. accountable) to a higher authority for ensuring such responsibility is executed or performed. May also be a performance requirement (e.g. Single-engine Accountability).
ACMI	Aircraft Crew Maintenance and Insurance.
ADF	Automatic Direction Finder.
AELTS	Aviation English Language Test Services.
Aerial Work	A commercial aircraft operation by aeroplanes or helicopters where they are used for specialized services and does not carry passengers.
Aeronautical Decision Making (ADM)	ADM is a structured process to assist a pilot with the recognition and management of threats as they may arise during flight.
AFM	Aircraft Flight Manual.
Air Transport Pilot Licence (ATPL)	An ATPL is the highest category of pilot licence. It is issued by a responsible regulatory authority and authorizes the user to act as Pilot-in-Command of scheduled passenger carrying services.
Airborne Collision Avoidance System (ACAS)	Also known as TCAS. A system utilizing interrogations of, and replies from, airborne radar beacon transponders and provides information to the pilot: • TCAS I will provide traffic advisories to the pilot; and • TCAS II will provide traffic advisories and resolution advisories in the vertical plane to the pilot.
Aircraft Movement Area	That part of an aerodrome to be used for the takeoff, landing and taxiing of aircraft, consisting of the runways, taxiways and the apron(s).
Aircraft Operator	Refers to an aircraft operating company used to provide aviation services.
AMO	Approved Maintenance Organization.
AOC	Air Operator's Certificate.
Approach and Landing Accident Reduction (ALAR)	A toolkit developed by the Flight Safety Foundation in conjunction with industry to assist with flight crew training for the prevention of accidents in this category.
ASI	Air Speed Indicator.

Term	Definition
ASZ	Aerial Surveillance Zone
ARZ	Aerial Restricted Zone
Automatic Flight Control System (AFCS)	The AFCS is a system that integrates the flight director with the Autopilot systems.
ATC	Air Traffic Control.
Automatic Dependent Surveillance Broadcast (ADS-B)	ADS-B works by broadcasting information about an aircraft's GPS location, altitude, ground speed and other data to ground stations and other aircraft. Air traffic control and properly equipped aircraft can immediately receive this information. 'ADS-B In' is the receiver part of the system. It allows properly equipped aircraft to receive and interpret other aircraft's 'ADS-B Out' data.
Automatic Weather Observation System (AWOS)	An AWOS is a set of systems designed to autonomously collect meteorological information and transmit this information on a local frequency and/or transmit this data to another location for collection and collation.
Autopilot (AP)	A system designed to allow the aircraft to be flown without the continuous intervention of the pilot.
Auxiliary Power Unit (APU)	A small gas turbine engine which is normally used to provide air conditioning, electrical and hydraulic pressure. The APU also provides high pressure air or electrical power to start the engines. Most APUs can also be used in-flight to provide back-up electrical power in the event of an engine failure.
Baggage	Personal property of a passenger or crew member loaded on an aircraft.
Basic Aviation Risk Standard (BARS)	The Program managed by the Flight Safety Foundation on behalf of subscriber BARS Member Organizations.
BIG	BARS Implementation Guidelines.
BMO	BARS Member Organization.
BPO	BARS Program Office.
Bridging Document	A document agreed to between the contracting company and the aircraft operator listing key personnel and contact details of both parties.
CAA	Civil Aviation Authority.
Cargo	Revenue and non-revenue movement of goods or property not including accompanied baggage or mail. Company material (COMAT) is considered to be cargo.
CBT	Competency Based Training.
Center of Gravity (CofG)	An imaginary point where the total weight of the aircraft appears to be concentrated. The center of gravity changes according to fuel, passenger and cargo load within various locations of the aircraft.

Term	Definition
Certified Safe Working Load	The manufacturer's recommended maximum weight load for a line, rope, crane or any other lifting device or component of a lifting device. The SWL is determined by dividing the minimum breaking strength (MBS) of a component by a safety factor assigned to that type and use of equipment.
Clearway	An area beyond the takeoff area clear of fixed obstacles.
CMT	Critical Maintenance Task.
Cockpit Voice Recorder (CVR)	A device designed to capture and record voice and other sounds heard within the cockpit of an aircraft.
Cold Weather Environment	Operations on the ground in freezing conditions where surface snow, ice, standing water or slush may be ingested by the engines or freeze on engines, nacelles, airframe or engine sensor probes.
Commercial Pilot Licence (CPL)	A licence issued by the responsible regulatory authority of a country to permit the pilot to undertake flying activities for hire or reward.
Company	Refers to the individual company using the BARS to support their aviation operations.
Competent Aviation Specialist	A company designated aviation advisor or Flight Safety Foundation BARS accredited auditor.
Control	Within the context of risk management: one or more activities within a system designed to reduce the likelihood or impact of a threat or error.
Controlled Flight Into Terrain/Water (CFIT/W)	An accident where an airworthy aircraft is flown into the ground or water.
Crew Resource Management (CRM)	A training course undertaken by flight crew, often involving cabin crew, focusing on crew coordination, human factors and leadership training.
CRFS	Crash Resistant Fuel System.
Crotch Strap Designs	One or more straps incorporated into the life jacket design to prevent the life jacket from riding up the body and over the head of the wearer upon entry to the water.
Dangerous Goods (DG)	Articles or substances which are capable of posing a risk to health, safety, property or the environment and which are shown in the list of dangerous goods in the Technical Instructions, or which are classified according to those instructions.
Defence	Within the context of risk management: one or more activities within a system designed to mitigate the consequences of a threat or error.
Deferred Defects	Operation of the aircraft with specified unserviceable systems or equipment under certain flight conditions or operating limitations for a defined period.

Term	Definition
Distance Measuring Equipment (DME)	A navigation aid that provides information relating to slant range distance from the aircraft to the DME aid.
Duty Time	A period which starts when a flight crew member or cabin crew member is required by an operator to report for or commence a duty and ends when the person is free from all duties.
Emergency Locator Transmitter (ELT)	A generic term describing equipment which broadcast distinctive signals on designated frequencies and, depending on application, may be automatically activated on impact or be manually activated.
Emergency Response Plan (ERP)	A documented plan for systematic activities following an accident outlining the actions and responsible persons.
External Loads	A load that is carried or extends outside the aircraft fuselage. Normally related to helicopters carrying loads on flexible sling equipment from an external hook arrangement.
Fatigue Management Program	A data driven means of continuously monitoring and managing fatigue-related safety risks, based on scientific principles and knowledge as well as operational experience, that aims to ensure relevant personnel are performing at adequate levels of alertness.
FAA	Federal Aviation Authority (USA).
Fixed reserve	The amount of fuel calculated using the estimated landing weight at the destination or destination alternate, to hold for a specified time (normally 30 or 45 minutes) at 1,500 feet above airfield elevation in standard conditions.
FLI	First Limit Indicator.
Flight Crew	A licenced crew member charged with duties essential to the operation of an aircraft during a flight duty period.
Flight Data Monitoring (FDM)	Also known as FOQA. A means of capturing and analyzing data obtained during a flight, or series of flights, to aid in the identification of undesirable operational trends.
Flight Following	A system of monitoring the movement of, and providing communication to, an aircraft for the full duration of the flight.
Flight Data Recorder (FDR)	A device that records specific aircraft performance parameters. Also known as a Digital Flight Data Recorder (DFDR) or 'black box' the unit is painted bright orange in color to aid in identification.
Flight Operations Quality Assurance (FOQA)	Also known as FDM. A means of capturing and analyzing data obtained during a flight, or series of flights, to aid in the identification of undesirable trends to prevent accidents.

Term	Definition
Flight Time	The total time from the moment the airplane first moves for the purpose of taking off until the moment it finally comes to rest at the end of a flight. For a helicopter this is from the moment the rotor blades start turning until the moment the helicopter comes to rest at the end of the flight and the rotor blades are stopped.
FSTD	Flight Simulation Training Devices.
GA	General Aviation.
Geophysical Operations	Aerial survey operations using either fixed wing or rotary wing aircraft with fixed or towed array sensor equipment.
Global Positioning System (GPS)	A space-based satellite navigation system providing time and location information on or near the Earth.
Go-Around	A missed or baulked approach whereby the approach to land is discontinued and the aircraft climbs to a safe height in order to re-attempt the approach and landing.
Health and Usage Monitoring System (HUMS)	A system designed to perform a diagnostic and prognostic role of critical components through the gathering of data using a variety of sensors.
HEC	Human External Cargo.
Helicopter Landing Site (HLS)	An area of land or water, or an area on a structure on land, intended for use wholly or partly for the arrival or departure of helicopters. HLS are often referred to as helipads.
High Frequency (HF)	A radio communication system utilizing frequencies within the HF radio band.
HISL	High Intensity Strobe Lights.
HOGE	Hover Out of Ground Effect.
Hoist Operations	Winching or lifting of personnel or equipment to or from a helicopter in the hover.
Hostile Environment	An environment in which a successful emergency landing cannot be assured, or the occupants of the aircraft cannot be adequately protected from the elements, or search and rescue response/capability cannot be provided consistent with the anticipated exposure.
Hot Refueling	The conduct of refueling the aircraft (or helicopter) with one or more main engines running.
HUET	Helicopter Underwater Escape Training.
Human Factors	Principles which apply to aeronautical design, certification, training, operations and maintenance which seek safe interface between the human and other system components by proper consideration to human performance.
ICA	Instructions for Continued Airworthiness.

Term	Definition
Instrument Flight Rules (IFR)	A set of regulations under which a pilot operates an aircraft in weather conditions unfavorable to flight by reference to terrain or water. En route navigation aids are used in lieu of visual references.
Instrument Landing System (ILS)	An electronic system providing precise slope and directional guidance to an aircraft conducting an approach to an aerodrome in IMC conditions.
International Air Transport Association (IATA)	An international association representing the interests of commercial air carriers.
International Civil Aviation Organization (ICAO)	An international body that is a part of the United Nations which establishes Standards and Recommended Practices (SARPS). These SARPS are the basis of the aviation regulations adopted by Member States.
Last Light	The end of civil twilight. See night flying definition.
LDP	Landing Decision Point.
Lifting Devices	The line, swivel, shackles, D-rings, straps, nets, baskets, welded lifting lugs, bags and anything used to secure or support an external load.
Line Check	A regular check flight where the pilot demonstrates knowledge and experience in normal line operations.
Long Line	External Load operations utilizing a cable greater than 50ft (15.2m).
Long-term Contract	Any contract using dedicated aircraft for a planned duration of greater than six months.
Lowest Safe Altitude (LSALT)	An altitude that is at least 1,000 feet above the highest terrain or obstacle within a defined area or region.
Medevac	Medical Evacuation (Medevac) is a specific flight for the purpose of retrieving a patient in medical distress from injury or illness.
METS	Modular Egress Training Simulator.
Minimum Equipment List (MEL)	A list which provides for the operation of aircraft (subject to specified conditions, with particular equipment inoperative) prepared by an operator in compliance with, or more restrictive than, the Master MEL established for the aircraft type.
Missed Approach Point (MAP)	During the conduct of an instrument approach, the MAP is the latest point at which a pilot must conduct a missed approach if they do not become visual with reference to the aerodrome.
MSD	Minimum Separation Distance
MWD	Maximum Work Distance
NDB	Non-Directional Beacon.

Term	Definition
Night Flying	Flight operations during the hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise, as may be prescribed by the responsible regulatory authority.
Night Visual Flight Rules (NVFR)	A set of regulations under which a pilot operates an aircraft in weather conditions favorable to flight by reference to terrain or water at night.
Non-hostile Environment	An environment in which a successful emergency landing can be reasonably assured, 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.
OEM	Original Equipment Manufacturer.
Official Sunset	The time that the surface of the sun disappears below the horizon.
One Engine Inoperative (OEI)	In relation to a multi-engine aircraft, the failure of an engine results in a thrust imbalance with performance degradation.
Operations Manual (OM)	A manual containing procedures, instructions and guidance for use by operational personnel in the execution of their duties.
OPGW	Optical Ground Wire.
ORA	Operational Risk Assessment.
PAPI	Precision Approach Path Indicator.
PCDS	Personnel Carrying Device System.
Personal Locator Beacon (PLB)	Similar in role and function to the ELT and EPIRB, the PLB is a small, hand-held emergency beacon normally carried in either a flight crew vest or otherwise on the person.
Personal Protective Equipment (PPE)	Equipment worn or carried by the person to provide protection from natural or man-made environmental or other factors.
Pilot-in-Command (PIC)	The pilot designated by the aircraft operator as being in command and charged with the safe conduct of the flight.
POH	Pilot Operating Handbook.
Proficiency Check	A regular check flight where the pilot demonstrates competence in normal, non-normal and emergency procedures.
Pulse Lights	A modification for existing landing light/taxi light systems for aircraft which varies the intensity of the lights in a predetermined sequence to improve collision and bird avoidance.
Quality Assurance	A set of activities that are carried out to set standards to monitor and improve performance so that the service or product provided will satisfy stated or implied needs.

Term	Definition
Responsible Regulatory Authority	The authority of a country designated to manage and oversee compliance and safety of civil aviation.
Risk Assessment	A systematic and documented process of identifying risks and mitigating actions associated with a particular activity.
Rotor Running Load/ Unload	Loading or unloading of passengers or cargo/baggage with the helicopter main engines operating.
Route Check	A regular check flight where the pilot demonstrates knowledge and experience in an area or route and its airports.
RPAS	Remotely Piloted Aircraft System.
Safety Management System (SMS)	A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.
Search and Rescue (SAR)	The search for and provision of aid to people who are in distress or imminent danger.
Seat Belt Extensions	Any method of extending the physical length of the seat belt.
Shackles	A ring or device used to connect the load (line) to the hook (helicopter).
Short Line	External Load operations utilizing a cable less than 50ft (15.2m) and shorter than the distance from the hook to tail rotor.
SoM	System of Maintenance.
SOP	Standard Operating Procedure.
Special VFR Procedures (SVFR)	Meteorological conditions that are less than those required for basic VFR flight in controlled airspace and in which some aircraft are permitted flight under visual flight rules.
Standard	Standard means the Basic Aviation Risk Standard as issued by the Flight Safety Foundation.
Stop Way	An area beyond the takeoff runway able to support the airplane during a rejected takeoff without causing structural damage to the airplane, and designated by the airport authority for use in decelerating the airplane during a rejected takeoff.
Strobe Lights	One or more flashing lights in aviation red or aviation white fitted to the aircraft as part of the aircraft navigation light system.
Sub Chartering (Cross Hiring)	The temporary use by the aircraft operator, of aircraft and/or crew from a different AOC holder to that which holds a contract for the provision of aviation services. Other terms such as Wet Leasing, ACMI are included in this definition.

Term	Definition
Supplementary Type Certificate (STC)	A certificate issue approving the modification to an aircraft.
TDP	Takeoff Decision Point.
Terrain Awareness Warning System (TAWS)	A system designed to warn a flight crew when their flightpath may take them into proximity with terrain. Air traffic control systems may be equipped with TAWS to warn the controller when an aircraft's flightpath may take it into proximity with terrain.
Traffic Collision Avoidance System (TCAS)	Also known as ACAS. A system utilizing interrogations of, and replies from, airborne radar beacon transponders and provides information to the pilot: • TCAS I will provide traffic advisories to the pilot; and • TCAS II will provide traffic advisories and resolution advisories in the vertical plane to the pilot.
Threat	Source of risk that must be managed to maintain the margin of safety.
Threat and Error Management (TEM)	A training program designed to educate students on aviation related threats and errors and associated risk mitigation strategies.
Technical Standards Order (TSO)	A minimum prescribed standard for the performance and manufacture of parts and materials used in aircraft.
Ultra High Frequency (UHF)	A radio band used for two-way communications. Limited to line-or-sight communications.
UMS	Unit Monitoring System.
Upper Torso Restraint (UTR)	Aircraft seatbelts incorporating shoulder straps. Can be either a three point, four point or five point harnesses.
Variable Reserve	An amount of fuel carried to account for unforeseen factors that could have an influence on the fuel consumption to the destination aerodrome.
Variations	Any variation to this Standard is at the discretion of each company. It is recommended that each variation be assessed to demonstrate that the risks associated with the variation are tolerable and justify safe continuation of operations.
Vertical Speed Indicator (VSI)	A device that measures the rate of climb or descent of an aircraft.
Very High Frequency (VHF)	A radio band used for two-way communications. Limited to line-of-sight communications.
VHF Omni-directional Range (VOR)	A navigation system utilized by aircraft. Limited to line-of-sight reception.
Vibration Health Monitoring System (VHM)	A system designed to monitor and identify vibration trends that could assist in predicting the onset of mechanical failure.

Term	Definition
Visual Flight Rules (VFR)	A set of regulations under which a pilot operates an aircraft in weather conditions favorable to flight by reference to terrain or water.
Visual Meteorological Conditions (VMC)	A set of conditions where a minimum visual range, distance from cloud and height above ground can be maintained.
V_{MCA}	Minimum Control Speed in the takeoff configuration.
VMS	Vibration Monitoring System.
V_{NE}	Never exceed speed.
VRS	Vortex Ring State (often referred to as 'settling with power')
V_S	Stall speed or minimum steady flight speed for which the aircraft is still controllable.
V_{SSE}	Safe single-engine speed.
V_Y	Best rate of climb speed.
V_{YSE}	Best rate of climb speed with a single operating engine and a twin engined aeroplane.
V_1	Decision speed on takeoff.
WSPS	Wire Strike Protection System.

Introduction

Purpose

The Flight Safety Foundation (FSF) Basic Aviation Risk Standard (BARS) for Utility and Energy is a safety standard aimed at any aviation operation (contracted or company-owned) supporting this very specific and demanding sector.

The BARS Implementation Guidelines complement the Standard by providing additional context to the controls and defences presented against each threat. It assists Utility and Energy companies ('company'), aircraft operators and BARS Registered Audit companies to understand what evidence is required to validate the control and defence design and operating effectiveness. These guidelines will assist both the Operator and the company to implement the BAR Standard Utility and Energy.

These guidelines are structured to be applicable to the contracting of aviation support by any company. If the company conducts its own aviation operations, the controls and defences specified as being applicable to the contracted aircraft operator are to apply with the same intent to the company flight department.

All national and international regulations pertaining to aviation operations must always be followed. The information contained in the BAR Standard and this document is intended to supplement those requirements.

Document Structure

This document covers threats and controls applicable to all aircraft operations and addresses the role specific requirements applicable to certain aviation activities through detailed appendices.

The text of the control or defence may contain the term 'appropriate' as a descriptor of a particular element of the requirement. The supporting Implementation Guidelines will provide additional context to the use of 'appropriate'.

These guidelines use the same risk-based format and same sections and control numbering as the contractible standard version of these controls for ease of cross-referencing. The information provided for every BARS Control is presented in this document in the following format:

Basic Aviation Risk Standard (BARS) Control Title

Safety Goal - Each BARS control and defence has been provided with a Safety Goal to assist users of the Implementation Guidelines to identify the purpose of the control or defence and a pathway towards creating a performance indicator to measure the effectiveness of the organization in achieving a desired level of safety performance.

Details the control as written in the BAR Standard.

Information to provide further context and background to the control, threat or defence that is being addressed by the subsection.

Example evidence is provided for guidance, it is not prescriptive nor limiting. It relates the expected manner in which the issue could be addressed by the aircraft operator (through drafting of procedures, etc.)
It is provided in order to assist the BARS Auditor and aircraft operator in assessing whether or not the control or defence requirements have been adequately addressed or implemented.

References presented as a 'quotation' are intended to highlight those aspects of particular relevance to Utility and Energy companies ('company').

Change bars have been utilized to indicate material changes to the content or intent of the Implementation Guidelines.

Variances

There will be occasions where the Utility or Energy company will determine that a Variance to the BARS Controls or Defences is required to permit ongoing operations. Any variance is at the discretion of the company in consultation with the aircraft operator. Each Variance should be risk assessed by appropriately qualified personnel before approval is granted.

During the risk analysis of any variance, the following factors should be considered:

- The circumstances affecting the Operator's inability to satisfy the BARS Utility and Energy (BARS UE) Control or Defence;
- Is this an ongoing or only temporary situation;
- Are the operations short term, ad hoc or longer term; and
- Is the variance wide-ranging or only affecting one particular operation/location?

All variances should be clearly documented and regularly monitored and reviewed to assess continued applicability.

A schematic of the process is outlined in Figure 2.

Figure 2: Variance Process

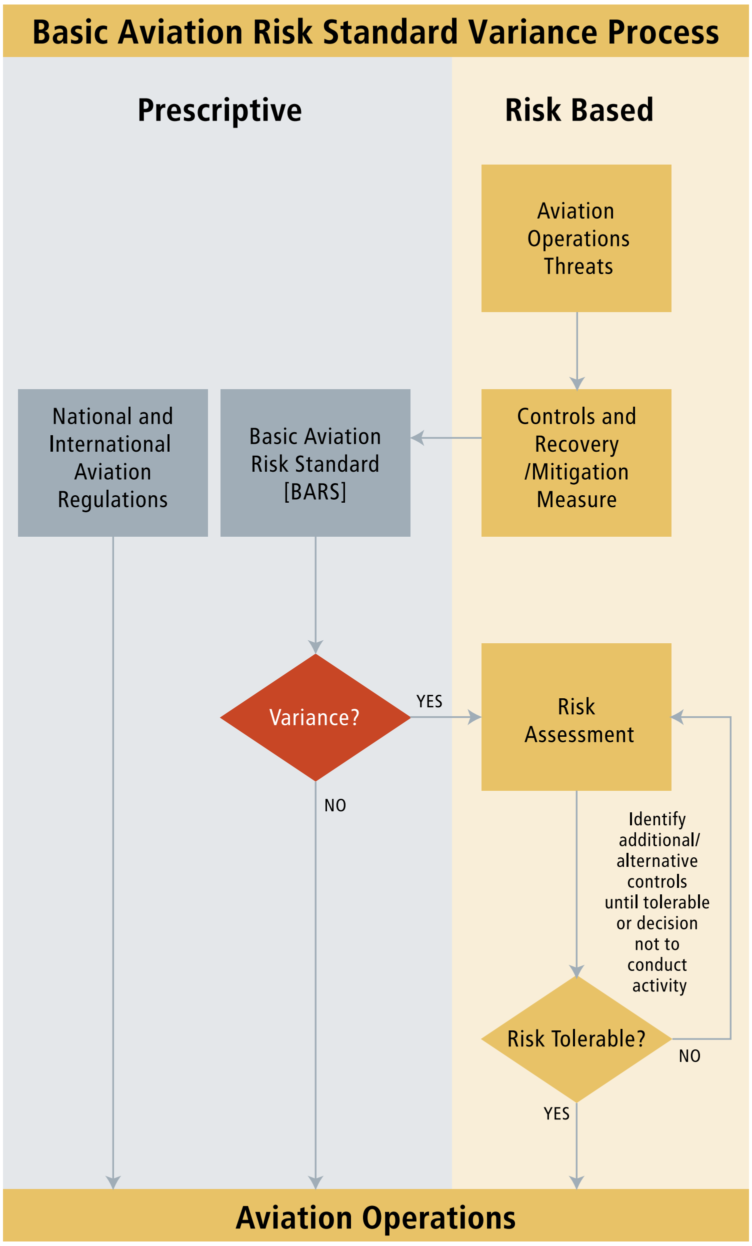


Figure 1: BARS Bow Tie Risk Model – Schematic of Aviation Risk Management Controls

Common Controls:
All Threats 1.0

- 1.1: Safety Leadership and Culture
- 1.2: Safety Management Systems (SMS)
- 1.3: Safety Intelligence
- 1.4: Operational Risk Assessment
- 1.5: Standards and Oversight
- 1.6: Flight Crew Qualifications, Experience and Recency
- 1.7: Flight Crew Competence
- 1.8: Flight Crew Renumeration
- 1.9: Technical Crew Member (TCM) and Task Specialist (TS) Competence
- 1.10: Maintenance Personnel Competence
- 1.11: Maintenance Personnel Training and Competence Assessment
- 1.12: Personnel Readiness
- 1.13: Drug and Alcohol Policy
- 1.14: Flight and Duty Time Limits
- 1.15: Flight Crew Duty Time
- 1.16: Maintenance Duty Time
- 1.17: Accident and Incident Notification
- 1.18: Sub-chartering Aircraft
- 1.19: Briefing
- 1.20: Essential Crew Only

Threat	Controls	
Threat 2.0: Fuel Exhaustion/ Starvation	Fuel Check and monitoring Fuel Plan Fuel Low Level Visual and Aural Alert	Auto Relight Hot Refueling
Threat 3.0: Fuel Contamination	Fuel Supplier Fuel Testing	Fuel Filtration Fuel Sampling
Threat 4.0: Controlled Flight Into Terrain (CFIT) and Infrastructure/ Asset Strikes	Flight Operations Route Briefing and Situational Awareness Environmental Conditions Go/No-Go	Power Margin Crew Composition, Communication and Cooperation Flying in the Wire Environment
Threat 5.0: Loss of Control – In-flight (LOC-I)	Flight Crew Skills Flight Data Monitoring Performance and Control Margins	Helicopter Unanticipated Yaw Helicopter Vortex Ring State (VRS)/Settling with Power
Threat 6.0: Incorrect Loading	Occupant Weight Cargo Weight and Loading	Load and Trim Calculations Manifest
Threat 7.0: Collision On Ground	Operating Location External Load Laydown Area	Airfield/Helicopter Landing Site (HLS) Design Pilot at Controls
Threat 8.0: Collision In Air	Simultaneous Aircraft Operations Management Wire Strike Protection System (WSPS)	Airfield/HLS Bird Control Automatic Dependent Surveillance Broadcast (ADS-B)
Threat 9.0: Technical Failure	Single-engine Aircraft Supply of Spares Hangar Facilities	Helicopter Vibration Health Monitoring (VHM) System Engine Trend Monitoring
Threat 10.0: Weather	Flight Planning Weather Data Adverse Weather Policy	Thunderstorm Avoidance Minimum Weather Requirements

and Recovery Measures for Utility and Energy Sector Operations.

- Fuel Storage
- Drummed Fuel

- Separation Distances - All Aircraft
- Helicopter Separation Distances
- Fixed Wing Separation Distances

- Fixed-Wing Dynamic Stall

- Dangerous Goods Cargo (Hazardous Materials)
- Safety Briefing

- Airfield/HLS Management
- Remote Landing Site Assessments

- High Intensity Strobe Lights (HISL)
- Aircraft Windshield and Window Condition

- Minimum Equipment List (MEL)
- Critical Maintenance Tasks (CMTs) and Independent Inspections

Aircraft Accident

Recovery Measures:

- Emergency Response Plan
- Emergency Locator Transmitter
- Flight Tracking and Communication
- Survival Kit
- Flight Crew Personal Locator Beacon (PLB)
- First-Aid Kit
- Crew Helmets
- Clothing
- Upper Torso Restraint (UTR)
- Helicopter Underwater Escape Training (HUET)
- Helicopter Crash Resistant Fuel System (CRFS)
- Emergency Response Capability
- Insurance

Operational Risk Assessment Appendices

- Appendix 3 **Patrols and Inspection**
- Appendix 4 **Powerline Stringing**
- Appendix 5 **Insulator Washing**
- Appendix 6 **Aerial Platform Work and Structure Transfer**
- Appendix 7 **Human External Cargo (HEC)**
- Appendix 8 **Helicopter External Load Operations**
- Appendix 9 **Aerial Sawing and Grapple Sawing**
- Appendix 10 **Operating in Close Proximity to High Voltage Lines**

Table 1: Operational Risk Assessment Matrix

Activity	Risk areas
Appendix 3 **Patrols and Inspection**	**Loss of Situational Awareness** • Crew Complement • Position of Sun **Crew Communications Breakdown** • Crew Resource Management • Terminology • Crew Communications
Appendix 4 **Powerline Stringing**	**Loss of Control In-flight (LOC-1) – Stringing** • Ground/Flight Reconnaissance • Line Plan • Sideways Pull • Jettison **Equipment Failure – Stringing** • Brake System • Weak Link • Puller Tensioning Fouling • Swivel • Communications with Brake Operator
Appendix 5 **Insulator Washing**	**Equipment Failure – Washing** • Equipment Documentation • Equipment Inspection Schedule **Incorrect Loading – Washing** • Weight and Balance **Hot Refill - Water** • Replenishment of water tanks
Appendix 6 **Aerial Platform Work and Structure Transfer**	**Equipment Failure – Platform Work** • Design and Certification • Servicing Schedule **Incorrect Loading – Platform Work** • Weight and Balance • Aircraft Performance
Appendix 7 **Human External Cargo (HEC)**	**Technical Malfunction of Hoist or Aircraft** • Twin Engine Aircraft • Hoist Design • Hoist Cable Protection • Hoist Cable Cutters • Hoist Emergency Release Mechanism **Failure of Harnesses and Carrying Devices** • Certification of Role Equipment • Servicing Schedule • Visual Inspections
Appendix 8 **Helicopter External Load Operations**	**Fuel Exhaustion** • Minimum Fuel Reserve • Ground-based Fuel Reserve Monitoring **Equipment Failure – External Loads** • Lifting Equipment Certification • Servicing Schedule • Visual Inspections • Shackles **Inadvertent Release – External Loads** • Release Mechanism • Standardized Controls • Guarded Release Switch • Load Construction • Flightpath Management
Appendix 9 **Aerial Sawing and Grapple Sawing**	**Lack of Communication** • Air to Ground Communications • Briefing • Ground Spotters **Equipment Failure – Aerial Sawing** • Design and Certification • Maintenance
Appendix 10 **Operating in Close Proximity to High Voltage Lines**	**Inadequate Communication** • High Voltage Live Work Management Plan • Asset Owner Approval • Preflight Risk Assessment **Equipment and Training** • Helicopter and Associated Equipment • Training

Refer to the applicable Appendix 3 to 10 for a more detailed explanation of the Operational Risk Assessment for each activity.

Loss of Control In-flight (LOC-I) – Inspection
- Hover Out of Ground Effect (HOGE) Performance
- On-Task Speed
- Turning Radius

Controlled Flight into Terrain (CFIT)
- Minimum Heights
- Performance Monitoring
- Escape Route Consideration

Fuel Starvation
- Minimum Fuel Reserve/Un-porting

Communications Failure
- Ground Spotter and/or Air Spotter

Obstacle Clearance
- Minimum Safe Distances

Crew Communications Breakdown
- Crew Resource Management

Personal Protection
- Safety Harness
- Personal Protective Equipment (PPE)

Inspection Procedure of the Structure and Wire Integrity
- Before-Start Inspection Procedure

Electrical Discharge
- Electrical Bonding
- Corona Discharge
- Electrical Protection

Inadvertent Release – Human External Cargo (HEC)
- Redundant Load Path
- Two-stage Release Mechanism
- HEC Long Line and Associated Equipment Storage

Human Error
- Flight Crew Composition
- Crew Communications
- Flight Crew Experience
- Visual Signals

Loss of Control In-flight (LOC-I) – External Loads
- Pilot Experience
- Pilot Daily Flight Times
- Instrument Remote Indicators
- External Mirrors or Camera
- Load Weight

Line Fouling in Transit
- Weighted Lines
- Never Exceed Speed
- Maneuver Boundary Envelope

Ground Loss of Control
- Ground Briefing
- Ground Personnel

Saw Fouling
- Saw Remote Operation
- Release Mechanism

Obstacle Clearance
- Flightpath Planning
- Long Line Experience
- Minimum Height

1.0: All Threats: Common Controls

Common controls that apply to all threats outlined in this Standard.

Threats to aviation must be managed to provide the necessary assurance for continued safe operations at all times.

A risk-based standard allows the identification of critical controls that are intended to prevent an incident from occurring. Those controls are outlined in the BAR Standard for Utility and Energy.

Some controls are specific to a limited number of threats. However, there are controls that can be effective against many threats encountered in the Utility and Energy sector aviation operations. These common controls are discussed further in this section.

1.1: Safety Leadership and Culture

Ensuring an organizational culture where the normal behavior at all levels is risk conscious, safe, learning and collaborative behavior.

All organizations must demonstrate an active commitment to safety. They must actively encourage and promote a positive safety culture within their organization through development of safety leadership skills, behaviors and authentic engagement of their entire workforce. They must regularly evaluate their culture as part of their Safety Management System (SMS) using safety culture surveys or analysis of other indicators.

All organizations have a 'culture'. In this context the term safety culture is used to represent the collective values, beliefs expectations, commitments and ultimately the behavioral norms of members of the organization, in relation to safety. The resulting behavior is particularly important because it provides observable evidence and influences the behavior of others.

Professor James Reason described a safety culture as one that:

- Supports open reporting;
- Is a just culture where it is clear what behavior is acceptable or not;
- Is flexible, adapting to changing threats; and
- Supports learning (and by extension improvement).

In his report on the loss of a military aircraft, Charles Haddon-Cave QC suggested adding a fifth facet that of a questioning culture. Other researchers have suggested 'mindfulness' of hazards or 'chronic unease' as other considerations.

Here safety leadership is used to represent the actions that motivate and influence the behavior of others (rather than indicating hierarchal status). Hence safety leadership is seen as an important method of influencing culture.

Safety leadership can be exhibited at all levels in the organization, but it is the safety leadership of middle and senior management that is most critical when assessing an organization. Having a stated corporate safety vision or policy that encompasses safety culture is necessary, the cultural reality may still have to mature to reach that vision. How the company is striving to enhance its culture is critical.

Auditors should take care not to draw excessive conclusions from isolated individual behavior or superficial secondary indicators of behavior. Culture is a collective characteristic and so it is important to recognize what is typical, not what is atypical. Equal care should be taken not to confuse signs of safety management activity with leadership or culture. While a well-organized SMS may indicate an effective safety culture a well structure safety process does not guarantee full engagement. Similarly, a desired culture is not the same as the actual culture.

Findings made in this area should relate to constructive and achievable near-term objectives. Care should be taken by auditors to ensure that SMS process matters are dealt with under Control 1.2. Control 1.1 is an overarching enabler for Control 1.2.

evidence

Interview of key personnel and observation of operations.

Consider how the organization set outs behavioral and cultural expectations. Are those expectations clearly communicated, widely understood, accepted and respected?

Consider how the management engages with the workforce. Do they communicate solely by e-mail, memo and notice or do they also engage face to face in meetings and management visits? Are safety messages clear? In large organizations do senior managers use video messages to provide a more human face to their communication? Are there opportunities for two way communication? Can management show they listen? Do they display passion for safety or is it 'just another' issue? Are employees regularly surveyed for their opinions on safety? If so, how is that feedback used?

Consider how the organization develops safety leadership skills in key personnel. Are senior managers role models for safety leadership? Consider how the organization rewards safety leadership, participation in safety activities and other safety contributions. Are employees empowered to intervene on operational safety matters regardless of their position in the organization?

Consider how strongly the organization cares about safety. Is there pride to deliver safe operations?

Other References:

Managing the Risks of Organizational Accidents, James Reason (Ashgate) 1997

Organizational Culture and Leadership, Edgar Schein (Jossey–Bass) 5th Edition 2018

Beyond SMS, AeroSafety World, May 2008

Nimrod Review, Charles Haddon-Cave QC (HMSO) 2009

ICAO Safety Management Manual

Courtesy: Heliservices HK

1.2: Safety Management System (SMS)

Ensuring Safety Management Systems are effective at gathering and analyzing safety information, managing risk, providing assurance and ensuring continuous improvement.

All aircraft operators must have a Safety Management System (SMS) that is integral to the management activity of their organization.

The SMS must identify occurrences, actual and potential safety hazards, assess the associated risks and include consideration of human performance, safety culture and threat and error management.

The SMS must enable effective workforce participation and appropriately cover activities conducted by safety critical sub-contractors and other on-site contractors involved in the operations.

The SMS must be subject to continuous improvement. The organization must have safety objectives that are reviewed at least annually and regularly monitor appropriate Safety Performance Indicators.

In this context, SMS includes the management of quality and regulatory compliance, however these may be defined in separate procedures and under separate departmental management.

Although this control discusses a Safety Management System, an organization may operate multiple 'management systems' to achieve these aims (e.g. having a Quality Management System and/or an Occupational Health and Safety System for non-aviation safety). It is beneficial to standardize terminology and methodology between these where practical.

Extensive guidance exists on the design of an SMS. Auditors should take care to assess the SMS effectiveness rather than against any pre-conceived 'ideal' and not limit innovation or constrain the optimization or continuous improvement of the SMS. Auditors should take care not to focus on superficial aspects of the SMS Manual or procedures.

Refer to the following information on SMS development:
ICAO Annex 19
ICAO Safety Management Manual
Flight Safety Digest Volume 24 No 11 – 12, Nov – Dec 2005
International Helicopter Safety Team – SMS Toolkit

evidence

The aircraft operator's Safety Management System should be documented and include the necessary organizational structures, accountabilities, policies and procedures that will facilitate a systematic process for the identification of hazards and minimization of risk.

Records must confirm that these requirements are complied with and that continuous improvement is being tracked and monitored.

1.3: Safety Intelligence

Ensuring all risks associated with the contracted activities conducted by aircraft are analyzed, minimized and accepted.

Safety Intelligence

Organizations must actively participate in relevant industry safety bodies and initiatives.

Organizations must share safety occurrences using locally applicable mandatory and voluntary safety reporting schemes.

The aircraft operator must promptly advise the contracting company or their own organization (if company owned operation) of any incident, accident or non-standard occurrence related to the service provided to the company that has, or potentially could have disrupted operations or jeopardized safety, and include any corrective or preventative actions being taken.

Organizations must examine available external occurrence and accident reports and safety promotion material and identify relevant lessons and necessary internal actions.

This control is focused on gathering intelligence from outside the organization and collaboratively helping spread Safety Intelligence wider in the industry.

Typical industry safety bodies that aircraft operators could participate in include (but are not limited to) local flight safety committees, industry associations or professional bodies such as Vertical Aviation International, regulatory rule making teams, and the Flight Safety Foundation. While there are practical limits to how much any operator can participate in, it is expected that the operator can articulate which groups they support, how and why.

Aircraft operators are expected to be able to demonstrate that they meet mandatory and contracted reporting requirements and show that, subject to local privacy and confidentiality requirements, they are voluntarily sharing information (both to help raise awareness across the industry, but also to encourage others to share information). There are limits to how many outside reports an operator, especially a small one, can study. It is expected an operator will be able to demonstrate that they are aware of the majority of the most recent and relevant accidents and serious incidents involving the types they use or their area of operation that have been documented in the public domain. It is expected that they have analyzed the most significant to identify any opportunities for improvement. Care should be taken by auditors to ensure that SMS process matters are dealt with under Control 1.2. Control 1.1 is an overarching Control for 1.2 and 1.3.

evidence

The aircraft operator should maintain meeting minutes, membership certificates and other records. Submitted occurrence reports will also demonstrate conformance.

1.4: Operational Risk Assessment

Ensuring all risks associated with the contracted activities conducted by aircraft are analyzed, minimized and accepted.

Aircraft operators must conduct and maintain a risk assessment, including mitigation controls, for each aviation activity. These should be approved at an appropriately senior management level in the organization.

Risk assessments are an essential element in identifying and mitigating risks to any operation. The aircraft operator should have a well-developed risk assessment process as part of their SMS and it should be used to review all activities undertaken on both a periodic and exceptional basis.

Mitigation controls may include specific aircraft role equipment.

The aircraft operator's Safety Management System should detail the requirement for the assessment and management of operational risks as an integral part of the planning and execution of any change within the operation.

Documented evidence must be available to demonstrate that the assessment and management of operational risks is being conducted before implementing changes within existing activities or commencing any new operations.

1.5: Approvals and Operating Standards

Ensuring operation with all necessary approvals and with an effective system of documented operational procedures.

The aircraft operators must hold all necessary regulatory approvals.

Aircraft operators must have an Operations Manual (or equivalent) with the necessary content, approved (or when applicable, accepted) by the responsible regulatory authority. This must cover normal and emergency operations and be suitable for the operational circumstances and the aircraft types operated.

The aircraft operator should define and implement an adequate management organization structure, a method of control and supervision of flight operations, training programs and oversight of ground handling and maintenance arrangements appropriate for the operations specified.

The aircraft operator must have documented job descriptions for the key positions including roles and responsibilities, reporting lines and interfaces.

Where applicable, the responsible regulatory authority should provide the aircraft operator with a copy of any document approving a person to a key position.

The aircraft operator has a person appointed and approved in all key positions, and the organizational structure reflects the accountabilities and level of responsibility assigned to the positions.

1.6: Flight Crew Qualifications, Experience and Recency

Ensuring flight crew are competent to fulfill their duties by having appropriate training, qualifications and experience.

The aircraft operator must have a system that ensures flight crew meet the requirements listed in Appendix 1.

Minimum Qualifications

The aircraft operator should have a system that ensures all flight crew assigned to Companies choosing to use this Standard have a current licence that meets both the minimum requirements defined by the responsible regulatory authority and those specified in Appendix 1 of the BAR Standard for Utility and Energy.

The aircraft operator must maintain records of pilot qualifications, complete with copies of flight crew licences and summaries of experience and type ratings. A documented control mechanism must be in place to ensure that pilots are qualified and experienced to meet the task requirements when assigned to flights. Information contained on files maintained by the aircraft operator for each individual flight crew member should provide a record of flight crew qualifications.

Minimum Experience

The aircraft operator should have defined selection criteria and procedures for all flight crew, including full-time, freelance/part-time and casual flight crew.

Key is the requirement for flight crew to be suitably experienced and competent for the activity to be conducted. Experience in extreme topographical conditions is also required for operations in such areas.

The aircraft operator must document minimum experience requirements for all flight crew positions that reflect both the minimum standard for the roles as defined in the BAR Standard and the requirements of the responsible regulatory authority. Where the BAR Standard is not used for all operations, there should be a statement indicating that crew who do not meet the BARS requirements are excluded from BARS operations until the minimum qualification and experience requirements are met.

Information contained on pilot files and rostering records maintained by the aircraft operator should show that the stated BARS requirements have been met or that the individual is excluded from BARS operations until meeting the minimum qualification and experience requirements.

Minimum Recency

The aircraft operator should not assign flight crew to a flight unless they meet the minimum pilot recency requirements of either the BARS or the responsible regulatory authority (whichever is the more stringent).

The aircraft operator should have a records management system for recording and monitoring all relevant flight crew recency parameters, such as:

- Day and night takeoffs and landings;
- Flight time;
- Specific hours/cycles for particular activities; and
- Requirements of the aircraft operators training and checking program.

The rationale behind minimum recency requirements rests largely on assuring flight crew manipulative skills continue to be of the required standard.

The aircraft operator must document the method for tracking recency requirements. Manual, paper-based systems are acceptable however computer programs that more accurately track the varying limits are the preferred option. Where BAR Standard is not used for all operations, a statement must be included indicating that crew who do not meet BARS recency requirements are excluded from BARS operations until such time as these requirements are met.

A paper-based or electronic recency tracking system should be in place with the aircraft operator. Associated records should confirm that pilots are maintaining the required recency and that the rostering system has attended to upcoming check and training requirements prior to expiry. Flight crew files and rostering records should confirm appropriate implementation.

1.7: Flight Crew Competence

Ensuring flight crew continue to remain competent and appropriately trained and are familiar with the operating environment.

Flight crew must receive annual training to the standards of a responsible regulatory authority but not less than one proficiency check annually (non-operational mission flight), and one (standardization) flight/route check annually (operational mission flight permissible).

A check and training program must be provided to ensure that flight crew are trained prior to commencing and while engaged in activities supporting BARS Member Organizations. The program is to ensure individual competencies and the aircraft operator's flight standards are being maintained.

Flight Check and Training – Personnel

Where the responsible regulatory authority has provided the aircraft operator with delegated authority to conduct check and training, the aircraft operator must ensure that selection of personnel is merit-based and demonstrate the consistent application of standards, ethics and objectiveness.

The aircraft operator must document the minimum experience requirements and selection criteria applicable for positions within the aircraft operator's check and training program. Records should confirm that the documented requirements have been applied.

The aircraft operator's check and training pilots must:

- Receive initial and periodic training evaluations;
- Be approved by the responsible regulatory authority; and
- Follow established check and training criteria.

Where possible the crew providing the training should be independent (different) to those conducting the checking of the pilots.

Details of the aircraft operator's check and training program should be published in the Operations Manual and follow established criteria. The syllabuses and procedures for initial training and approval and the processes for conducting periodic training, evaluation and ongoing standardization of check and training pilots should also be documented. Check and training pilots' records should confirm that the documented requirements have been applied.

Flight Crew Check and Training – Program

The aircraft operator must not assign a Pilot-in-Command or a co-pilot as an operating crew member of a flight unless that person has met all applicable requirements of the aircraft operator's training and checking program, and has been certified by a check pilot as being competent to act as an operating crew member. Such requirements must be applied to flight crew likely to be assigned to a BARS Member Organization flight regardless of their employment basis (e.g. full-time, free-lance, part-time or casual).

Ground Training

The operator's flight crew ground training program must cover all the aspects of normal operations and include:

- Aircraft performance, including the requirements of the responsible regulatory authority; Original Equipment Manufacturer (OEM) and the aircraft operator's Standard Operating Procedures (SOPs). Address items such as how the performance is calculated and the applicable procedural controls that apply (e.g. obstacle clearance calculations, runway performance, helicopter in-ground/out-of-ground effect performance, etc.);
- English Language Proficiency for flight crew where it is required by the responsible regulatory authority and where international operations are being conducted; and
- For helicopter operators an understanding of Performance Class 1, Class 2, Class 2 Enhanced and Class 3 performance with Category A and B certified helicopters.

A training syllabus for these topics should be published in the Operations Manual and follow established check and training criteria. The syllabus for initial training and processes for conducting periodic training and ongoing evaluation should also be documented. Pilot training records should confirm that these training requirements have been applied in the induction training of new pilots and where applicable, in the ongoing evaluation of pilot competency.

Flight Training

The aircraft operator's check and training program must provide initial and recurrent training and a minimum of one flight check every six months. These flight checks, at a minimum, should include a combination of a proficiency check (non-revenue) and a route check (revenue-flight permissible).

Details of the aircraft operator's check and training program should be published in the Operations Manual and follow established check and training criteria. The program should cover requirements and procedures for initial training and approval and the processes for conducting recurrent training and checking. Pilot training records should confirm that the requirements of the training program have been applied in the induction training of new pilots and the ongoing evaluation of pilot competency.

Flight Crew Check and Training – Procedures

Documentation of the aircraft operator's check and training program must cover all requirements and procedures relating to pilot training and ongoing evaluation of pilot competency.

The aircraft operator's documentation must provide details of all ground training and flight training that are relevant to the operations. The documentation must also provide adequate guidance to check and training staff regarding the acceptable standards for flight crew performance along with the procedures for dealing with unsatisfactory flight crew performance.

A system should be established by the aircraft operator to ensure that records are maintained of all training and checking sequences that flight crew have been subject to (both ground and flight training) and the associated outcomes.

Details of the aircraft operator's check and training program should be published in the Operations Manual and follow established check and training criteria. The syllabus and procedures for conducting initial and recurrent ground and flight training, along with guidance regarding the acceptable standards for flight crew performance, and policies and procedures for dealing with unsatisfactory performance should be documented.

Pilot training records must be available and confirm that the documented requirements of the aircraft operator's training and checking program have been applied consistently in the training and ongoing evaluation of flight crew performance.

1.8: Flight Crew Remuneration

Ensuring safety is not compromised through financial incentivization to flight crew.

To remove the pressure to fly when safety margins are degraded, flight crew must not be solely paid based on completion of tasks, hours flown, or distances covered.

Remuneration based on completion of tasks, flights or flying hours can create a financial incentive to operate with degraded safety margins.

Examples of contracts should reflect the method of remuneration in place and that flight crew are not incentivized to compromise safety margins to achieve numbers of hours and/or tasks.

1.9: Technical Crew Member (TCM) and Task Specialist (TS) Competence

Ensuring that other personnel performing tasks are suitably competent.

Technical Crew Members (TCM) and both ground and air Task Specialists (TS) must be suitably trained, and competence assessed annually for their duties in accordance with documented procedures.

TCMs are members of the aircraft crew, who are not pilots, but whose assigned duties include matters directly related to the safe operation of the aircraft (e.g. hoist operators). They need a higher level of training in aeronautical matters, aircraft systems, procedures and CRM.

Air Task Specialists perform duties that do not directly relate to the safe operation of the aircraft, but that are directly related to the contracted activity (e.g. sensor operators, platform or basket workers, etc). They require knowledge and skills beyond that of passengers to perform their duties (including communication with the crew, keeping a lookout, etc), but generally need less training than TCMs.

Ground Task Specialists are engaged in duties directly related to the contracted activity who could directly affect aviation safety (e.g. aircraft refuelers, ground loadmasters and riggers or operators of equipment the aircraft is connected to [such as cable reeling devices], etc). This is not intended to extend to all personnel on the ground who are proximate to the aircraft, although all personnel should be trained to perform their specific duties.

Task Specialists may be provided by the company, in which case an agreement with the air operator on interfaces will be necessary.

evidence

The training syllabus and/or details of training arrangements for these topics should be published in the relevant manual.

Personnel training and competency assessment records should be maintained and show when further training and competence assessment is due.

1.10: Maintenance Personnel Competence

Ensuring maintenance personnel are competent to fulfill their duties by having appropriate training, qualifications and experience.

The aircraft operator or approved maintenance organization must have a system that ensures maintenance personnel meet the requirements listed in Appendix 1.

The aircraft operator and/or approved maintenance organization must ensure its Maintenance Controller, Chief Engineer and all other line maintenance personnel meet the minimum qualification and experience requirements prescribed by the responsible regulatory authority and the BAR Standard.

evidence

The aircraft operator and/or approved maintenance organization must document the minimum qualification and experience requirements and selection criteria for all technical positions within the maintenance organization.

Records should confirm that these requirements have been applied and where required, that the responsible regulatory authority has approved the individual appointed to a position.

1.11: Maintenance Personnel Training and Competence Assessment

Ensuring maintenance personnel continue to remain competent and appropriately trained.

The aircraft operator or approved maintenance organization must implement a program of maintenance training and perform a competence assessment at least once every two years.

This training should include:

- Human factors in maintenance;
- Relevant maintenance documentation and procedures;
- Specific training when new equipment is introduced; and
- Technical updates and/or refreshers on the aircraft and systems being maintained.

evidence

The training syllabus and/or details of training arrangements for these topics should be published in the relevant manual.

Personnel training and competency assessment records should be maintained and show when further training and competence assessment is due.

1.12: Personnel Readiness

Ensuring mental health and well-being for all personnel is prioritized and assistance made available to assure fitness-for-work.

The aircraft operator must have a Well-being Policy and associated procedures that encourages personal well-being and resilience, whilst managing the risk of physical or mental health conditions developing into a safety concern for the individual or those around them. The Well-being Policy will offer opportunity to participate in personal resilience training, Peer Support Programs (where available) and Employee Assistance Programs.

Aircraft operators should facilitate personal wellbeing and resilience, while having safety nets to address physical and mental conditions that affect safety of the individual and those around them.

Aircraft operators should encourage confidential non-punitive self-reporting and clearly articulate expectations of personnel treatment considerations, access to peer support/ counselling, employee assistance and pilot loss-of-licence insurance. Medicals and health surveillance should be appropriate to the role and exposure of individuals. Specific local regulatory requirements and limitations should be addressed.

evidence

Aircraft operators should have a documented policy regarding the maintenance of good health, both physical and mental, of all their staff. The policy should be implemented via detailed procedures, supported by appropriate records of their application. Evidence could include: company manuals, personnel files, meeting minutes, membership certificates and other records.

Other References:

MUK CAA Paper 2002/06 Work Hours of Aircraft Maintenance Personnel

FSF/ICAO/IFALPA/IFHA Fatigue Management Guide for Helicopter Operators

An Aviation Professional's Guide to Wellbeing, Flight Safety Foundation

Skybrary Hindsight 30 'Wellbeing' issue, April 2020

Flight Safety Foundation – The Keil Centre Personal Resilience Program

Courtesy: Leading Edge Helicopters

1.13: Aircraft Equipment

Ensuring aircraft are suitably configured for the intended operations.

Aircraft basic equipment fit must meet the requirements listed in Appendix 2 and role equipment must be suitable for the activities conducted.

When operating for a BARS Member Organization, the aircraft operator must ensure that aircraft are fitted or equipped in accordance with Appendix 2 of the BAR Standard, in addition to the minimum equipment requirements set by the responsible regulatory authority.

Appropriate role equipment should be identified for the activities conducted and considered in the associated Operational Risk Assessment.

evidence

The aircraft operator must provide documentation that acknowledges the requirements for the fitment of the minimum equipment listed in Appendix 2 of the BAR Standard and the Operational Risk Assessments for all relevant aircraft and activities.

1.14: Drug and Alcohol Policy

Ensuring all safety critical personnel are fit-for-work at all times.

The aircraft operator must have a Drug and Alcohol Policy which meets all requirements of the responsible regulatory authority. Where no such regulatory requirements exist the operator must at a minimum meet the requirements of the contracting company or the aircraft operator's own organization (if company owned).

The documented Drug and Alcohol policy and associated procedures should clearly articulate the minimum acceptable level of compliance. Guidance regarding the effects of readily available over the counter medications and drugs should be provided.

Details of the aircraft operator's Drug and Alcohol Policy and the associated procedures should be published in the Operations Manual or other applicable manual. The policy and plan must cover all persons involved in safety sensitive aviation activities.

Records should confirm that applicable requirements of the drug and alcohol monitoring program are being routinely applied for persons involved in safety sensitive aviation activities.

1.15: Flight and Duty Time Limits

Ensuring flight crew are alert and fit-to-fly the aircraft.

The aircraft operator must follow all aspects associated with regulatory requirements specific to flight and duty limitations for aerial work operations.

Consistent with the provisions of any regulatory requirements, the aircraft operator must be able to demonstrate their processes for ensuring any additional flight and duty time expended on flight activities not associated with utility and energy operations is tracked and recorded in accordance with standard flight and duty time requirements.

Additional specific limitations should be imposed for high workload/high risk tasks. Suitable guidance should be provided to empower flight crew to determine when cessation of operations is appropriate.

Details of the aircraft operator's fatigue management program should be published in the Operations Manual and be either specifically approved by the responsible regulatory authority, or be in compliance with that authority's fatigue management regulations. The documented program should cover daily, weekly, monthly and annual flight time limits.

The aircraft operator should include details in their Operations Manual of the system to be used for recording and tracking flight and duty times as well as rest periods. While manual, paper based systems are acceptable, computer programs that comprehensively track the varying limits and predict exceedances are the preferred option.

Flight and duty time records must confirm compliance with all requirements of the flight time limits that are applicable the aircraft operator's flight time management program. The flight and duty time records that are maintained should be consistent with information provided in other documents such as aircraft flight records.

1.16: Maintenance Duty Time

Ensuring maintenance personnel are not impacted by fatigue.

The aircraft operator or approved maintenance organization must establish a fatigue management policy to minimize the effects of acute and chronic fatigue amongst maintenance personnel. This must include maximum working hours, not to exceed 14 hours and a minimum of 8 hours rest in a 24 hour period. The requirement to conduct overnight maintenance must be reviewed by a Competent Aviation Specialist.

This policy should ensure that fatigue occurring during a shift or accumulated over a period of time due to the pattern of shifts worked and other tasks, does not endanger the safety of flight.

Any routine requirement to conduct overnight maintenance must be reviewed by a Competent Aviation Specialist.

evidence

The aircraft operator or contracted maintenance organization(s) should provide fatigue management guidance for all maintenance personnel. This documentation should be in compliance with any associated regulatory requirements.

Records should confirm that aircraft maintenance personnel roster schedules, hours worked and rest periods are in accordance with any documented fatigue management guidance.

Engine Maintenance

1.17: Accident and Incident Notification

Ensuring all events that impact safety or have the potential to impact safety, are reported appropriately.

As part of their SMS, the aircraft operator must advise the company of any incident, accident or non-standard occurrence related to the services provided to the company that has, or potentially has, disrupted operations or jeopardized safety and meet regulatory reporting requirements.

International Civil Aviation Organization (ICAO) Annex 13 Aircraft Accident and Incident Investigation provides the definitions of accident, serious incident and incident.

The procedures should ensure reporting is in a timely manner and evidence is preserved for investigations.

The aircraft operator should provide feedback to the company regarding the investigation and close-out of significant incidents and whether any findings could be incorporated in risk mitigation strategies.

evidence

The aircraft operator should have a procedure to ensure that its senior management, the responsible regulatory or safety investigation authority (as required) and where applicable the company, are informed of any incident, accident or non-standard occurrence that has disrupted or has the potential to significantly disrupt operations or jeopardize safety.

Documented requirements and procedures associated with communication of non-standard events by the aircraft operator should be made available on request.

1.18: Sub-chartering Aircraft

Ensuring sub-chartered aircraft are operated in accordance with regulatory approvals and to a standard acceptable by the contracting company.

Sub-chartering (cross-hiring) by the aircraft operator must not be undertaken without approval of the contracting company. Regardless of ownership, contracted aircraft must be operated and controlled by an approved aircraft operator under their own regulatory approvals.

When the sub-chartered aircraft has to be operated under a different air operator than the entity who is considered the aircraft operator for that aircraft, procedures must be in place that detail the ongoing airworthiness arrangements for the aircraft.

Proposals to sub-charter should be agreed by a Competent Aviation Specialist.

evidence

Unless procedures are in place that establish how sub-charter is conducted, sub-chartering should be assumed to be prohibited.

1.19: Briefings

Ensuring that opportunities to learn and improve are promptly identified.

The aircraft operator must have a requirement for a structured briefing to be conducted both preflight and post-flight between flight crew, task specialist(s), ground crew and other personnel (as appropriate) to maximize understanding of the upcoming task, and further identify and learnings and improvements for future similar operations.

When multiple short flights are conducted it is acceptable to de-brief periodically, however this should be at least once per day and ideally when breaks occur during the day’s work. Debriefings should be conducted face to face when practical.

The procedure should layout a simple methodology for debriefings. The debriefing should openly and constructively consider what went well, what was learnt and what can be improved. This may result in raising a formal safety report or other feedback to the management team for action. Personnel should, however, not be encouraged to ‘invent’ false learning or improvements.

evidence

The aircraft operator should establish a process for regular briefings and be able to show relevant feedback is recorded and acted on.

1.20: Essential Crew Only

Ensuring only crew essential to conduct the utility and energy work operations are carried during operationally-focused flights.

Only operating crew members such as Flight Crew, Technical Crew Member (TCM), and Task Specialists (TS) are to be carried on any flight designated an operational mission or task-related flight.

To eliminate unnecessary exposure to risk, only personnel who are essential to the safe conduct of an operation can be carried on-board an aircraft during the conduct of utility and energy work operations. In addition to the pilot(s), these additional personnel may include designated crew members that are essential to the operational task.

If the operator is authorized for passenger carrying activities, these must be conducted as separate independent tasks and not associated with operational activities.

evidence

The aircraft operator should include a requirement in the Operations Manual and/or SOPs that only personnel who have a role that is directly related to the safe conduct of an operation are carried on aircraft during each flight.

Auditor observations of operations where possible and review of flight planning manifests can confirm compliance.


Courtesy: Heliservices HK

2.0: Fuel Exhaustion/Starvation

An aircraft is forced to land or ditch at an unprepared site with minimal warning due to fuel exhaustion or starvation that causes a loss of engine power and potential accident

Two factors contribute to fuel mismanagement and loss of power:

- Fuel exhaustion – no usable fuel remaining to supply the engine(s); or
- Fuel starvation – fuel supply to engine(s) is interrupted although sufficient fuel remains on-board (e.g. incorrect tank selection). Starvation due to technical failures is covered under Threat 9.

During external load flights, when the fuel quantity is minimized in order to maximize payload, special care is needed, particularly where significant maneuvering is required.

2.1: Fuel Check and Monitoring

Ensuring aircraft depart with sufficient fuel on-board to safely conduct the flight.

The aircraft operator must have procedures in place that require the Pilot-in-Command to ensure the required amount of fuel is on-board the aircraft prior to takeoff, and stage fuel state is regularly monitored throughout the flight to ensure safe landing with reserves.

The risk of fuel exhaustion is greatly reduced when flight crew accurately determine the amount of fuel on-board prior to starting and confirm that quantities are sufficient for the flight planned. Determination of this quantity should be cross-checked using a minimum of two sources, such as:

- Fuel Quantity Gauges;
- Dipsticks;
- Flow Meters/Totalizers; and
- Calculations from previous refuels and fuel usages (calibrated regularly for accuracy as part of the System of Maintenance). See also Control 2.3.

Accurate knowledge of fuel quantity at the start of a flight is essential for any fuel critical operation. All subsequent assessments to the safety of the flight are derived from that initial figure. If only one fuel quantity measurement is used, then it is not possible to determine if the system is working properly because the fuel quantity calculation becomes self-referencing.

The aircraft operator's procedures should require fuel quantity checks to be conducted prior to each flight and provide details of the acceptable methods for undertaking such checks. The aircraft operator's procedures should provide for the quantity of fuel on-board to be checked by two separate and independent methods.

In-flight checks

Fuel burn will be constant for a consistent combination of altitude, power setting and mixture setting (where applicable). Changing winds and deviations due to weather conditions will vary the groundspeed and therefore the range. Flight crew should regularly update fuel status, at least every 30 minutes, to ensure adequate reserves are maintained.

The aircraft operator should specify procedures for the flight crew to monitor in-flight fuel quantity, to detect any anomalies that may appear in planned versus actual fuel burn. Fuel flows greater than planned, stronger headwinds, in-flight fuel leaks and course deviations have all contributed to past Utility and Energy sector accidents. Constant monitoring of fuel quantity at designated time intervals or waypoints is critical to the safe progress of any flight.

evidence

The aircraft operator must document SOPs that require the aircraft Pilot-in-Command to confirm the required amount of fuel is on-board the aircraft prior to each flight. Such procedures should provide for the quantity of fuel on-board to be checked by two separate methods and should state a maximum tolerance to apply to any difference in quantities determined by the two methods. SOPs should also cover the conduct of in-flight fuel progress checks that will enable the early detection of a fuel anomaly.

The flight record or similar document should demonstrate that the SOPs have been complied with and that the required preflight and in-flight fuel checking and monitoring has been conducted.

2.2: Fuel Plan

Ensuring sufficient fuel, including required reserves, is carried on flights.

Fuel loads must be sufficient for the flight and include as a minimum the regulatory required reserves or 30 minutes of flight time, whichever is the greater.

(Exception: See Appendix 8 control 80.1- For short-range/localized helicopter external load, and platform operations, a minimum of 20 minutes reserves fuel may be used).

The responsible regulatory authority will normally specify the minimum fuel that must be carried on a VFR flight.

evidence

The aircraft operator must document a fuel policy for VFR flights that meets the minimum requirements legislated by the responsible regulatory authority, or that is consistent with their guidance. In circumstances where the regulatory fuel quantity requirements are less than that required by the BAR Standard, the Standard applies.

Associated records such as aircraft load-sheets, Flight Logs and fuel records should confirm that documented procedures and requirements for determining the amount of fuel to be carried on VFR flights have been applied appropriately.

2.3: Fuel Low Level Visual and Aural Alert

Ensuring flight crew situational awareness with regard to available fuel reserves.

When available for the aircraft type, a fuel low level visual warning and aural alert must be fitted.

The fuel low level warning, when activated, provides cautionary advice to the flight crew that the quantity of fuel on-board has reduced to a low level and action must be taken to terminate the flight before fuel exhaustion.

Where available, it is preferable to have the fuel warning linked to the Master Caution system to further increase its conspicuity. Due to the ‘heads out’ nature of most Utility and Energy sector operations, the aural warning ensures that any illumination of a low fuel state will be aurally presented to the crew in addition to the visual warning system.

The flight crew must understand the actions required of them in the event of a warning. This includes having detailed knowledge of the aircraft fuel system and how much usable fuel remains when the light illuminates.

When use of the low level fuel light is relied upon, such as external load operations, regular calibration or testing of the low fuel detection system should be part of the scheduled maintenance.

evidence

Where a fuel low level warning system is fitted to a helicopter, it should be referenced in the AFM (possibly as a Supplement or STC). Aircraft operators must include these requirements in their Operations Manual or SOPs as a responsibility of the Pilot-in-Command. The applicable MM and/or SoM must address the ongoing maintenance and calibration requirements (minimum annually) applicable to the system installed.

2.4: Auto Relight

Ensuring a restoration of engine power in event of a flameout.

Procedures must be in place so that, when fitted, auto relight is activated at critical phases of flight.

Auto relight capability ensures a gas turbine can rapidly recover from a compressor surge/stall or similar power interruption. Potential critical phases of flight where a relight capability will most likely be required are at low power, in high precipitation, and/or icing conditions.

When an engine is fitted with this capability, assuming there is not a mechanical failure within the engine or fuel is exhausted, the system will provide engine automatic re-ignition capability in the event of an engine flameout. The re-ignition of the engine is actuated, when the system is armed, by decay of engine bleed air as a result of the flameout.

evidence

The aircraft operator must document suitable policy and procedures for auto relight if fitted. Any limitations on use should also be documented.

2.5: Hot Refueling

Ensuring hot refueling operations are used appropriately and conducted safely.

Hot refueling must only be conducted when considered operationally necessary and must be approved by the company prior to use. Hot refueling with gasoline and wide cut turbine fuel is prohibited. Aircraft operators must have a procedure on hot refueling which includes the following requirements:

- ***No Task Specialists and/or passengers are to be on-board during refueling unless the Pilot-in-Command assesses that it is safe to do so. In this scenario personnel remaining on-board must receive a safety brief prior to refueling. No side well-seats are to be used (e.g. Bell 212, 214, 412);***
- ***Firefighting capability must be available and crewed;***
- ***The aircraft operator's Operations Manual must detail all aspects of hot refueling, including personnel training, sequence of aircraft bonding and duties of personnel (in addition to the pilot) required: a minimum of three for helicopter ops – one for refueling, one for pump shut-off and one for fireguard;***
- ***Radios are not to be used during refueling;***
- ***Prior to removing the fuel cap and inserting the fuel nozzle or connecting the pressure hose into the aircraft fuel tank, bonding wires running from the fuel station and from the fuel hose to the aircraft must be connected;***

The following is a list of operational situations that may justify the requirement for hot refueling:

- Operations involving high movement cycles (e.g. external load);
- Excessive wind speed make full shutdown impractical or dangerous;
- Medical evacuation requiring quick turn-around; and
- Search and Rescue.

In helicopter operations, the noisy and dynamic environment complicated by added threat of 'hot'/active engine(s) in close proximity to the open refueling activity demands additional controls to be in place to ensure safe conduct.

The documented procedures required by the aircraft operator should be in the approved Operations Manual and include as a minimum:

- The operational circumstances in which hot refueling may take place;
- The procedures to be followed during hot refueling;
- Three ground crew for helicopter hot-refueling operation (1) refueler, (2) emergency pump shut-off guard and (3) fireguard;
- All persons engaged in hot refueling must be trained in, and familiar with, the procedures to be followed during hot refueling or any emergency that may occur in relation to the refueling;
- Suitable and properly maintained firefighting equipment must be readily available for use if an emergency occurs during the refueling;
- The quantity of fuel to be loaded must be decided before hot refueling is commenced;
- A properly licenced pilot must remain at the controls of the aircraft throughout the hot refueling process and maintain contact with the person on the ground in charge of the refueling system by means of an electronic intercommunication system or by visual contact and an agreed system of signals;
- All Task Specialists and passengers disembarked from the aircraft (helicopter) prior to commencement of refueling procedures (unless the PIC has assessed that it is safe for personnel to remain on-board and they have been appropriately briefed);
- Before the fuel filler cap is removed, the refueling equipment and aircraft must be earthed and connected so as to ensure they are of the same electrical potential;
- While hot refueling is taking place, radio transmissions must be restricted to the greatest extent practicable. HF radio and weather radar must not be used;
- On completion of the refueling operation, the Pilot-in-Command confirms that all equipment has been removed from the vicinity of the helicopter prior to departure from the refuel point, the fuel cap has been securely replaced, the correct fuel quantity has been loaded and the aircraft is properly configured for flight; and
- The fuel supplied is managed by a fuel quality audit program and whose regular Audit Reports are checked by the aircraft operator.

evidence

Where hot refueling is to be utilized for helicopter operations, the aircraft operator must have approved procedures that are documented. In addition to addressing applicable regulatory requirements, the procedures should articulate all minimum items contained in the BAR Standard and details contained within these guidelines.

3.0: Fuel Contamination

An aircraft is forced to land or ditch at unprepared site with minimal warning due to contaminated fuel that causes a loss of engine power and potential accident

Aircraft engines are intolerant to fuel contamination and will readily fail if provided with out-of-specification fuel. Maintaining the quality and cleanliness of aviation fuels is fundamental to aviation safety.

Personnel responsible for the transportation, storage or dispensing of aviation fuels are a key part of the aviation safety equation. The guidelines, procedures and standards prescribed by the fuel manufacturer must be adhered to at all times.

All parties associated with flight operations (aircraft operator and company) must be cognisant of the requirement for high quality and tested fuel to ensure any potential contaminants are eliminated or separated out of fuel before it is pumped into the aircraft. Fine sediment in fuel may block the aircraft fuel filters and erode critical parts in the engine and fuel control systems.

Particular care should be taken to avoid contamination with the wrong types or grades of fuel as this can cause aircraft fuel system or engine damage and possible failure in-flight.

3.1: Fuel Supplier

Recognizing internationally accepted fuel standards and practices.

Where fuel is being provided by a recognized supplier using internationally accepted standards and practices, an equivalent level of risk management may be considered as being in place if all other applicable fuel quality control procedures are being complied with.

Where fuel is supplied from a recognized third-party provider, the aircraft operator's policies and procedures should address how fuel quality control is guaranteed. The aircraft operator's oversight program that applies to fuel supplies would normally be one component of the Safety and Quality Management System.

evidence

Safety and Quality Management System policy and procedures should address fuel standards.

Records (including audit schedules, checklists and reports) will confirm compliance.

3.2: Fuel Testing

Ensuring the fuel on-board prior to flight is the correct type and grade and free of contamination.

When turbine fuel is in use, testing with water detector capsules or an equivalent able to test for water in suspension must be used. The Pilot-in-Command must verify that the quality of the fuel being uplifted is acceptable.

Turbine fuel has the ability to hold water, thereby contaminating the fuel being supplied to the engine(s). Water can be held in the fuel in a number of states including dissolved, in suspension and free. There are a number of fuel testing regimes available, but it is the aircraft operator's responsibility to document acceptable methods to confirm that the fuel is free of water contamination.

Particular care should be taken to avoid use of the wrong types or grades of fuel as this can cause aircraft fuel system or engine damage and possible loss of engine power.

The aircraft operator's SOPs and maintenance documentation should document the requirements and/or procedures for fueling of aircraft and performing fuel testing as part of the preflight preparation process. Where an accredited third party agency provides fuel they should have procedures in place that provide the equivalent level of compliance. In such cases, the aircraft operator should have a quality assurance process to ensure that the third party provider is delivering fuel of an acceptable standard.

Records such as audit schedules, checklists, reports and non-conformance/ corrective action closeout reports must confirm that the ongoing quality of fuel supplies is being provided.

3.3: Fuel Filtration

Ensuring the quality of the fuel dispensed to aircraft is acceptable.

Equip fuel delivery systems including portable systems with water blocking filtration of the Go/No-Go types. Mark filter canisters with the next date of change or inspection cycle. Replace all filters at least annually or at nominated pressure differentials as annotated on the filter housing or as recommended by the manufacturer.

The aircraft operator should document the process by which fuel delivery systems including portable systems that are to be used for fueling the aircraft operator's aircraft are assessed and suitable for use.

Where the fuel system is owned and/or operated by the aircraft operator, the operator's documentation should detail procedures, such as initial and routine audits, that ensure fuel delivery systems used in fueling aircraft meet the required standards.

Where fuel is supplied from a recognized third-party provider, the aircraft operator's SMS should address how fuel quality control is guaranteed.

The aircraft operator's oversight program that applies to fuel supplies would normally be one component of the Safety and Quality Management System. Associated records such as audit schedules, checklists, reports and nonconformance/corrective action closeout reports must confirm that fuel delivery systems used for fueling the operator's aircraft, and their associated operating procedures, meet the required standards.

3.4: Fuel Sampling

Ensuring samples of tested fuel are retained appropriately.

When using a dedicated fuel source, a sample from the source must be retained in a clear jar with screw-top-lid, labeled with the current date and retained until completion of the daily flying activities.

The aircraft operator's SOPs should contain requirements for fuel testing as part of the preflight preparation process. During the conduct of these procedures, flight crew may request to view the relevant fuel sample prior to commencement of fueling.

Daily fuel samples should be retained until completion of the daily flying activities as evidence that the fuel stored in the installation is fit for use in aircraft. Such samples enable demonstration of the fuel's chemical compliance with published standards following an aircraft incident that had received fuel from the installation.

The aircraft operator's documentation should detail the requirements for performing fuel testing as part of the preflight preparation process.

The aircraft operator's documented requirements for initial and routine audits of fuel delivery systems that are routinely used in fueling the operator's aircraft should provide for assessment of compliance with the required storage and daily fuel sampling procedures.

The aircraft operator's audit program that applies to fuel supplies, including audit schedules, checklists, reports and non-conformance/corrective action closeout reports, must confirm the ongoing quality of fuel supplies (such as fuel installation daily product quality checks).

3.5: Fuel Storage

Ensuring fuel is stored in a manner that will prevent contamination.

Prior to testing and approving for use, all fuel storage facilities must be allowed to settle one hour per one foot of fuel depth (or three hours per meter) after the tanks have been resupplied. Additional storage requirements include:

- ***Storage tanks must have floating suction or, at a minimum, equipped with a standpipe;***
- ***Bulk deliveries must be filtered into storage tanks;***
- ***Fuel systems must be identified by placard during the settling period indicating the time when settling will be completed;***
- ***Steel tanks must be lined with an approved epoxy liner unless the tanks are constructed of stainless steel or aluminium; and***
- ***Company new-build fuel systems must have stainless steel and connection welded plumbing or approved aluminium construction.***

The aircraft operator should document the process by which fuel delivery systems including portable systems that are to be used in fueling the aircraft are assessed and determined to be suitable for use.

When installing supply fuel tanks at company owned and operated facilities, there should be a slope at the base with a sump drain at the tank low point (or equivalent) for sampling purposes.

evidence

The aircraft operator's documentation should include procedures, such as initial and routine audits, that ensure fuel delivery systems and their associated operating procedures meet required standards.

The aircraft operator's audit program that applies to fuel supplies would normally be one component of the Safety and Quality Management System. Associated records such as audit schedules, checklists, reports and non-conformance/corrective action closeout reports must confirm that fuel delivery systems used for fueling the operator's aircraft, and their associated operating procedures, meet the required standards.

3.6: Drummed Fuel

Ensuring drummed fuel is handled in a manner that will not compromise fuel quality.

Aircraft operators who make use of drummed fuel in the course of their operations must have a procedure in place addressing the management and use of drummed fuel stock. The following performance requirements must be addressed:

Storage:

- ***Drums must be stored:***
  - ***horizontally with access bungs at 3 and 9 o'clock; or***
  - ***vertically with drum top cover in place to prevent the accumulation of water on the drum lid; and***
- ***Drums must have minimal contact with the ground (ideally using wooden slats or equivalent) and preferably be stored under cover.***

Quality:

- ***Fuel must be consumed within its Aviation Release Note certification date*;***
- ***The access bungs must be tight and the seals unbroken prior to use;***
- ***The fuel must be sampled and tested in accordance with Control 3.2.;***
- ***The refuel pump must be equipped to the standards detailed in Control 3.3.;***
- ***Before fueling the aircraft, a small amount of fuel must be pumped into a container to remove any contaminants from the hose and nozzle; and***
- ***All drum pumps, spears, and hoses must be sealed when not in use to protect from ingress of dust and contaminents. Seals must be non-porous and secure.***

To provide optimum opportunity for any contaminants to settle, drums must be brought to the vertical three hours prior to testing. Where this is not practical (e.g. SAR, Emergency Response, etc.) all performance requirements of this control must be followed.

The aircraft operator should document in their Operations Manual specific requirements and/or procedures that are to be followed for the storage and use of drummed fuel, whether it is under their control or that of a third party. The procedures must provide assurance of the quality of drummed fuel supplies that are to be used. The aircraft operator's documented procedures must be consistent with guidance provided by fuel manufacturers where these are more stringent than the BAR Standard.

evidence

The aircraft operator's SOPs and maintenance documentation should detail the requirements and/or procedures that must apply as part of the preflight preparation process, where drummed fuel is used for fueling of an aircraft. Such procedures should require the Pilot-in-Command to assess that the drum-stock to be used has been stored appropriately. The aircraft operator's documentation should also detail procedures, such as initial and routine audits, that provide assurance of the ongoing quality of fuel supplies.

*Where authorized testing of out-of-date fuel is permitted by the fuel provider and the original certification period is extended, drummed fuel may be used up until that date but not exceeding two years.
The revised certification documentation must be retained for the duration the drummed fuel is held on stock.

Courtesy: Heliservices HK

4.0: Controlled Flight Into Terrain (CFIT) and Infrastructure/Asset Strikes

An airworthy aircraft under the control of crew is flown into the ground (or water) resulting in an accident

Controlled Flight into Terrain (CFIT) occurs when an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew.

Obstacle strikes are those helicopter events that occur while maneuvering in the hover or slow speed where the helicopter contacts an adjacent obstacle.

4.1: Flight Operations

Ensuring effective and safe separation from terrain and obstacles.

To minimize risk of CFIT/obstacle strikes, any aviation activity at lower altitudes (zone ASZ-3 or lower) must be conducted with appropriate weather limitations understood and in place.

As part of the ORA, consideration should be given to the complexity and workload of the contracted activities, the ground environment and any potential emergencies in order to determine if activity specific weather limitations or other guidance are necessary.

evidence

The aircraft operator's ORA for each contracted activity should consider if specific, more restrictive weather limits are necessary and if they are, they should be clearly defined.

4.2: Route Briefing and Situational Awareness

Ensuring advanced awareness of terrain, obstacles and other sources of threat during flight planning.

For aviation activities that are conducted at lower altitudes over a route (such as patrol or specialist survey/inspection tasks) the crew must have access to threat-related research (maps, system photos, new line information, current circuit maps and geospatial information, etc.) and to assist in flight planning and during the flight.

Crews should have access to mapping, records of obstacles and location details as to where there are threats to flight safety (e.g. bird sanctuaries) or sensitive sites that are to be avoided. Especially for very low level operations, a greater fidelity of information may be needed than is commonly publicly available (e.g. of obstacles not recorded in aeronautical databases). This may require liaison with multiple public bodies and corporations, access to specialist geospatial information sources and maintaining records within the aircraft operator.

evidence

The aircraft operator should have access to suitable data and procedures for the preparation and conduct of route briefings.

4.3: Environmental Conditions Go/No-Go

Ensuring vigilance of environmental conditions and postponing/discontinuing flights as necessary.

The aircraft operator must have a defined process where there is consideration of the likely environmental conditions by the appropriate personnel before a flight is scheduled, then again during flight planning and finally during the flight. In each case, there should be a non-punitive policy that accepts no-go decisions based on actual conditions or the foreseeable deterioration of those conditions.

A no-go decision should be an acceptable outcome in the flight planning phase, where the data and professional judgement does not support a go decision. This should be reflected in the completion of the ORA.

Predicting changes in the environment is not perfect, so when conditions do deteriorate in-flight, crews should feel confident that they can discontinue the activity without being penalized. See also Control 10.2 (Adverse Weather Policy).

The aircraft operator should have a documented policy that details a non-punitive process for the Pilot-in-Command to make a 'Go/No-Go' decision based on an assessment of current and forecast environmental conditions.

4.4: Power Margin

Ensuring vigilance of environmental conditions and postponing/discontinuing flights as necessary.

When operating in the Aerial Restricted Zone (ARZ) or Aerial Surveillance Zones (ASZ) 1 and/or 2, the aircraft operator is to aim to have a minimum of 20% power margin. Where this is not practical the aircraft operator, utility company and flight crew must all be satisfied through risk assessment that the available power margin is acceptable.

Aircraft performance and the ability to avoid obstacles and terrain is directly related to the excess power available to the aircraft.

It is critical that the pilot calculates the margin between 'power required' and 'power available.' Providing a suitable safe margin ensures that sufficient performance is available to clear obstacles or terrain under both normal and adverse conditions.

If a helicopter is operating at close to its maximum power available, then there is limited ability to counter adverse conditions such as turbulence or make quick control inputs to avoid an obstacle.

When it is not possible to maintain the minimum power margins, the operator must conduct a risk assessment to be satisfied that the reduced power margin is acceptable to both the operator and company.

The Operations Manual should be checked to ensure that the required power margins have been nominated.

Any risk assessment of reduced power margins should document the mitigating factors taken into consideration. The risk assessment should be available for review by the Competent Aviation Specialist as part of the BARS 'two-dimensional' operational reviews.

Other References:

Helicopter Performance, Civil Aviation Authority of New Zealand, revision February 2020.

4.5: Crew Composition, Communication and Cooperation

Ensuring crew composition is cognizant of threats (including workload) and flight crew, task specialists and ground personnel cooperate during the activity.

The minimum composition of the crew aboard the aircraft and of ground personnel must be assessed in the appropriate ORA and enhanced if necessary for specific flights.

The aircraft operator must have processes in place to ensure that flight crew, task specialists and ground personnel have a common understanding of their respective duties, are skilled at effective communication and where designated as operating crew members are trained and current in CRM.

The ORA should consider both this and other threats (for example Mid-Air Collision risk, load impact accidents, etc).

Verbal communications and visual (i.e. hand signal) protocols should be defined as necessary for each contracted activity (though to avoid confusion, care should be taken that to avoid different meanings for different activities or similar phrases or signals that could be misinterpreted).

Crew Resource Management (CRM) and/or Threat and Error Management (TEM) training are common means to build communication and cooperation skills. Such training should be at least every two years and can be proportionate to a person's role. The skills promoted by CRM/TEM training provide a significant defense against threats to safety and help defend against human error and its consequences. Training personnel in threat and error management reinforces that threats and errors are a part of everyday aviation operations that must be managed to achieve safe outcomes. Completion of an Aeronautical Decision Making (ADM) course is acceptable for single-pilot operations as an alternative to CRM.

evidence

The aircraft operator should document the risk assessment and mitigations implemented. This should be evidenced through the operator's documented duties and responsibilities and training records.

4.6: Flying in the Wire Environment

Ensuring all crew, are aware of the unique hazards and threats of flying in the wire environment.

All crew that could potentially operate low-level in and around wires, whether it be patrolling, stringing and other utility activities, must have completed an initial Flying in the Wire Environment course.

A "Flying in the Wire Environment" or "Flying in the Wire and Obstruction Environment" course as it is often referred to, is designed to give low level pilots and other crew members the specific skills they need to safely fly in the wire and obstruction environment.

It is widely acknowledged that the wire and obstruction environment is the most lethal environment you can operate an aircraft in and is the number one cause of fatal accidents in the civil helicopter industry. The risks and hazards associated with this environment are not generally understood by aviators as they are not 'aviation specific' and pilots and flight crew members do not necessarily learn about them in their normal aviation training throughout their careers.

Most courses are designed to train pilots and all other flying utility professionals to work together as a team employing sound CRM principles and to understand the hazards in the low-level wire and obstruction environment.

evidence

The training syllabus and/or details of training arrangements for these courses should be published in the relevant manual.

Personnel training and assessment records should be maintained.

Figure 3: Separation Distances Transmission Lines – Helicopters

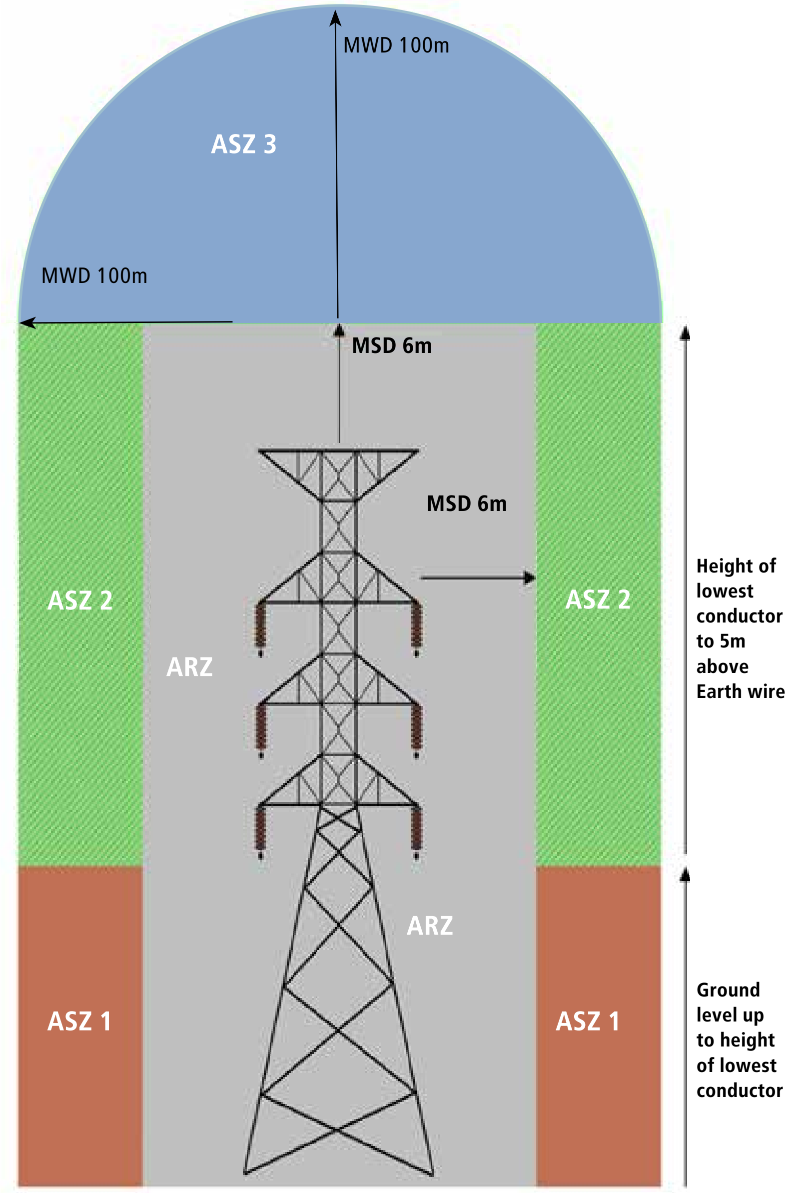


Diagram showing ASZ 1, ASZ 2 and ASZ 3 Zones applicable for helicopters operating around transmission tower type structures.

The ARZ is the area inside ASZ 1, 2 and 3 and extends along the conductor span.

4.7: Separation Distances – All Aircraft

Ensuring safe separation between aircraft and infrastructure during all phases of operation.

To minimize risk of impacting the lines and/or infrastructure assets, the 'Aerial Surveillance Zone' (ASZ) must be risk assessed and defined prior to the activity. If considered necessary, separation distances should be increased from those defined in the controls contained within this Threat scenario.

The area around transmission line infrastructure is extremely hazardous to all aircraft.

Crews that operate in such environments must adhere to the published minimum separation distances. This includes higher speed infrastructure patrol missions in addition to slow speed infrastructure maintenance activities.

Aerial Surveillance Zone (ASZ)

The ASZ is that area between the Minimum Separation Distance (MSD) and Maximum Work Distance (MWD) and is further defined in Controls 4.7, 4.8 and 4.9.

Minimum Separation Distance (MSD)

The MSD is that distance between the structure and the closest point of the aircraft (helicopter rotor tip path plane/tail rotor or aeroplane wing tip/undercarriage). The MSD is 30 meters/100 feet for fixed wing and 6 meters/20 feet for helicopters.

Notwithstanding the defined minimum distances, when determining the MSD consideration must be given to factors such as the aircraft type, pilot experience, task activity and environmental conditions through completion of a documented pre-start operational risk assessment. This will determine whether distances should be increased from the minimum distances defined in this Threat scenario.

Maximum Work Distance (MWD)

The MWD is that distance with which beyond it, the aircraft is considered outside the operational 'work area'. This is 100 meters /300 feet for both fixed wing and helicopters.

ASZ 1 – Helicopter Operations Only

This zone extends from ground level to the height of the lowest conductor/wire and in a straight line between structures.

When any part of the helicopter enters ASZ 1, the aircraft must be restricted to hovering flight, which includes slow directional maneuvering to allow for detailed inspection of the asset.

ASZ 2 – Helicopter Operations Only

This zone extends from the height of the lowest conductor/wire to 6 meters/20 feet above the top of the structure and/or overhead line and in a straight line between structures.

ASZ 2 may include obstructions directly in the flightpath such as merging lines, line deviations, over-crossing lines, guys and tee-offs, under-crossing lines and trees. When any part of the helicopter enters ASZ 2, it must be restricted to the hover or flight speeds appropriate to the location/conditions.

ASZ 3 – Fixed Wing and Helicopter Operations

This zone is for both fixed wing and helicopter operations, and encompasses the extremity of the wire environment down to a defined distance above the highest wire and in a straight line between structures, but not less than 6 meters/20 feet for helicopters and 30 meters/100 feet for fixed wing.

In this zone, the aircraft can be maneuvered as required to achieve the task safely.

Aerial Restricted Zone (ARZ)

The Aerial Restricted Zone (ARZ) is the area within 6 meters/20 feet of a structure tower or powerlines, and is inside of ASZ 1, 2 and 3. Operation within the ARZ is only permissible for helicopter operations engaged in precision external loads, platform operations, powerline stringing and powerline cleaning.

When any part of the helicopter enters ARZ the pilot must ensure the aircraft maneuvering speed and power margin is adequate to provide separation from the structure and conductors.

The aircraft operator should have documented policy and procedures relating to minimum distances to be enforced around transmission infrastructure and safe flying practices when in this environment. This may be included in the company Operations Manual and further specific guidance may be included in SOPs. Procedures should include a risk assessment process prior to working within these zones. The operator should also document any additional training required before crews can operate in these zones. Training courses and records may also be examined as required.

4.8: Helicopter Separation Distance

Ensuring safe separation between helicopters and infrastructure during close proximity activities.

Transmission Lines and Power Poles

The aircraft operator must have a defined process when operating in Aerial Surveillance Zones (ASZ) 1, 2 and 3.

Operation within the ARZ is only permissible for helicopters engaged in precision external loads, platform operations, powerline stringing and powerline cleaning.

The area around transmission line infrastructure is extremely hazardous to all aircraft, but particularly helicopters. In addition to the threat of physical contact with objects that can be difficult to sight, there is the additional hazards associated with close proximity to live high voltage wires.

Crews that operate in such environments must adhere to the published minimum separation distances.

The aircraft operator should have documented policy and procedures relating to minimum distances to be enforced around transmission infrastructure. This may be included in the company Operations Manual and further specific guidance may be included in SOPs. This should include risk assessment processes prior to working within these zones. The operator should also document any additional training required before crews can operate in these zones. Training courses and records may also be examined as required.

Figure 4: Fixed Wing Separation Distances – Transmission Lines

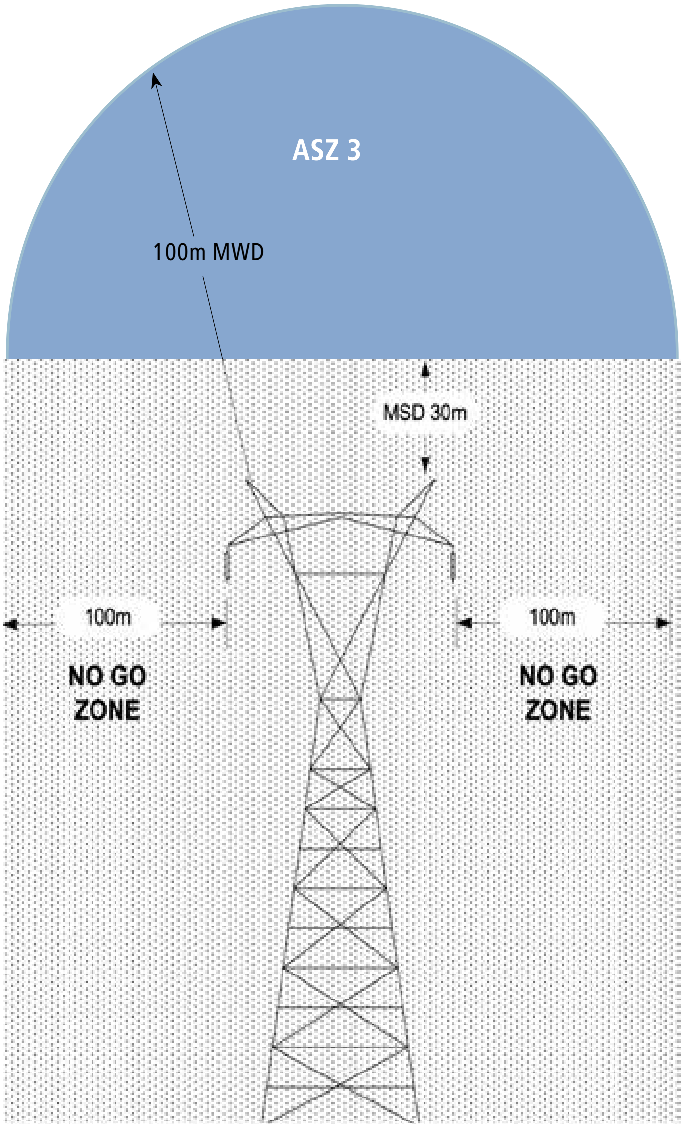


Diagram showing the No-Go Zone and the ASZ 3 Zone that applies to Fixed wing aircraft.

4.9: Fixed Wing Separation Distances

Ensuring safe separation between fixed wing aircraft and infrastructure.

For fixed wing operations, the Aerial Surveillance Zone (ASZ) 3 extends from the Minimum Separation Distance (MSD) of 30 meters/100 feet from above the top of the structure to the Maximum Working Distance (MWD) of 100 meters/ 300 feet. ASZ 3 is connected by a straight line between the structures.

All patrols and inspections conducted by fixed wing aircraft must not compromise the MSD defined above, and shown in Figure 4.

Fixed-wing patrols and inspections must adhere to minimum safe distances from infrastructure. Operating speeds and maneuverability considerations (e.g. maximum angles of bank/turn radius) should be detailed in the aircraft operator's documentation.

evidence

The Operations Manual and SOPs should contain details of minimum parameters for fixed-wing patrols and inspections. Operational risk assessments should include patrol heights, speeds, maximum angles of bank and any mitigating factors considered.

5.0: Loss of Control – In-flight (LOC-I)

Crew actions or inactions inadvertently place the aircraft outside the normal flight envelope or the intended flightpath and lead to an unrecoverable flight situation

LOC-I events are characterized by the flight crew losing control of their aircraft for a variety of reasons. In most circumstances, the primary cause is the failure to effectively manage the aircraft flightpath and energy state. Often, LOC-I is preceded by a loss of airspeed reducing the aircraft's energy state, which is then followed by a flight maneuver that raises the stall speed (fixed-wing) or takes the aircraft past its level of control authority (fixed or rotary wing). Fixed wing stall events and rotary wing Loss of Tail Rotor Effectiveness events are classic examples of LOC-I. Unless immediate and effective corrective actions are undertaken, the LOC-I event can lead to ground impact, particularly when the aircraft is operating close to ground level, as is classically the case with most Utility and Energy Sector operations.

5.1: Flight Crew Skills

Ensuring high quality training of flight crew in a safe training environment.

Crews operating any aircraft in any role must be fully prepared for the task. Due to the often sporadic nature of Utility and Energy sector flight operations, crew recency in any particular task must be carefully considered and managed. Refer to Appendix 1 for flight crew recency minimum requirements. Any additional requirements for specific tasks should be determined by risk assessment.

Specific training programs should be utilized by the aircraft operator to enable crews to remain current in the flying techniques and procedures applicable to the variety of tasks likely to be undertaken.

The wide scope and variable nature of Utility and Energy sector aviation operations requires the development and implementation of bespoke training programs. The successful completion of an initial and subsequent recency training and checking program should ensure that flight crew are fully prepared for the upcoming tasking.

While unlikely to be available for task specific training, a FSTD does enable crews to practice 'standard' abnormal aircraft operations such as engine or system emergencies. Use of a FSTD should be considered during the design of a training program.

The company and aircraft operator should consider whether FSTDs are considered an appropriate component of an aircraft operator's training program. The availability of full flight simulators for smaller aircraft types is low, but simpler devices still offer valuable training.

evidence

Where the aircraft operator's check and training program utilizes flight simulators, the Operations Manual should contain procedures for their use.

The responsible regulatory authority's approval status of FSTDs should be monitored.

5.2: Flight Data Monitoring

Provision of accurate and timely feedback to flight crew via a monitoring program.

For long-term contracts, the aircraft operator must have a Flight Data Monitoring (FDM) program as part of its SMS, to systematically analyze and make pro-active use of digital flight data from routine operations to reduce risk and provide operational feedback.

FDM should be an important component of an aircraft operator's SMS, used to monitor and analyze the safety and quality of flight operations.

Data may be downloaded from the aircraft's FDR (e.g. by addition of a Quick Access Recorder or a wireless data transmission system) when fitted, by data card recording from certain modern glass cockpit designs or, for smaller aircraft that lack an FDR, by addition of a dedicated FDM recorder with some integral sensors. The comprehensiveness of the parameter suite monitored and data sampling rates will determine the comprehensiveness and fidelity of the analysis that can be performed.

Baseline flight data parameters are established following an initial data gathering exercise. Variations from the baseline are identified through a flight data monitoring computer analysis program.

FDM is an effective tool for identifying possible systemic issues (e.g. procedures, training, etc), improper techniques or unanticipated extremes of usage. Of particular significance is the detection of adverse trends that require revision of the aircraft operator's training or procedures. An effective program will encourage consistent adherence to procedures and their continuous improvement, while deterring any inappropriate techniques.

Where FDM is available to an aircraft operator, the operator's Safety Management System manual should detail the process for integrating FDM into the SMS. The process for regular reviews of the data and an investigative process for out of tolerance events should also be clearly documented.

An aircraft operator's records should confirm that data is being analyzed and that any events outside of normal operational parameters are investigated. They should also demonstrate that appropriate actions are determined and are verified as being carried out and effective.

UK CAA CAP739 Flight Data Monitoring
Helicopter FDM Industry Best Practice document *(www.hfdm.org)*

5.3: Performance and Control Margins

Ensuring the aircraft has sufficient performance and control margins to safely complete the task.

Prior to takeoff, the Pilot-in-Command must calculate the helicopter 'power available' versus 'power required' and ensure that the figures are within limits and that the required performance and control margins are maintained throughout the flight.

Aircraft performance and the ability to avoid obstacles and terrain is directly related to the excess power available to the aircraft.

Providing suitable safe power and control margins ensures that sufficient performance is available to clear obstacles or terrain under both normal and adverse conditions.

If a helicopter is operating at close to its maximum power available, then there is limited ability to counter adverse conditions such as turbulence or make quick control inputs to avoid an obstacle.

It some contracted missions, such as hoisting and side pulls, lateral CofG can be problematic.

Carrying unnecessary mass during flights where high engine power will be needed both degrades flight performance and makes safe forced landings more challenging.

evidence

The Operations Manual should prescribe required performance and control margins. Preflight risk assessments and flight planning documentation may also demonstrate conformance.

5.4: Helicopter Unanticipated Yaw

Operation of the helicopter in a manner that minimizes the risk of an unanticipated yaw.

The aircraft operator's procedures must ensure pilots are familiar with the conditions where helicopters are vulnerable to unanticipated yaw. Competence in the understanding of triggering conditions and subsequent recovery actions must be assessed each year during the annual proficiency check.

Unanticipated yaw is a flight characteristic to which all types of single rotor helicopter (regardless of anti-torque design) can be susceptible at low speed, dependent usually on the direction and strength of the wind relative to the helicopter.

This characteristic is sometimes described as "loss of tail rotor effectiveness (LTE)" even though the tail rotor always remains fully serviceable. It is not linked to any failure and has nothing to do with the full loss of tail rotor thrust.

Understanding unanticipated yaw is important to avoiding it, particularly as it appears to continue to be a contributing factor to some accidents. Therefore, it is important that aircraft operators document how this issue is covered in their procedures and training.

evidence

The aircraft operator must have SOPs or similar, taking into consideration any specific guidance from the aircraft manufacturer regarding unanticipated yaw. Training should also cover this area.

5.5: Helicopter Vortex Ring State (VRS)/Settling with Power

Operation of the helicopter in a manner that minimizes the risk of VRS/ Settling with Power.

The aircraft operator's procedures must ensure pilots are familiar with the conditions where helicopters are vulnerable to VRS/Settling with Power. Competence in the understanding of onset and development of VRS/settling with power and recovery actions must be assessed each year during the annual proficiency check.

Vortex Ring State (VRS), a flight condition also sometimes called 'settling with power' or 'power settling', is a flight condition in which a helicopter that is receiving power from its engine(s) loses main rotor lift and subsequently experiences loss of control.

It occurs when a recirculation vortex envelops a helicopter's rotor system, causing significant loss of lift. It can be sudden, and it results in a rapid increase in rate of descent. Any increase in rotor thrust to reduce this further energizes the vortices and increases the rate of descent. Conditions potentially leading to VRS are low forward speed, high rate of descent, power on.

It is very important that flight crews are aware of VRS, its incipient indication and recovery measures.

The aircraft operator must document how this phenomenon is covered in their training and procedures. It should detail the conditions that are favorable to encountering VRS, techniques to avoid as well as recovery techniques.

5.6: Fixed-Wing Dynamic Stall

Control of the aircraft in a way that prevents operations at low speed and high angles of bank.

The aircraft operator's procedures must ensure pilots are familiar with stalls and that a stall can occur at any indicated airspeed, in particular with the increase in stall speed at high angles of bank and the necessity to avoid this flight regime. All flight crew should be cognizant of the pre-conditions that lead to a dynamic stall and be competent at the recovery procedures if they do occur. Competence in stall identification and recovery must be assessed each year during the annual proficiency check.

Many aircraft accidents have occurred when flight crew have attempted to maneuver at high angle of bank at low airspeed. The stalling speed or the minimum steady flight speed at which the aeroplane is controllable increases exponentially with increasing angle of bank. Any temptation to increase angle of bank while maneuvering to observe infrastructure at low level must be avoided.

The aircraft operator must document angle of bank and airspeed limits in their Operations Manual or SOPs and demonstrate how these matters are covered in their training and procedures.

6.0: Incorrect Loading

Incorrect loading results in an aircraft accident

Loading errors can present a major hazard to flight safety and there have been numerous incidents where control of aircraft has been either lost or compromised, due to incorrect loading.

Aircraft loading must be conducted in a way that ensures the specified maximum allowable weights are not exceeded and that the load distribution results in the center of gravity being in, and remaining within, the permitted flight envelope for all stages of the intended flight.

It is crucial that the flight crew are aware of the aircraft's weight and center of gravity so that the aircraft equipment can be configured appropriately for all stages of flight. This is important to ensure that the aircraft can be operated with full control authority available.

6.1: Occupant Weight

Ensuring accurate occupant masses are utilized in load calculations, appropriate to the type of aircraft.

Actual weights that include the clothing/PPE/safety equipment must be used unless an appropriate alternative is agreed to by the end-user and/or client company.

The actual mass should either be determined using accurate scales prior to the flight (or series of flights) or, where personnel are routinely involved in the contracted activities, subject to periodic sampling with a documented record of that individual mass. In the latter case, adjustments may need to be made when clothing/PPE/safety equipment varies depending on the specific activity being conducted, environmental conditions, etc. Standard masses for combinations of clothing/PPE/safety equipment are usually acceptable.

The use of standard masses for personnel is not appropriate in aeroplanes with a small seating capacity or helicopters, with the exception of emergency rescue scenarios.

The aircraft operator's documented procedures should include the method to determine the weight of passengers to be carried on each flight. Such procedures must require determination and use of actual body weight (including hand luggage) for passengers. Records of calibration of scales should be examined.

6.2: Cargo Weight and Loading

Ensuring aircraft loads are accurately weighed, manifested, appropriately positioned and secured.

Weigh items of baggage (including personal equipment bags), cargo and any role equipment carried separately and include details on the manifest.

Items carried in the cabin, on external hardpoints or on helicopter external platforms must be secured in accordance with aircraft operator's procedures consistent with the Flight Manual. Normal and emergency exits must not be obstructed. To maximize performance margins minimize unnecessary mass carried on-board the aircraft.

The procedures for securing these items must consider floor loadings, CofG ranges, appropriate means of restraint, manual handling (including in flight if necessary), cabin access/movement and emergency egress.

Actual weights should be determined using accurate scales.

Appropriate measures must be taken to protect items from the effects of rain between weighing and loading on-board (both to protect items and avoid mass growth from absorption of water).

The Pilot-in-Command is responsible for ensuring that the aircraft is loaded within its center of gravity and weight limits at all times.

evidence

The aircraft operator's documented procedures should detail the requirements and processes that are to be used to determine the weight of all baggage and cargo that is to be carried on each flight. Where an aircraft operator has obtained agreement from the company for cargo to be carried in the passenger compartment during passenger carrying operations, the approval should be included in the Operations Manual. The aircraft operator's procedures should also detail the locations in the cabin that may be used and the method by which cargo will be restrained.

6.3: Load and Trim Calculations

Ensuring accurate and safe aircraft loading within approved limits.

Prior to takeoff, the Pilot-in-Command must ensure that fuel and oil requirements are correct, and that weight and center of gravity limits of the aircraft have been calculated and are within limits for flight. The Load and Trim calculations may be accomplished by any approved means, but the details must be available in the cockpit at all times.

The aircraft operator's load management procedures should specify the calculation methods acceptable, the center of gravity limits and the requirement for the Pilot-in-Command to authorize the final load calculation. An approved load-sheet (or approved alternative) must be completed prior to departure of the aircraft on each stage of every flight. Where a flight involves a number of stages, a supplementary load sheet reflecting the loading at the initial stage and accounting for all changes in the load may be used for each subsequent stage on the same day.

Any changes to the aircraft baseline configuration should be managed through documented procedures, including aircraft reweight. Where the basic operating weight changes with the addition and removal of role equipment, the aircraft operator should provide basic operating weights in each configuration.

The aircraft operator should retain records associated with flight for a period of 90 days.

evidence

The aircraft operator's procedures should detail the requirements and processes to determine the aircraft weight and balance for each flight, and require a copy of the associated load sheet to be carried on the aircraft and be available on the flight deck at all times during flight.

Documented procedures should also detail requirements for retention of load sheets and other documentation related to the weight and balance calculation for each flight for a minimum period of 90 days.

Courtesy: Heliservices HK

6.4: Manifest

Ensuring accurate manifests are completed.

A manifest that accurately reflects the load must be raised for each flight or, where applicable, each sector.

The aircraft operator's load management procedures must ensure that a manifest (including details of crew, passengers and cargo) is raised for each flight or each sector of a flight where there is a change.

Manifests should usually be retained for a minimum period of 90 days.

evidence

The aircraft operator's documented procedures should detail the requirements and processes that are used to compile manifests for each flight. Such procedures should require that manifests contain the names of crew and passengers carried, the places of their embarkation and destination and clear details of the flight to which the manifest relates such as the date, estimated time of departure, flight route. Manifests should be retained with load sheets and other associated loading documentation and should be available in accordance with the aircraft operator's documented records retention procedures.

6.5: Dangerous Goods Cargo (Hazardous Materials)

Ensuring only appropriately packaged and documented DG is carried in aircraft and is handled by trained and current personnel.

The aircraft operator must comply with current International Air Transport Association (IATA) requirements (or similar requirements such as Title 49 of the Code of Federal Regulations) associated with Dangerous Goods Regulations. The aircraft operator must have appropriate procedures and trained personnel for the carriage and acceptance of dangerous goods and/or ensuring dangerous goods are not carried. All flight crew must complete dangerous goods awareness training at least every two years.

Dangerous goods may only be carried if an aircraft operator has met the specific training, documentation, record keeping and incident reporting requirements of the responsible regulatory authority.

The successful application of regulations for the transport of dangerous goods by air is dependent on all individuals being aware of the risks involved and having a detailed understanding of the regulations. This level of awareness can only be achieved through the completion of initial and recurrent dangerous goods training programs for all personnel that may be involved in the handling of cargo that has been consigned for carriage on an aircraft.

evidence

The aircraft operator must be able to demonstrate approval from the responsible regulatory authority for the carriage of dangerous goods (if applicable) or have procedures to ensure dangerous goods are not inadvertently carried.

The aircraft operator must have a Dangerous Goods Manual (or equivalent document) to provide all personnel with the instructions and information that is necessary to enable them to safely perform the task of handling and carrying dangerous goods.

6.6: Safety Briefing

Ensuring aircraft occupants have the necessary knowledge to safely board, disembark and evacuate the aircraft in all situations.

Task specialists and any passengers must be briefed on emergency procedures and safety matters prior to flight.

Safety briefing should include as a minimum:

- That there is no smoking during the flight or around the aircraft and apron area;
- A general description of the aircraft and specific avoid/danger areas;
- The location of non-smoking and fasten seatbelt signs and briefing cards;
- The use of seat belts and shoulder harnesses;
- The fitment and use of certified helmets, if applicable;
- The means of communication between crew and passengers;
- The brace position;
- The location and use of normal and emergency exits and all life-saving equipment;
- Instructions on the limitations on the use of Personal Electronic Devices (PEDs) and any role specific equipment; and
- The use of sideways facing seats during takeoff and landing unless approved UTR harnesses are fitted.

Regardless of previous flight experience, all aircraft occupants maximize their chance of survival if they receive an appropriate preflight safety briefing, retain the information passed to them and can apply it in an emergency situation.

In Utility and Energy sector operations where multi-sector flights utilizing the same passenger complement and crew occurs (e.g. bushfire patrol activities), one safety briefing for a 24-hour period is sufficient to satisfy the intent of this control.

evidence

The aircraft operator's procedures should specify the requirements that are to be followed to ensure that all passengers are properly briefed on emergency procedures and other matters of importance to their personal safety before flight. The content and delivery of the briefing will demonstrate that the above requirements have been met.


Courtesy: Leading Edge Helicopters

7.0: Collision on Ground

An aircraft/external load and an object collide on the ground

The term ‘collision on ground’ covers a range of safety scenarios relating to damage arising from aircraft colliding with obstacles while maneuvering on the ground, or the collision of people or equipment with a stationary aircraft (including propellers and rotors that may be in motion).

Take appropriate measures to address and minimize the possibility a collision on the ground. Such measures start with the design and layout of the operating site and extend to controlling the movement of personnel and equipment around aircraft movement and maneuvering areas.

Particular care needs to be taken in situations where an aircraft is being readied for departure or arrival whilst departures of multiple aircraft are occurring.

7.1: Operating Location

Ensuring personnel and unsecured items are segregated from aircraft to avoid collisions.

Aircraft must only start-up, taxi, takeoff, land and shut-down in areas segregated from any personnel not involved in the aircraft operation and from uncontrolled vehicle movements. Pilots are to consider the effects of rotor downwash when selecting departure and approach flight-paths.

Depending on the nature of the site and the collision threats, the segregation may be achieved by permanent physical barriers, temporary barriers, signs or lookouts. Personnel who are not trained at working in close proximity to aircraft should be escorted (e.g. if they are to board the aircraft).

The company and/or aircraft operator should have documented information regarding the facilities available and the procedures that are to be followed for each airfield or landing site under their control. All relevant information should be provided to aircraft operators so that it can be incorporated into their site-specific SOPs, as required.

evidence

The aircraft operator should document site-specific SOPs covering ground operations and the safe conduct of loading/unloading cargo and or passengers.

7.2: External Load Laydown Area

Ensuring personnel are segregated from external loads to avoid collisions.

External loads may only be moved between areas that are clear of vehicle movement and any personnel not associated with the activity.

Depending on the nature of the site and the collision threats, the segregation may be achieved by permanent physical barriers, temporary barriers, signs or lookouts.

Ground operations involving helicopter external load lifting are extremely hazardous and it is crucial that all ground personnel involved in these operations have received appropriate training.

The aircraft operator must document the ground requirements that must apply during external load operations. This includes the placement as required of physical barriers and signage. Additionally, ground personnel involved in external load operations must be trained and provided with the appropriate PPE.

7.3: Airfield/Helicopter Landing Site (HLS) Design

Ensuring the physical design of airfields and HLS, their markings, lighting, emergency cover and all ancillary systems are suitable for safe operations.

Local regulatory guidance should be used when establishing airfields and/or helicopter landing sites. Additional information for short-term sites can be found in BARS Implementation Guidelines Annex B Short-term or Emergency Airstrip Use and Annex C Helipad Guidance.

Consider prevailing winds and the location of activity associated infrastructure in relation to the proposed sites.

ICAO Annex 14 should be included in design considerations for any permanent sites when local guidance is otherwise unacceptable to the BARS Member Organization.

7.4: Pilot at Controls

Ensuring aircraft that are under power and on the ground remain under control.

A pilot must remain at the controls of any aircraft on the ground with engines running at all times.

The controls are not to be left unattended with the aircraft under power in any circumstances - even to assist in activities such as hot refueling, external load attachment, briefings or personnel escort.

Personnel in close proximity to a running helicopter on the ground have a high risk of being struck by helicopter main or tail rotors. During rotors turning operations, aircraft operators must minimize the risks to ground personnel by ensuring that a pilot remains at the controls at all times. The pilot must only be engaged in essential cockpit duties so that they can consequently devote their attention outside the cockpit to identify external hazards and monitor activities around the aircraft.

The aircraft operator must document in the Operations Manual the requirement for a pilot to remain at the controls of a helicopter that is under power and with the rotors turning at all times while on the ground.

7.5: Airfield/HLS Management

Ensuring airfields and HLS are maintained and operated safely.

All company or aircraft operator owned and/or operated airfields/HLS must have personnel who are responsible for overseeing and managing the site In accordance with documented procedures.

Personnel should be appointed that are responsible for the oversight and management of the airfield/HLS and operating standards of associated facilities. Their functions will include:

- Inspections of aircraft movement areas and checking surface conditions and the possible presence of foreign objects;
- Inspections of any markers and markings, lighting, wind direction indicators and ground signals;
- Monitoring obstacles that may infringe the takeoff, approach and transitional surfaces;
- Inspections to determine if any birds or animals are near the movement areas;
- Inspections of measures, such as perimeter fencing and signage, that are in place to control the inadvertent entry of persons or animals into the movement area; and
- Management of any works to ensure the safety of aircraft operations and personnel.

The aircraft operator must be advised of possible or known changes to conditions that may present a hazard to aircraft operations.

See also Annexes A, B and C.

The Owner/Operator of the airfield or helipad should be able to provide documentary evidence of the scope and frequency of completed inspections.

7.6: Remote Landing Site Assessments

Ensuring effective assessment of remote landing sites to enable safe operations.

Aircraft operators must follow a standardized landing site assessment process as outlined in Company Standard Operating Procedures (SOPs) for all remote site landings.

Conducting a landing site assessment prior to commencing operations to a new remote site provides a necessary level of assurance for the conduct of safe operations. This can be a desktop review using available and documented information, or for more routine and established operations consist of an actual site visit to review facilities, infrastructure and the surrounding environment.

The aircraft operator’s procedures should prescribe landing site assessments. Completion of such an assessment will allow the aircraft operator to determine the presence of any operational risks to be addressed and facilitate the management of identified risks through the Safety Management System.

Courtesy: Heliservices HK

8.0: Collision in Air

An aircraft and object collide in air

The threat of collision in the air most commonly refers to an aircraft colliding with another aircraft; however, it also includes collision with RPAS, wires and wildlife.

The AAWHG website contains information on wildlife management at: http://aawhg.org/publications-and-tools/ See also: Airports Council International - Wildlife Hazard Management Handbook hosted on the ICAO website.

8.1: Simultaneous Aircraft Operations Management

Ensuring proper deconfliction between simultaneous aircraft operations in close-proximity.

Simultaneous operations include operations conducted by the same aerial operator at similar times using multiple aircraft or RPAS, or operations where multiple aircraft or RPAS from different aerial operators will be operating in close-proximity (i.e. vicinity of production mine sites, port areas, along pipeline/ powerline routes, storm response, etc.)

When simultaneous operations are planned, the company should use all available sources of information to ensure that all aerial operators are informed and that a deconfliction plan is generated, agreed and communicated.

The plan should include, the following:

- ***A unique identifier or callsign assigned to each air vehicle; and***
- ***Transit Altitudes: When transiting to the operating area, comply with the ICAO cruising altitudes, unless circumstances, such as weather, require non-standard procedures. Where known bird migratory routes are identified make practical attempts to plan cruise altitudes above 3,000 feet above ground level.***
- ***Deconfliction procedures can differ depending on the geography but ensure that it includes adequate margin, and references are clearly understood by all and can include the following:***
- ***Vertical separation requirements (with a 'not above' and 'not below' height) ;***
- ***An agreed set of geospatial references that define operating locations, areas or tracks;***
- ***A timeline that links operation serials to callsigns and geospatial references;***
- ***A process for coordinating changes; and***
- ***FSF RPAS Simultaneous Operations protocol articulated in RPAS Standard Annex A Model of Separation Standards should be referenced.***

The conduct of simultaneous operations demands an additional level of oversight and planning.

It is imperative that pre-operation planning involves consideration of all possible air operations in the area and the associated conflicts this may create. Aircraft operators must engage with all known operators during the planning stages. Any potential conflict of operations can then be factored into the plans and provide deconflictions based on physical separation (lateral or altitude) or time-based separation.

The aircraft operator should demonstrate that the pre-operation risk assessment and planning considers all facets of simultaneous operations with particular emphasis on communications and separation requirements.

8.2: Wire Strike Protection System (WSPS)

Ensuring survival in the event of a wire strike.

Helicopters expected to operate at a low level in a wire environment must be fitted with a WSPS for all operations. Where additional equipment such as cameras or mirrors are located on the aircraft and in the vicinity of the WSPS, the operator must conduct a risk assessment acceptable to the utility company, operator and pilot in command that ensures the WSPS is able to provide the complete protection as originally designed.

A Wire Strike Protection System (WSPS) is a mechanical wirecutter designed to mitigate the risk of wire strikes whilst flying helicopters at low-level.

The systems typically consist of a roof-mounted cutter and a lower cutter fitted to the fuselage, though some configurations can include multiple cutters. The operating concept is that if a helicopter strikes wires, the wires are diverted into the cutter and severed before they can impact the control rods to the main rotor system or snag on the undercarriage.

A WSPS is a passive mechanical system that requires no input from the pilot. In most cases, a WSPS can be retro-fitted to a helicopter that does not already have the system, although this will come at some cost.

It should be noted that WSPS are not effective at slow speed or while maneuvering around wires.

Aircraft documentation or physical inspection should show that the aircraft is fitted with a certified WSPS when tasked to operate at low level.

8.3: Airfield/HLS Bird Control

Ensuring that the probability of bird strikes to aircraft in the vicinity of airfields/HLS is minimized.

Conduct active bird control at all company or aircraft operator owned and or operated airfields/HLS as necessary. Where possible, birds must be dispersed or removed in accordance with local wildlife regulations. Seeding grass, open waste disposal and water ponds must be restricted to remove attractions for birds.

Environmental conditions attract birds for a variety of reasons resulting in differing bird control challenges at every location. Variables such as migratory routes, seasonal changes, bird species, local feeding influences, availability of water, freshly cut grass and close proximity of refuse sites will all play a part in the presence of bird life. The availability of nesting habitats provided by hangars compounds the problem.

The key to any successful bird control program is habitat control, which involves making the airfield less attractive to birds. This requires an understanding of why a particular species of bird may be present in the area and around the operating airfield or HLS.

Airfield/HLS site procedures should address this matter by conducting active bird control at all company owned and operated airfields when required and record the presence of birds periodically. Where possible, birds must be dispersed or removed in accordance with local wildlife regulations. Seeding grass, open waste disposal and water ponds must be restricted to remove attractions for birds. Where bird activity exists, aircraft operators should provide guidance to minimize the risk of bird strike during all operations.

8.4: Automatic Dependent Surveillance Broadcast (ADS-B)

Ensuring the optimum use of ATC services and data to maximize air traffic separation.

Aircraft operating on dedicated long-term contracts must be equipped with ADS-B.

Particularly for aircraft doing low level survey and inspection tasks, ADS-B In gives increased situational awareness and can also serve as an avoidance control for RPAS/UAV operations in the locality.

Inspection of aircraft and/or documentation should confirm that the aircraft is fitted with ADS-B 'IN' when appropriate. The aircraft operator should also document procedures for its use.

8.5: High Intensity Strobe Lights (HISL)

Ensuring aircraft are conspicuous to all other traffic.

Aircraft on long-term contract must have HISL or suitable pulse lights fitted.

Regardless of the type of aircraft flown or the classification of airspace being operated in, it is the responsibility of all flight crew to avoid in-flight collisions with other aircraft through visual contact. Although a simple premise, the 'see and avoid' concept is the last line of defence.

The provision of high intensity strobe or pulse lights on aircraft reduces the risks of in-flight collision by making an aircraft a positive visual target to other flight crew at earlier stages of a potential conflict. As an added control to the final defence, this is particularly true when an aircraft is being observed against terrain, a dark sky or in conditions of low light.

The aircraft should be fitted with HISL or pulse lights when appropriate and this confirmed by inspection of the aircraft and/or aircraft documentation. The aircraft operator must document a procedure for the use of all aircraft lighting and where applicable, this procedure must be reflected in the flight check system for each aircraft type. Aircraft fitted with conforming light systems should be regularly checked for correct functioning of the lights.

8.6: Aircraft Windshield and Window Condition

Ensuring good visual acuity.

To facilitate good lookout and field-of-view, aircraft transparencies used by crew and task specialists must be assessed for cleanliness and serviceability during the daily preflight inspection. Particular attention should be paid in ensuring any scratches do not obscure a clear field-of-view at all times.

Clean, clear canopies reduce flight crew workload by reducing glare and permitting the acquisition of terrain details earlier in the flight. Clean transparencies also permit the early identification of airborne hazards such as other aircraft or birds.

evidence

Inspection of the aircraft is more likely to occur as part of the Operational Review process, but may be undertaken during the BARS audit if a representative aircraft is available.

Courtesy: Leading Edge Helicopters

9.0: Technical Failure

A technical failure of the aircraft or its equipment results in an accident

Structural or mechanical failure is less commonplace than it used to be in the early days of aviation. The evolution of analytical technologies, a greater understanding of stress and fatigue management, advanced manufacturing techniques with closer tolerances and better monitoring systems have combined to dramatically reduce the incidence of structural or mechanical failures.

Nonetheless, structural and mechanical failures do still happen and it is critical that controls are put in place to minimize the opportunity for these types of failures to occur.

9.1: Single-engine Aircraft

Minimizing the risk in the event of a loss of engine power and subsequent forced landing.

All single-engine aircraft used for energy and utility activities in accordance with this standard must have turbine engines. Aircraft operators/maintenance organizations must comply with any recommended modification standards or maintenance procedures issued by the engine or aircraft Type Certificate Holders to reduce loss of power events.

The greater reliability of turbine engines over reciprocating engines is well documented and results in less risk of experiencing an engine failure when operating turbine powered aircraft.

For a number of years manufacturers of multi-engine helicopters in particular have issued information notes to aid compliance with JAR-OPS 3 and now EASA Air Ops requirements. If the TC Holder does not issue such guidance, the aircraft operator should demonstrate they have thoroughly reviewed all Service Bulletins, Service Letters and other similar publications to determine their effect on propulsion reliability (which includes engine, fuel, intakes, controls, etc), adopting as appropriate.

evidence

The aircraft operator may have a mixed fleet of single-engine, multi-engine, piston and turbine. Records should be reviewed to ensure that any single-engine aircraft utilized on BARS operations are turbine powered.

9.2: Supply of Spares

Ensuring the provision of genuine, serviceable parts.

The aircraft operator must ensure that all parts accepted into stores and fitted to aircraft conform to approved design data, were released to service by an appropriate organization, are appropriately stored and are in a condition for safe operation.

The aircraft operator must have suitable procurement, stores and maintenance procedures.

Storage areas for serviceable aircraft components must be clean, well-ventilated, adequately lit and maintained at a constant dry temperature to minimize the effects of condensation.

Adequate protection must be provided to protect components from damage, contamination, electro-static discharge and environmental effects during storage and handling.

Processes must be in place to control items with shelf life limits or which require periodic action to remain in storage. Processes must be in place to ensure that all components that cannot be returned to a serviceable state are mutilated in a way they can never be illegitimately passed off as serviceable.

Stored components will be adequately marked, tracked and segregated.

Explosive, flammable, corrosive and toxic materials must be segregated and appropriately stored. All shipments of Dangerous Goods from the stores should comply with the applicable regulations.

When aircraft are deployed to temporary operating locations, there needs to be a means to ensure spares needs can be met from forward deployed stock or by shipment to the site. The aircraft operator will be able to demonstrate that foreseeable commonly used spares and consumables are readily available during a deployment so that maintenance can routinely be completed in full compliance with the applicable maintenance data and that delays in returning an aircraft to service will only be due to less common failures where forward stock is not economically justified.

evidence

The aircraft operator should have a list of approved suppliers that are included in a Quality Assurance Program to ensure that parts received conform to FAA approved (or equivalent) design data and are in a condition.

9.3: Hangar Facilities

Ensuring facilities are conducive to maintenance practice.

At permanent operating locations, hangar facilities that are suitable for the activities being performed, considering human factors issues, must be available.

The aircraft operator, in consultation with the company, must ensure that aircraft have access to suitable hangars. Protection of the aircraft from the elements will substantially increase the life of certain components and will allow maintenance personnel to focus their attention on maintenance tasks without being distracted by poor weather, fading light, strong winds, high rainfall, snow, etc.

Procedures must be in place to assess the suitability of any temporary facilities that may be needed.

evidence

Facilities should be regularly inspected to ensure that all required equipment is installed and serviceable.

9.4: Helicopter Vibration Health Monitoring (VHM) System

Ensuring the early detection of impending critical failures to facilitate timely corrective action.

Where available and reasonably practicable, helicopters must be fitted with an approved VHM system capable of monitoring the rotor and rotor drive systems.

The VHM system must measure vibration characteristics of rotating critical components during flight utilizing suitable vibration sensors, techniques, and recording equipment. Alert generation processes must be in place to reliably advise maintenance personnel of the need to intervene and help determine what type of intervention is required.

The operator must have documented procedures and trained personnel to:

(1) Collect the data including system generated alerts;

(2) Analyze and determine component serviceability; and

(3) Respond to detected incipient failures.

Health and Usage Monitoring Systems (HUMS) and VHM systems in particular are used to provide early detection of rotor and transmission/rotor drive system component issues. They may also provide engine data, but rotors and transmissions are the primary target. The VHM system should be certified to CS-29.1465 or an equivalent VHM regulatory standard.

HeliOffshore have a defined recommended practice in relation to the management and use of HUMS/VHM that is a useful resource. As well as being able to download and maintain a VHM, the aircraft operator should demonstrate that they have the skills to assess the data, liaising with the VHM Designer and/or the TC Holder as appropriate.

The VHM system should be certified to CS-29.1465 or an equivalent VHM regulatory standard.

evidence

Where an aircraft operator has VHM systems in use, the System of Maintenance should address procedures for routine data download and analysis of the data.

Personnel training and Go/No-Go criteria should also be addressed by the aircraft operator.

9.5: Engine Trend Monitoring

Ensuring the early detection of impending failures in engine systems to facilitate timely corrective action.

The preference is for all single-engine aircraft to be equipped with an electronic engine usage and trend monitoring system. The aircraft operator must follow procedures to routinely download the system, analyze engine trend data and take necessary actions to minimize the probability of engine failures. Where electronic monitoring is not available or installed, the system of maintenance must ensure manual (paper-based) engine trend monitoring is employed.

In order to minimize the probability of engine failures, the recording of engine usage and the assessment of the data for abnormal occurrences and adverse trends should be conducted. Such equipment should be certified for the purpose.

evidence

When a system is used, the aircraft operator should document the process that ensures engine condition trend monitoring is effectively carried out through:

- Articulating relevant personnel training and qualification requirements;
- Stipulating data is accessed at specified intervals;
- Stipulating data is only interpreted by an appropriately trained person;
- Ensuring all procedures meet OEM and regulatory requirements; and
- Outlining actions to be taken in response to detection of adverse trend data.

Associated records such as trend data print-outs/graphs and staff training records must confirm that requirements of the trend monitoring program are being appropriately carried out.

9.6: Minimum Equipment List (MEL)

Ensuring clear guidance for the safe operation of the aircraft with inoperative equipment prior to dispatch by use of approved procedures.

Aircraft operators must develop a MEL for all aircraft on long-term contracts. All equipment installed on an aircraft must be operational, unless it is operated in accordance with an approved MEL or approved by the appropriate civil aviation authority under an established program for deferred defects.

Most aircraft are designed and certified with an amount of redundancy in their systems such that the minimum required airworthiness standards are exceeded by a substantial margin. Not all instruments, systems and equipment on-board an aircraft are required for safe operation of the aircraft all of the time. For example, instrument lighting is not required for operations in day visual conditions and heating systems may be inoperable in hot environments.

The MEL is a document which provides a regulatory approved framework allowing the aircraft operator's personnel to determine what items of equipment under what conditions are allowed to be inoperative at the time of dispatch for the intended flight. An approved MEL consists of an approved list of the specific inoperative equipment for a particular make and model of aircraft by serial and registration mark.

The MEL will define any operational or maintenance procedures and/or limitations that may be required to be applied prior to dispatch and/or during subsequent flight to maintain safe operations. The key to using the MEL is to understand that varying time limits exists for how long an aircraft may be operated between the deferral of an inoperative item and its repair. The aircraft operator should always ensure that the continued operation of an aircraft with inoperative equipment is minimized.

It is essential that training in the applicability and use of the MEL and associated documentation should be provided to both the aircraft operator's flight crew and the maintenance personnel.

evidence

Where required, the aircraft operator must have approved MELs for the relevant aircraft. The aircraft operator's MEL should be consistent with the Master MEL and approved by the responsible regulatory authority.

The Operations and Maintenance Control Manuals should detail MEL training requirements for all flight crew and technical personnel who have the operational expectation to utilize an MEL. Training records should be available as supporting evidence.

9.7: Critical Maintenance Tasks (CMTs) and Independent Inspections

Ensuring maintenance tasks that are critical to the safety of flight are managed with additional independent scrutiny.

Maintenance tasks that involve assembly or disturbance of any system that may affect the flightpath, attitude or propulsive force, which, if errors occurred, could result in a failure, malfunction, or defect that would endanger the safe operation of the aircraft must be considered as a CMT.

CMTs must be clearly identified in maintenance worksheets or job cards.

CMTs must be subject to an Independent Inspection in accordance with established procedures, carried out by at least two persons, at least one of which is qualified and authorized to sign the Maintenance Release.

The aircraft operator should ensure that all CMTs that meet the definition above, as a minimum, are defined as such. Any item identified by the Type Certificate Holder or the responsible regulatory authority as a CMT (or an equivalent) should also be treated as such.

An Independent Inspection (also sometimes referred to as a Required Independent Inspection or Duplicate Inspection) should be conducted on all CMTs. The first of the two-person complement to inspect the task shall be the person who is to sign the Maintenance Release and may have been involved in execution of the task. The second person is the independent checker (verification) and should not have been involved in the task. Ideally they should also be qualified to sign the release but a person otherwise qualified to do Independent Inspections may be used.

Independent inspections must be recorded.

evidence

The Maintenance Procedures Manual of the Approved Maintenance Organization should detail the requirement and procedures for identifying and carrying out Independent Inspections following Critical Maintenance Tasks.

Work packs will provide evidence of identification of Critical Maintenance Tasks and evidence of Independent Inspection.

10.0: Weather

Adverse weather conditions cause an accident

Weather is a key consideration in the planning and execution of all flight operations. Every weather assessment made by flight crew must be protected from external pressures intended on influencing their decision to commence or continue a flight (this includes the client and company personnel).

10.1: Flight Planning Weather Data

Ensuring flight crew receive accurate actual and forecast weather data to enable sound planning decisions.

Flight crew must have access to suitable weather data, even when deployed to forward operating sites, to be able to anticipate deteriorating conditions.

Availability of accurate weather data significantly enhances the safety of the aviation operation. In remote areas. At some remote work sites trained observers and/or automatic weather equipment may be appropriate if there is limited access to other sources of data.

evidence

The aircraft operator must document a description of minimum expectations associated with weather forecast review used in support of preflight planning. Flight crew must ensure that they obtain and assess a weather forecast that covers the route to be flown, the planned destination and when required, the airfield that is to be provided for as an alternate destination.

10.2: Adverse Weather Policy

Establishing weather limitations consistent with the capabilities of the aircraft and the available rescue assets, are applied to each flight.

An Adverse Weather Policy must be developed by the company in conjunction with the aircraft operator when weather conditions exist that are suitable for flying, but not suitable for the contracted activity or only suitable with risk mitigations. The Adverse Weather Policy must outline clearly under what conditions the contracted activity should be restricted or temporarily halted.

The purpose of an Adverse Weather Policy is to formalize an agreement between the aircraft operator and the company as to when weather conditions are such that aircraft operations are stopped, or are continued albeit with an increased level of approval authority.

See also Control 4.3 Environmental conditions Go/No-Go.

The requirement for an Adverse Weather Policy is to be identified during pre-mobilization planning/operational risk assessment.

10.3: Thunderstorm Avoidance

Ensuring safe operations in the vicinity of thunderstorms.

Aircraft operators must outline thunderstorm avoidance techniques in the Operations Manual.

The aircraft operator must document all techniques relevant to the aircraft type operated that are related to navigating around thunderstorms and avoiding the worst of the conditions that are associated with these systems.

Information will include:

- Avoidance techniques applicable to operations;
- The most likely location of severe turbulence around the thunderstorm and the separation standards to be applied to avoid this;
- Precautions to be taken when operating in the vicinity of building storms; and
- The minimum lateral separation to be applied when avoiding the upwind and downwind sides of storm cells.

evidence

The aircraft operator must ensure that information contained in the Operations Manual provides crews with adequate guidance on the techniques to use to avoid severe weather associated with thunderstorms.

10.4: Minimum Weather Requirements

Ensuring aircraft are operated safely with appropriate weather minimums in dynamic or marginal environments.

Local Standard Operating Procedures must be developed for areas, such as mountainous or jungle areas, where rapidly changing VFR conditions can be common.

Each aircraft operator needs to establish weather minimums, which will meet or exceed the minimums prescribed by the responsible regulatory authority for VFR flight.

If the local conditions are dynamic and constantly changing, there may be a requirement for a conservative approach of increasing the weather minimums depending on the experience and skill level of the flight crew. Examples of these areas are the high density-altitude mountainous jungle environments as experienced in PNG, South American Andes operations, parts of South East Asia and Africa.

(http://www.faa.gov/training_testing/training/fits/guidance/media/Pers%20Wx%20Risk%20Assessment%20Guide-V1.0.pdf)

During the start-up operational risk assessment prior to supporting Utility and Energy sector activities, the aircraft operator must review the VFR weather minimum criteria for the area of operations.

evidence

The aircraft operator must document a clear policy regarding the minimum weather conditions that apply to a VFR flight, particularly where local conditions are dynamic and constantly changing due to local topography or other conditions.

19.0: Aircraft Accident

Mitigating defences in the event of an aircraft accident

All BARS UE operations must be conducted in a manner that manages and mitigates the known or identifiable risks involved to ensure that the residual risk is as low as reasonably practicable.

If a critical control failure results in an event occurring, the BAR Standard identifies defence controls to mitigate the impact of the incident.

The defences identified in this section are recognized as the minimum expectation and companies, through risk assessment conducted jointly with their contracted service providers, are encouraged to provide additional mitigation as warranted by localized conditions.

The defenses identified in this section are the minimum expectations. Further defenses may be identified by risk assessment.

19.1: Emergency Response Plan

Ensuring adequate and appropriate SAR or emergency response procedures are up to date and tested.

All aircraft operations (including company owned or operated airports) must have an Emergency Response Plan (ERP) commensurate with the activity undertaken that covers: documented land-before-last-light limitations, exposure considerations, local Search and Rescue (SAR) capabilities, and hazards associated with the surrounding environment.

The ERP must be exercised annually for all long-term operations and include a bridging document detailing lines of communications between the company and aircraft operator.

Aviation accidents/significant incidents are rare events and despite the importance of implementing immediate and positive action, evidence shows that very few organizations are prepared when such an event occurs. Initiation of timely and appropriate action is extremely critical in situations where delays or the implementation of incorrect actions may affect the chances of survival.

People who have been involved in the immediate response to an aircraft accident will readily agree that during the first few minutes (and maybe hours) events can be confusing and chaotic. How an organization performs in the aftermath of an accident or other emergency can depend on how well it handles the immediate response during that time immediately following a major safety event.

Successful response to an emergency begins with effective planning. Both the company and aircraft operator should develop a documented ERP detailing what should be done after an accident and who is responsible for completion of each action. The ERP provides the basis for adopting a systematic approach to managing the organization's affairs and operations following a significant and unplanned event and should be practiced and reviewed regularly.

The Flight Safety Foundation BARS Program Office can provide an ERP Bridging Document template on request.

evidence

The aircraft operator must document an ERP to provide instructions and guidance on the duties and obligations of personnel following an accident or significant incident.

The company must document an ERP for each airfield/HLS at which they operate.

An ERP must be appropriate to the aircraft operations and other activities conducted at that location and should provide for the coordination of actions to be taken in an emergency in its vicinity.

An ERP appropriate to the size, nature and complexity of the operations being undertaken should be documented and available.

The ERP should adequately detail and provide for:

- A responsible and qualified person to lead the emergency response;
- The duties and responsibilities of key personnel in an emergency;
- Contact details for all relevant organizations and individuals including local search and rescue (SAR) capabilities;
- Effective communication between the aircraft operator, company and SAR resources;
- A process for periodically checking and updating emergency contact lists; and
- Conducting periodic, scheduled emergency response drills, exercises and/or tests.

The documented ERPs for both the company and aircraft operator should provide guidance to both organizations in pre-planning for emergencies, as well as detailing the protocols that will ensure appropriate coordination between the company and aircraft operator and other affected agencies.

Courtesy: Leading Edge Helicopters

19.2: Emergency Locator Transmitter

Ensuring timely alerting and location identification to aid SAR services.

An Emergency Locator Transmitter (ELT) meeting the requirements of Technical Standard Order (TSO) 126 (406MHz) or equivalent must be fitted to all contracted aircraft. The responsible party noted on ELT registration as the primary contact is also to be detailed in the aircraft operator's Emergency Response Plan.

ELTs are distress beacons that are activated following an aircraft accident either automatically using a crash sensitive switch that detects excessive force of deceleration or manually by a pilot or other person.

Each ELT has a discrete digital code that, when activated, transmits a position and identification signal that is detected by satellites within the international Cospas-Sarsat system. This information is then transmitted back down to ground stations where the code is read, enabling the source of the transmission to be identified (aircraft registration and location) and the owner of the aircraft determined. ELT registrations are required to be updated to reflect the current operator and contact details. The aircraft operator's point of contact (normally a key member of the Emergency Response Team) should be registered with the applicable authority.

evidence

Documented procedures for the activation, serviceability testing and maintenance of ELTs should be provided in the Aircraft Flight Manual (AFM), Operator Manual (OM) and Maintenance Manual (MM) as required and applicable.

Each ELT should be registered with the appropriate authority and the details recorded in the ERP. The aircraft operator should maintain ELT registration documents that ensure the operator contact details and applicable aircraft identification are current and correct.

Aircraft maintenance records must detail the completion of serviceability testing and maintenance procedures of ELTs, and show that devices are being maintained in accordance with the approved System of Maintenance.

19.3: Flight Tracking and Communication

Ensuring that the location of aircraft during normal and emergency situations is known at all times.

All aircraft must be fitted with a reliable flight tracking system. The position reporting frequency must be appropriate for the operation and update at least every two minutes. The aircraft operator must implement a flight following system for all flights that includes scheduled position reports, position logs maintained on the ground, operational flight plans and overdue/emergency response procedures, unless they remain in close proximity to a ground party who are directly monitoring the aircraft. The system must be monitored by personnel who are able to promptly initiate the ERP. Flight followers must regularly practice ERP activation.

There must be a reliable means of direct communication available between the aircraft and flight follower throughout the flight.

Flight following using a suitable flight tracking system significantly reduces the time required to locate an aircraft and respond to an emergency situation, in turn maximizing the chances of survival where aircraft operations are conducted in hostile environments.

evidence

The Operator's Operations Manual (or equivalent document) should contain documented procedures and training requirements.

19.4: Survival Kit

Ensuring that in the event of an emergency, aircraft occupants have access to suitable equipment and supplies to aid survival in the geographical environment.

Aircraft occupants must have access to survival equipment designed for the operating environment and sufficiently stocked to anticipate duration before the arrival of appropriate emergency response.

The ability for a search and rescue response will vary, and will always be affected by variables such as weather, availability of resources and time of day. Because of this, every flight should be considered as a potential survival situation requiring survival equipment appropriate to the location and climate.

Survival kits should be controlled and subject to inspections and shelf-life control as necessary.

evidence

The contents of the survival kit and its maintenance should be described in the aircraft operator's procedures.

19.5: Flight Crew Personal Locator Beacon (PLB)

Ensuring timely alerting and location identification to aid SAR services.

Flight crew operating aircraft in hostile environments must have ready access to a 406MHz Personal Locator Beacon (PLB) that is either voice-capable or is accompanied with a satellite phone when operating away from direct ground support.

The requirement for flight crew to have a PLB that is either voice-capable, or accompanied by satellite phone, as a mitigation control addresses several lessons-learned from Utility and Energy sector accidents:

- Back-up source of location in the event the ELT does not activate;
- The ability to communicate to searching aircraft to assist in locating survivors. This is particularly important in a jungle environment where the overhead canopy may prevent the searching aircraft from visually identifying the survivors below; and
- The ability to communicate the condition of the survivors to the searching aircraft, and whether there is a requirement to winch the critically injured out prior to last light before a ground party can reach the accident scene.

Having a PLB carried in a survival vest worn by flight crew maximize the opportunity of its use in any accident scenario.

Where an aircraft operator undertakes helicopter operations in hostile environments directions should be provided in the Operations Manual regarding the requirement for flight crew to carry a voice-capable, GPS PLB on their person.

Maintenance records should detail the completion of serviceability testing and maintenance procedures of beacons fitted to survival vests.

The aircraft operator should maintain registration documents for each beacon that appropriate identification and contact details are up to date and correct.

19.6: First-Aid Kit

Ensuring that in the event of an emergency, aircraft occupants have access to medical equipment.

At least one first-aid kit must be carried on all aircraft.

The aircraft operator must ensure that a minimum of one first-aid kit is carried on all aircraft that are used to support Utility and Energy sector operations. Where not defined by regulatory requirements, the contents of first-aid kit(s) should be determined by specialist medical advice as applicable for the type of activities being undertaken.

The first-aid kit(s) should be stored in an appropriate location in the aircraft to ensure ready access by the crew in-flight. The location should be near an exit as it may need to be used outside the aircraft in an emergency situation.

The content of the survival kit and its maintenance should be described in the aircraft operator's procedures.

19.7: Crew Helmets

Ensuring crew conducting external loads and extended low level operations in Aerial Surveillance Zones: ARZ, ASZ-1 and ASZ-2 have appropriate head protection.

All crew members operating in these zones must wear serviceable, visor equipped crew helmets that comply with industry standards.

The prime purpose of the helmet is to provide impact protection from bird strikes (or equivalent) and during accidents and thereby reduce the risk of a head injury.

The aircraft operator must ensure that flight crew involved in low level operations wear serviceable flying helmets that comply with industry standards.

19.8: Clothing

Ensuring that aircraft occupants wear appropriate protective clothing.

All occupants must wear clothing and footwear as detailed in the companies operating procedures that are appropriate to the environment being flown over and the task being performed.

The operator should clearly define the clothing required for each contracted activity and role, with seasonal differences when appropriate. As a minimum, long sleeved and long pants made from natural fibers are to be worn, accompanied by sturdy footwear.

evidence

The aircraft operator must have policies that ensure that all crew wear appropriate clothing, applicable to the environment in which they are operating.

19.9: Upper Torso Restraint (UTR)

Ensuring aircraft occupants survive a crash impact.

All helicopter and single-engine aircraft cockpit and cabin seats used during low level activity must be fitted with upper torso restraints and these are to be worn by occupants when seated, unless there is a valid reason not to do so, confirmed by risk assessment.

For helicopter operations, each front seat occupant is to be provided with, as a minimum, a restraint system that is fitted with a double-strap shoulder harness (four-point system). Aircraft may be fitted with a five-point system that also includes a crotch strap.

Valid reasons for not wearing a UTR include when secured by a personnel harness and preparing to move to/from a seat or when shoulder restraints are incompatible with the task. The latter case must be considered within the Operational Risk Assessment.

evidence

The aircraft operator's SOPs should provide directions regarding the mandatory wearing of seat belts/ UTRs and the circumstances under which UTRs can be undone.

19.10: Helicopter Underwater Escape Training (HUET)

Maximizing all crew members successful egress from the aircraft in the event of water impact.

Where operations may involve infrequent transit over water, beyond autorotative/gliding distance from a suitable landing area, consideration should be given for all crew members to successfully complete an annual verbal assessment of ditching procedures with focus on articulating emergency exit use, and ensuring PPE is managed in the event of water egress.

If extended hovering over water and/or conducting sustained low-level operations beyond autorotative/gliding distance from land are planned for, on a routine basis consideration should be given for all crew members to complete initial HUET and maintain three yearly refresher training.

Having the knowledge and skills necessary to assist with survival in a ditching scenario, significantly increases the chances of surviving such an emergency situation. Underwater escape training courses will increase an individual's knowledge of safety procedures and ability to successfully exit an actual ditching involving a submerged aircraft or helicopter. Underwater escape training should be representative of the escape paths and exit types for the aircraft or helicopter model being flown. Underwater escape training facilities that can replicate spray/wave and day/night conditions are preferred.

evidence

Associated training records must confirm that the documented requirements, processes and procedures associated with the aircraft operator's underwater escape training program are being complied with consistently in initial training and on a routine basis. Personnel files and rostering records confirm appropriate implementation of training programs.

19.11: Helicopter Crash Resistant Fuel System (CRFS)

Ensuring helicopter occupants survive a crash impact.

Helicopters operated at extended periods at low altitude and slow speeds must be fitted with a certified Crash Resistant Fuel System (CRFS) where available for the aircraft type.

The purpose of a CRFS is to reduce the risk of a post-crash fire causing casualties.

Exceptions, such as CRFS that are not certified for use with a cargo hook, may be accepted by the company after risk assessment.

evidence

Inspection of aircraft and/or documentation should confirm that the aircraft is fitted with a Crash Resistant Fuel System as required by the intended operating environment for the aircraft.

19.12: Emergency Response Capability

Ensuring aircraft occupants survive an accident at or close to a worksite.

Airfields and HLS in routine use must have a proportionate fire-fighting, rescue and first aid capability with appropriate emergency response procedures and exercises.

Where a contracted helicopter activity is at or close to a site where there is a ground party present, then capability must be available, with appropriate emergency response procedures and exercises.

The worksite equipment potentially includes fire extinguishers, a crash box (with tools and PPE), rescue ladders and first aid kits. Airfields and larger/busier HLS will have one or more fire-fighting vehicles.

The intent of the worksite requirement is to ensure that suitable equipment and trained personnel are available in the event of an accident. Some of these items will be needed for non-aviation emergencies. Ready access to local emergency service resources will tend to reduce the resources needed

evidence

The aircraft operator must document an ERP to provide instructions and guidance on the duties and obligations of personnel following an accident or significant incident. The aircraft operator and/or company must document an ERP for each worksite. The ERP should be appropriate to the size, nature and complexity of the operations being undertaken should be documented and available.

A suitably provisioned 'crash box' or similar, as well as fire-fighting equipment should be made available and must be tailored to the environment and aircraft type. Relevant documentation must include a list of emergency equipment at the worksites, location and contents of the crash box and applicable inspection schedules.

19.13: Insurance

Ensuring financial mitigation of losses.

It is the responsibility of the contracting company to determine the minimum level of insurance required in accordance with company risk management standards.

Such insurance must not be cancelled or changed materially by the aircraft operator during the course of the contract without at least 30 days written notice to the company.

The company must be named as additional insured under the contract.

Insurance forms a necessary part of any recovery from an incident or accident.

The company should ensure sufficient insurance cover is in place and that aircraft operators have the necessary insurance in place as part of their AOC and approval to operate.

The company should ensure that the aircraft operator's insurance meets their expectations and that the company is nominated as additional insured.

evidence

The aircraft operator should have statements of insurance cover that state the level of insurance carried for both hull loss events and per passenger.

Courtesy:Heliservices HK

Appendices

Appendix 1: Flight Crew Qualifications, Experience and Recency

Pilot-in-Command – Aeroplanes and Helicopters

Qualifications	5700 kg and below Multi-engine	Single-engine
Licence	CPL[1]	CPL
Experience[2]		
Total Hours	2500	2000
Total Command	1500	1500
Total Command Multi-engine	500	N/A
Total Command on Type	100	100
Experience in Topographical Area	One year experience in area similar to specified in contract (arctic, offshore, high density altitude mountainous, jungle, international operations, etc).	

Co-pilot – Aeroplanes and Helicopters

Qualifications	5700 kg and below Multi-engine	Single-engine
Licence	CPL	CPL
Experience[2]		
Total Hours	250	250
Total Multi-engine	50	
Total on Type	10	10

Pilot-in-Command, Co-pilot and Task Specialists[4] – Aeroplanes and Helicopters

Recency	
Total Hours previous 90 days[3]	50 hours, ten on the aircraft type
Task specific recency	Determined by ORA
Flying in the Wire Environment training	Every three years
CRM/ADM initial and refresher	Every two years
Dangerous Goods Awareness	Every two years
Accident and Violation Record	Two years accident free for human error causes, subject to review by the company

Maintenance Personnel – Aeroplanes and Helicopters

Qualifications	Chief Engineer	Line Engineer
Total time on Aeroplanes/Helicopters (whichever applicable)	Five years	Two years
Engine/Airframe/Avionics Rating (where appropriate)	Yes	Yes
Human Factors Training – Two years	Yes	Yes
Maintenance Training and of Competence Assessment – Two years	Yes	Yes
Accident and Violation Record	Two years accident free for human error causes, subject to review by the company	

(1) Some regulatory authorities may require the PIC to hold an ATPL for multi-crew operations.
(2) Competency-Based Training (CBT) reviewed and endorsed by a Competent Aviation Specialist may be used in lieu of prescriptive hours in table.
(3) If not met, a non-revenue check-flight by a qualified company check pilot is required.
(4) Applicability to Task Specialists is for CRM/ADM and Flying in the Wire Environment initial and refresher training.
(5) Additional experience requirements are needed for HEC (control 73.1) and external load operations (control 83.1).

Appendix 2: Basic Aircraft Equipment Fit

Helicopters and Aeroplanes

Equipment	Multi-engine	Single-engine
Two VHF Transceivers	Required	
One HF Transceiver, if VHF coverage is not available for the entire area		
Mode C or S Transponder		
TSO 126 ELT		
Upper Torso Restraints		
First-Aid Kit		
One Fire Extinguisher		
Survival Equipment, tailored to environment		
Wire Strike Protection Systems (helicopters only)		
TCAS	Required for dedicated long-term contracts	Optional
TAWS		
Satellite Flight Following (hostile environment)		
CVR/FDR, or as required by local CAA		
HUMS, UMS or VMS		
FDM		
External Mirrors or Camera for Situational Awareness (helicopters only)	Optional	
Crash Resistant Fuel Systems	Required where available for aircraft type	
High Visibility Pulse Lights – in areas of traffic	Required for dedicated long-term contracts	
ADS-B	Required for dedicated long-term contracts	
Engine Trend Monitoring Systems	Required for single-engine long-term contracts Optional for multi-engine	

Appendix 3: Patrols and Inspection

Airborne patrols and inspections of utility assets such as pipelines and powerlines are routinely conducted by all types of fixed wing and rotary wing aircraft

Routine patrols facilitate inspection of Utility and Energy structures such as powerlines and pipelines. The inspections can identify structural defects as well as encroaching hazards (man-made or natural). The patrols can be flown using fixed wing or rotary wing aircraft and this is known as ‘flying through the wire environment.’

Detailed power line inspections are more intrusive than routine patrols and are known as ‘working in the wire environment’. This usually entails a helicopter hovering out of ground effect (HOGE) and maneuvering around the structure to facilitate detailed observation using both human observation as well as a wide variety of sensors attached to the aircraft.

In addition to all controls outlined in the Threats 1-10, the critical controls essential for the conduct of routine and detailed power line and pipeline patrols and inspections include:

- Minimum crew complement;
- Consideration of sun position and effect of glare;
- Crew Resource Management (CRM) training and Crew Communication;
- Route briefing including minimum heights, speeds and angles of bank;
- Escape route considerations; and
- Aircraft Performance Analysis.

Figure 5: Operational Risk Assessment Considerations for Utility and Energy Patrols and Inspection Operations

Patrols and Inspection

Loss of Situational Awareness
- Crew Complement
- Position of Sun

Crew Communications Breakdown
- Crew Resource Management
- Terminology
- Crew Communications

Loss of Control In-flight (LOC-I) – Inspection
- Hover Out of Ground Effect (HOGE) Performance
- On-Task Speed
- Turning Radius

Controlled Flight into Terrain (CFIT)
- Minimum Heights
- Performance Monitoring
- Escape Route Consideration

30.0: Loss of Situational Awareness

The pilot loses situational awareness and inadvertently impacts the structure or terrain resulting in an accident

Situational awareness is having an accurate understanding of what is happening around the aircraft from an environmental, spatial, time and aircraft system perspective. With so many sources of information providing constantly updated input, each essential to safe flight, the capacity to maintain situational awareness relies on the ability to accept and analyze all input in a systematic and flawless manner. Terms such as crew saturation, over-loading, tunnel vision and cognitive overload are all descriptors of factors that can individually or collectively contribute to a loss of situational awareness.

30.1: Crew Complement

Ensuring crew composition planning is cognizant of the high workload of low-level patrol and inspection duties, and is appropriately managed.

The minimum crew complement must be a pilot and task specialist that meet all requirements of Appendix 1, including Flying in the Wire Environment training every three years.

All inspections, whether they be routine or detailed, are high workload activities.
In order to share the workload, two-crew operations are to be considered the minimum acceptable standard.

Aircraft operators must include these requirements in their Operations Manual or SOPs as minimum crew acceptable for routine or detailed patrols and inspections.

Courtesy: Meridian

30.2: Position of Sun

Ensuring sun position and possibility of glare obscuring crew vision is considered prior to each flight.

The crew must articulate the position of the sun during the pre-route briefing to ensure that due consideration is given to the possible impact of glare. Where necessary, consideration should be given to adjusting the time of the day for the patrol or inspection.

The glare from a rising or setting sun has been the cause of several accidents and represents a real threat. The effect of glare is further magnified by a dirty or scratched canopy, emphasizing the need for a clean and clear canopy at all times. The threat of sun glare is greatest in the early morning sunrise or evening sunset when the winds are at their lightest and most conducive to flight. It is critical that consideration be given to this as part of pre-route briefing prior to all flights.

See also Control 8.7.

evidence

Aircraft operators must include the requirement to consider sun position and impact of glare in their Operations Manual or SOPs as a responsibility of the Pilot-in-Command to consider prior to patrols and inspections.

Courtesy: Leading Edge Helicopters

31.0: Crew Communications Breakdown

A breakdown in effective communication occurs between crew members, leading to an accident due to the ineffective response to a safety-related threat

The importance of effective communications amongst all members of an operating crew has been highlighted in many accident reports and is routinely cited as a contributing factor. The aviation industry has developed mechanisms to minimize communication breakdown, ranging from a simple checklist through to a more detailed study of interpersonal skills prerequisite to an effective crew.

31.1: Crew Resource Management

Ensuring an operating crew make effective use of all available resources to assure a safe and efficient operation, reducing error, avoiding stress and increasing efficiency.

All operational crew members are to conduct an initial and refresher Crew Resource Management (CRM) course every two years.

CRM focuses on cognitive and interpersonal skills needed to manage a flight within an organized aviation system. The interpersonal skills emphasize the need for communications and a range of behavioral activities associated with teamwork to be well executed. CRM training assists in identifying these skills and provides case studies of accidents that illustrate where ineffective use of CRM can have negative consequences, regardless of the size and complexity of the aviation activity undertaken.

See also Control 4.5.

Aircraft operators must document in their Operations Manual the requirement for all operating crew to undergo initial CRM training and biennial recurrent training.

31.2: Terminology

Ensuring consistent terminology is used by an operating crew and ground support crew to avoid accidents through misunderstanding.

All operational and ground crew members are to use standard terminology related to the routine and detailed patrol/inspection flights.

The need for clear and unambiguous communication between an operating crew and externally from the aircraft to ground personnel is essential in assisting safe operations.

Aircraft operators must include these requirements in their Operations Manual or SOPs as a responsibility of the Pilot-in-Command.

31.3: Crew Communications

Ensuring all crew communications are clear and unambiguous.

All crew members are to respond in a positive manner that removes any doubt as to the ability to proceed, or not.

Introduction of knowledge-based responses that include the words 'think', 'hope', 'maybe' are not conducive to positive communications required in the Utility and Energy environment. All crew communications are to be positive in the affirmative or negative, so that there is no misunderstanding between crew members of the shared view within the cockpit. Examples of mandatory callouts include, but are not limited to:

- Crossing ahead in 5,4,3,2,1;
- Wire located 10 O'clock;
- Stop/Proceed;
- Up/down;
- In/out: and
- Affirm/negative.

Aircraft operators must outline this requirement in their Operations Manual or SOPs as part of their crew coordination procedures.

Courtesy: Meridian

32.0: Loss of Control In-flight (LOC-I) – Inspection

During routine or detailed patrols and inspections, the performance margin of the aircraft is insufficient for sustained flight, and loss of control in-flight occurs

In the low-level/low-speed environment characterized by Utility and Energy patrol and inspection work, ensuring the performance margin of the aircraft is adequate for any profiles flown is essential. As an added defense an 'escape route' (an immediate direction of flight that can allow the pilot fly clear of ground and obstacles whilst maintaining control of the aircraft) must be continuously updated as part of the pilot's ongoing assessment of the environment.

32.1: Hover Out of Ground Effect (HOGE) Performance

Ensuring sufficient power is available for helicopter operations under localized ambient conditions that prevent a lack of performance resulting in an accident.

For any inspection work requiring the helicopter to hover-out-of-ground effect (HOGE), the Operator must ensure the pilot uses OEM-derived performance information from the approved Flight Manual prior to flight to confirm sufficient power is available for the conditions being operated in. This preflight check must be complemented by verification of power available through daily power assurance checking.

Aircraft must have power available verified each day through a documented power assurance check. Prior to each inspection program, the operating crew are to ensure the performance requirements of the aircraft are sufficient for the operating environment, taking into account aircraft weight, altitude and temperature in addition to any known localized factors such as turbulence and mountain/rotor waves that could be anticipated.

Aircraft operators must have documented requirements for the PIC to undertake a performance analysis prior to any patrol or inspection program.

32.2: On-Task Speed

Ensuring appropriate patrol speeds are calculated for fixed wing aircraft to allow safe control margins.

For all fixed wing aircraft, the minimum safe speed must be calculated using the greater of:

- ***130% of clean stall speed (Vs);***
- ***110% of best single-engine rate of climb speed (Vyse) if applicable; or***
- ***Minimum safe single-engine speed (Vsse) if published.***

Minimum speeds must be adhered to regardless of turbulence, gusts or when trading speed for altitude.

Aircraft performance and the ability to out climb obstacles and terrain is directly related to the excess power available to the aircraft. When airspeed is reduced, so is the available lift. Providing a suitable safe margin above the minimum control speeds stated above ensures that sufficient performance margin is available to clear obstacles or terrain under both normal and OEI conditions.

evidence

The aircraft operator must document in the Operations Manual the minimum on task speeds applicable to the varying aircraft in the fleet that are utilized for patrols. The Operations Manual should be checked during the BARS audit to ensure that the required speeds have been nominated.

32.3: Turning Radius

Ensuring appropriate limitations on aircraft turns during patrols and inspections.

Limit turns at low-level to a maximum angle of bank of 30 degrees and conduct them at a constant altitude. If the aircraft must climb due to the surrounding terrain, it should climb to the required height prior to commencing the turn. Descent back to patrol height must only occur after wings level attitude is established.

Patrols are typically flown in lines parallel to the powerline or pipeline, with repositioning maneuvers to establish back on the patrol line after changes in direction of the structure. To avoid excessive bank angles and subsequent loss of lift at low level, bank should be limited to 30 degrees. If the terrain requires an increase in height, the aircraft should be climbed to the required height prior to commencement of the turn.

evidence

The aircraft operator must document in the Operations Manual the maximum 30 degree bank angle applicable during patrols and inspections operations. The Operations Manual must also specify the need to climb to a constant height above terrain/obstacles before commencing the turn to the new patrol line.

33.0: Controlled Flight into Terrain (CFIT)

An airworthy aircraft under the control of crew is flown into the ground (water) or obstacles resulting in an accident

Controlled Flight into Terrain (CFIT) occurs when an airworthy aircraft under the control of the flight crew is flown unintentionally into terrain, obstacles or water, usually with no prior awareness by the crew.

CFIT has been associated with many fatal accidents in the utility and energy sector, involving both fixed and rotary wing aircraft. In many industry accidents, a recurring root cause involves aircraft operating under Visual Flight Rules in a degraded visual environment when a decision to abort or delay the flight may have been a more appropriate strategy.

Although CFIT remains a significant cause of accidents within the aviation industry, it is widely recognized that these accidents are preventable. In addition to the weather controls detailed in Section 10.0, the following controls are aimed directly at preventing CFIT accidents.

33.1: Minimum Heights

Ensuring patrols are conducted at a safe height after consideration of all factors including terrain and aircraft type.

Minimum Separation Distances (MSD) as outlined in Controls 4.7, 4.8 and 4.9 must be referenced in establishing minimum safe height. Other obstacles that must be considered along the route are the following: (Power Line Crossings, Towers, Trees and vegetation that are taller than the Lines, etc.)

The nominated patrol height must be based on a risk assessment and agreed by all parties.

The accompanying risk assessment should document the patrol height and the mitigating factors taken into consideration.

33.2: Escape Route Considerations

Ensuring an escape route is constantly considered by the pilot when operating in an environment that has high terrain and the aircraft with limited performance margin.

The pilot is to ensure escape route considerations form part of the ongoing assessment during the flight profile, particularly when operating in areas of high terrain and/or multiple obstacles.

In the low-level environment, the pilot must constantly assess the aircraft position and altitude in relation to obstacles, terrain and infrastructure whilst referencing prevailing wind and performance available. At the point where any combination of these factors prevents continued safe flight, the aircraft must be flown away for a second attempt or termination of the activity. The 'escape route' used will generally have to provide an option that allows power not to exceed limits whilst managing the escape maneuver.

In the same way pilots operating single-engine aircraft must always consider the whereabouts of available forced landing areas, the awareness of 'escape routes' when operating in high terrain or an environment populated by obstacles, wire and infrastructure is essential for the pilot.

evidence

Aircraft operators must have documented requirements that require consideration of escape routes during all patrols and inspections flights by the Pilot-in-Command.

33.3: Performance Monitoring

Ensuring compliance with patrol and inspection parameters.

Performance parameters including aircraft speed and height above terrain should be periodically reviewed using data collected during the inspection flights. Deviations below minimum speed and minimum height requirements should be noted, and corrective actions taken to ensure deviations cease and the minimum safety margins are maintained. Determine the frequency of performance parameter reviews during the pre-start risk assessment.

A post flight review of flight performance will quickly and clearly identify whether the minimum flight parameters are being complied with. Specifically, minimum heights and speeds should be examined. The Performance Monitoring is a similar philosophy to the Flight Data Monitoring programs run on airline fleets and it should be seen as a safety improvement opportunity, not a reason to criticize a pilot or their flying skills.

evidence

Post flight review reports should be available for inspection to confirm that minimum parameters are being complied with.

Appendix 4: Powerline Stringing

Helicopters provide the operational flexibility to string draw wire, conductor and Optical Ground Wire (OPGW) without the need for significant ground disturbance and support

The critical controls essential for the conduct of minimum-risk powerline stringing are:

- Certified, in-date and serviceable external load equipment and stringing site ground infrastructure;
- Qualified, experienced, current and competent ground and flight personnel;
- Serviceable helicopter suitable for the load/environment;
- Fuel management;
- Suitable pick-up and set-down areas;
- Appropriate aircraft performance margins; and
- Standard Normal and Emergency Operating Procedures with accompanying training.

Expanding on and implementing these critical controls allows risk mitigation measures to be applied to any stringing activity. Control self-assessments using the following standards helps to determine the localized controls required and provides the company with an assessment of their effectiveness.

Figure 6: Operational Risk Assessment Considerations for Utility and Energy Powerline Stringing Operations

Powerline Stringing

Loss of Control In-flight (LOC-1) – Stringing
- Ground/Flight Reconnaissance
- Line Plan
- Sideways Pull
- Jettison

Equipment Failure – Stringing
- Brake System
- Puller Tensioning Fouling
- Weak Link
- Swivel
- Communications with Brake Operator

Fuel Starvation
- Minimum Fuel Reserve/Un-porting

Communications Failure
- Ground Spotter and/or Air Spotter

40.0: Loss of Control In-Flight (LOC-I) – Stringing

The helicopter performance required exceeds the performance available resulting in loss of control of the helicopter and subsequent collision with structures or terrain

To prevent a loss of control in-flight (LOC-I), performance margins are to be established and adhered to. Loss of control will normally result from one or a combination of factors; power required exceeding power available or helicopter control authority limits being exceeded (normally, but not always associated with the tail rotor authority).

Invoking load limits on the weight to be pulled is an effective way of reducing a LOC-I event.

40.1: Ground/Flight Reconnaissance

Ensuring the risks associated with the upcoming pull are clearly understood by all personnel.

A reconnaissance flight must be undertaken by the pilot prior to the commencement of a stringing pull. This provides the pilot an opportunity to mentally rehearse the upcoming pull and identify any areas where challenges are likely to be encountered. A ground reconnaissance should also be conducted by the Stringing Supervisor to verify that all ground infrastructure is in place, correctly positioned and ready for the upcoming operation.

All personnel associated with the conduct of the upcoming powerline stringing operations must be fully cognizant of the risks associated with the task. While most stringing operations follow a standardized sequence, each pull is slightly different. Early identification of any areas of difficulty is essential to permit all parties to plan appropriate strategies as to how the task can be completed safely and successfully.

The undertaking of a ground reconnaissance by the stringing team should allow for verification that:

- All equipment is correctly positioned;
- Confirmation that conditions (e.g., dust, vegetation, sun angle, etc.) are suitable for the task; and
- Identification of any aspects of the pull that may require additional risk controls to be implemented.

Immediately prior to the commencement of the actual pull, the pilot of the helicopter assigned to the stringing task must complete an airborne reconnaissance flight over the section to be strung. The purpose of this reconnaissance flight is to satisfy themselves that all aspects of the pull operation have been adequately considered and that the final 'Go/No-Go' criterion have been satisfied.

evidence

Aircraft operators must include the requirement for the completion of a pre-stringing reconnaissance flight in their Operations Manual and associated SOPs and ensure that the ground reconnaissance has been completed and documented by the stringing team.

40.2: Sideways Pull

Ensuring that certified aircraft equipment is utilized in the conduct of stringing operations and that appropriate limits are established.

Helicopter powerline stringing using side-pull techniques has multiple advantages over the traditional belly-hook approach. To ensure that the operation can be

successfully conducted, appropriate equipment must be utilized, and limits must be in place.

Side pull configuration stringing must be conducted utilizing certified equipment. Side pull equipment must have been certified for use by the responsible regulatory authority, normally through and Engineering Order or Flight Manual Supplement.

The use of certified equipment guarantees that an engineering load analysis has been conducted on the side pull configuration that considers not only the safe working load of the physical structure, but also the control authority limits of the helicopter.

evidence

Aircraft operators must ensure that the AFM contains a copy of the certified side pull equipment through the inclusion of either a Flight Manual Supplement or Engineering Order, certified by an Aeronautical Designer approved by the responsible regulatory authority.

40.3: Line Plan

The Line Plan provides a graphical description of the line network, thereby allowing all parties to understand the 'big picture' and improve their situational awareness.

A Line Plan must be prepared for all powerline construction activities. The Line Plan should contain enough detail such that each component of the plan clearly describes the equipment being utilized, the geographical layout of the line and the sequence of stringing activities.

Line Plans form the basis of the stringing planning phase and must provide all applicable detail. The stringing crew will use the Line Plan to formulate the sequence of stringing.

evidence

All stringing operations must use a Line Plan as the basis for planning.

40.4: Jettison

Ensuring each helicopter conducting stringing operations is equipped with a line jettison feature.

Helicopters that are conducting line stringing operations must be equipped with line jettison capability.

All helicopters undertaking stringing operations using a pull system must be equipped with appropriate line jettison capability.

Ideally the system will consist of at least two independent jettison systems. One of the systems must be electrical and the other mechanical. In most cases, a third electrical jettison capability should be considered allowing release of the draw wire, conductor or OPGW from the sock line.

evidence

Aircraft operators must be able to demonstrate how the stringing system in use is equipped with an appropriate release system (preferably a dual system with an electrical and mechanical release). Preferred systems will also incorporate a third release point at the sock line attachment hook.

41.0: Equipment Failure – Stringing

The helicopter suffers an emergency as a result of failure of the stringing equipment

Safe and effective powerline stringing operations require the integration and operation of multiple components. Each individual component of the overall stringing system must be certified and maintained to provide the optimum performance during all airborne stringing operations.

41.1: Brake System

Ensuring safe and effective operation of the ground braking system.

Maintain all braking machines in a certified state such that they are fully capable of providing the required tension during pulling operations.

Each braking machine should be subject to a certification and inspection regime to verify that it is fit for purpose. All braking machines should be accompanied by certification that the machine has been inspected and calibrated and the certificate should be available for inspection.

A daily pre-start check requirement should also be in place and records kept to verify that the necessary checks have been completed.

evidence

Aircraft operators must include a requirement to validate calibration certificates and daily inspections as part of their daily inspection requirements prior to the commencement of stringing operations.

41.2: Weak Link

Ensuring that the helicopter hook automatically disconnects from the load in the event of an overload scenario that would otherwise lead to a loss of control.

Where a weak link is required as part of a stringing mechanism Rotorcraft Flight Manual Supplement, Engineering Order or Supplemental Type Certificate the weak link must be manufactured, certified, installed, inspected and maintained in accordance with approved maintenance data.

Where powerline stringing operations are conducted without specific tailor-made stringing systems and use a generic lifting capability (e.g. long line or grappling hook) a weak link should be fitted when determined by risk assessment.

In the case of a snagging event, the weak link will separate the helicopter from the cable being pulled prior to loss of control of the helicopter. The use of weak links is well understood in both the fixed and rotary wing environments when towed arrays are being used. Weak links have been shown to be very effective in preventing a loss of control event following snagging of the towed array.

The weak link should have a breaking strain that is higher than the maximum load capability of the pulling system and should be fitted as close as possible to the helicopter to avoid any 'ricochet' effect following line separation. The weak link should be subject to a formal certification and inspection regime and records maintained to that effect.

evidence

Aircraft operators must include in their Operations Manual the applicable STC or Engineering Order addressing fitment of the cable pull system.

41.3: Puller Tensioner Fouling

Ensuring safe and effective operation of the tensioning equipment.

Maintain the cable tensioning system and the braking site in a condition to minimize the opportunity for cable fouling.

Maintenance of the tensioning equipment and the brake site in optimum condition minimizes the likelihood of a cable fouling event occurring. Good site housekeeping, keeping the tensioning equipment in good operating condition and continually monitoring of all parts of the tensioning equipment operation should see a stringing operation run without difficulty.

evidence

Staff responsible for the set up and maintenance of tensioning sites and the associated equipment should maintain a daily inspection record to verify that the site is in the correct operating condition prior to the commencement of operations.

41.4: Swivel

Ensuring that any twisting force in the cable is eliminated.

Fit all sock lines with a swivel mechanism (insulated barrel swivel preferred) to prevent any twisting force being transferred from the cable to the helicopter hook.

All stringing operations must be conducted with a swivel mechanism fitted between the cable being strung and the aircraft hook. By design, the swivel will rotate and remove any rotational force being transmitted to the aircraft hook assembly, thereby preventing the possibility of the hook not releasing the cable when commanded, hook damage and possible torsional effects on the helicopter. An insulated barrel swivel is the preferred type of swivel.

evidence

Aircraft operators must include these requirements in their Operations Manual and Aircraft Flight Manual Supplement or Engineering Order.

41.5: Communications with Brake Operator

Ensuring that clear communications are prioritized throughout normal and abnormal operations.

Communications with the Brake Operator must be maintained on a dedicated channel using clear, standardized communications throughout the activity.

Positive communication is a fundamental requirement in helicopter support of powerline operations. Two-way radio systems must be used for communication between the pilot and brake operator. If radio communication fails, the operation should stop immediately. To avoid confusion particularly at maximum range, instructions should be one or two words only and clearly different for ease of recognition (e.g. "run", "brake", "stop"). The brake operator should repeat back to the pilot confirmation of instructions.

evidence

The aircraft operator must document communications policy and procedures, including the use of standard words and phrases. Brake Operators should be appropriately trained in communications procedures.

42.0: Fuel Starvation

The helicopter is forced to land or ditch at an unprepared site with minimal warning due to momentary or prolonged fuel starvation leading to a loss of engine power and potential accident

To prevent fuel exhaustion, aircraft operators must fully appreciate the implications of the various aircraft pitch and roll attitudes that the helicopter will experience during powerline stringing operations and mandate a minimum fuel state that takes all flight conditions into account.

42.1: Minimum Fuel Reserve/Un-porting

Ensuring that sufficient fuel remains in the fuel tank and always provides uninterrupted supply to the engine.

Conduct an analysis of the aircraft body angles anticipated during stringing operations, and use this data to calculate minimum fuel quantities required to prevent fuel system un-porting.

Most aircraft fuel indication systems are calibrated at a neutral body angle (0 degrees pitch and 0 degrees roll). Any aircraft body angle that differs from this neutral position for sustained periods of time (as experienced during stringing operations) may result in false fuel quantity indication that could lead a pilot to believe they have more fuel than actual useable fuel available.

To manage the threat of temporary or prolonged fuel exhaustion from a low fuel condition when operating with sustained angle of bank, aircraft operators should conduct an analysis of the expected body angles anticipated during the activity. The aim of the analysis is to determine minimum fuel quantities that take aircraft angles and engine fuel delivery positions into account. Original Equipment Manufacturer (OEM) data and Flight Manual information (where available) should be considered as part of the analysis.

evidence

Aircraft operators must include these minimum fuel requirements in their Operations Manual or SOPs as a responsibility of the Pilot-in-Command. These minimums applicable to stringing operations must differentiate from minimum reserves for non-stringing operations.

43.0: Communications Failure

The helicopter or ground team suffers a radio failure resulting in the inability to communicate remotely

To maximize the possibility of managing all risks and minimizing distractions associated with stringing operations, all stringing should be conducted utilizing a dedicated radio channel.

43.1: Ground Spotter and/or Air Spotter

Ensuring clearance from all structures.

Maintain open communications on a dedicated radio channel. Communications with the Ground Spotter and/or Air Spotter must be maintained on a dedicated channel using clear, standardized communications throughout the activity.

Operations are to be suspended in the event of a radio failure. Furthermore, the aircraft operator must have radio failure procedures that include visual signals (IAW Control 73.2) that enables the helicopter to safely move away from all obstacles and land.

The entire stringing crew should be on a dedicated stringing radio channel, thereby enabling open and distraction free radio communications. The key to maintaining clearance from fixed obstructions is the employment of a Ground Spotter equipped with a radio on the stringing channel.

The Ground Spotter should be positioned on the approach side of the structure to be strung and should closely monitor the helicopter's position in relation to the pylon/tower. In the event that safety clearances are breached, the Ground Spotter should immediately inform the pilot so that appropriate maneuvering can be completed to move the helicopter out of the hazard zone.

evidence

Aircraft operators must include Spotter requirements in their Operations Manual and accompanying Stringing SOPs. These should include responsibilities, communications, normal and emergency procedures. Appropriate training should be in place for ground and/or air spotters.

Courtesy: Heliservices HK

Appendix 5: Insulator Washing

Power outages due to flashover of contamination on insulators is a common problem in powerline transmission. Helicopters can provide a safe and efficient method of insulator washing

Live line washing of the insulators cleans the contamination that causes flashovers, without any interruptions to the power supply.

The helicopter is flown adjacent to the insulator string and positioned by the pilot to enable the line worker to direct a high-pressure stream of water onto and under each insulator. The swirling motion created by the water flow removes pollutants such as dust, dirt, salt, and bird droppings.

Insulator washing operations are highly specialised and rely on the following critical controls:

- Certified, in-date and serviceable insulator washing equipment;
- Qualified, experienced, current and competent ground and flight personnel;
- Serviceable helicopter suitable for the environment;
- Fuel management;
- Rotors running replenishment of fuel and water;
- Appropriate aircraft performance margins; and
- Standard Normal and Emergency Operating Procedures with accompanying training.

Figure 7: Operational Risk Assessment Considerations for Utility and Energy Insulator Washing Operations

Insulator Washing

Equipment Failure – Washing
- Equipment Documentation
- Equipment Inspection Schedule

Incorrect Loading – Washing
- Weight and Balance

Hot Refill - Water
- Replenishment of water tanks

Obstacle Clearance
- Minimum Safe Distances

Crew Communications Breakdown
- Crew Resource Management

50.0: Equipment Failure – Washing

The powerline insulator washing equipment suffers a technical failure that impacts the safety of operations

Specialist equipment used for insulator washing is to be appropriately designed and maintained to reduce the risk of catastrophic failures.

Equipment failures have the potential to impact aircraft safety when working in very close proximity to live powerlines.

50.1: Equipment Documentation

Ensuring insulator washing equipment is appropriately certified for use.

The aircraft operator must have appropriate documentation, such as Supplemental Type Certificates (STC), for all equipment installed in the aircraft.

All aircraft modifications that provide for attachment of spray-boom assemblies and other apparatus such as pumps and storage tanks, must be carried out in accordance with all applicable airworthiness requirements of the responsible regulatory authority.

evidence

All aircraft modifications that provide for attachment of equipment to the aircraft are to be appropriately documented with drawings, data and specifications and be subject to a Supplemental Type Certificate (STC) or equivalent. The Operations Manual must contain descriptions of the equipment fitted and the manner in which modifications to fit equipment may affect the normal and emergency operation of the aircraft and its systems. The equipment should be installed in the aircraft as per the specifications.

50.2: Equipment Inspection Schedule

Ensuring early detection of impending failure of insulator washing equipment.

All insulator washing equipment (including pumps and tanks) that is installed in the aircraft must be on an inspection and maintenance schedule.

The aircraft operator's System of Maintenance for an aircraft used in powerline insulator washing operations must include details of the inspection schedule applicable for all equipment fitted to the aircraft to ensure its ongoing serviceability. The inspection schedule should reflect any requirements or recommendations of the equipment manufacturer or any conditions that may be applicable to the STC (or equivalent) that address fitment of equipment to the aircraft.

evidence

The aircraft operator's System of Maintenance (or equivalent) for an aircraft that is used in powerline insulator washing operations includes details of the inspection schedule that applies to all ancillary equipment fitted to the aircraft to ensure its ongoing serviceability. Aircraft maintenance records must confirm that documented requirements and procedures contained in the aircraft System of Maintenance (or equivalent) are being followed.

51.0: Incorrect Loading – Washing

Incorrect loading of equipment or consumables results in an aircraft accident

Loading errors can present a major hazard to flight safety and there have been numerous accidents where control of the aircraft has been either lost or compromised, due to incorrect loading.

Aircraft loading must be conducted in a way that ensures the specified maximum allowable weights are not exceeded and that the load distribution results in the center of gravity being in, and remaining within, the permitted flight envelope for all stages of the intended flight. It is crucial that the pilot is aware of the aircraft's weight and center of gravity so that performance calculations can be accurately completed.

51.1: Weight and Balance

Ensuring all role equipment is accounted for in the weight and balance calculations.

The aircraft operator must ensure that because of the changing mass and center of gravity of the helicopter during washing operations, the weight and balance calculations accurately account for all auxiliary equipment that is fitted to the aircraft (including spray booms, pumps and tanks) as well as the changing fuel and water loads.

The aircraft operator must have load information available for flight crew to accurately complete weight and balance calculations. In particular, lateral Center of Gravity (C of G) calculations must account for equipment and personnel being predominantly located on one side of the helicopter.

Weight and balance calculations must also consider the dynamic changes of consumption of washing fluid and fuel.

evidence

The aircraft operator's Operations Manual must contain procedures to be used to determine the aircraft weight and balance for each flight where additional equipment is fitted.

52.0: Hot Refill - Water

An incident during replenishment of water impacts on aircraft safety

For most types of helicopters, performance considerations during insulator washing operations will necessitate regular interruptions to the task to replenish fuel and/or wash water tanks.

This will invariably be completed whilst the rotors are running and the pilot remaining at the controls.

See also Control 2.5.

52.1: Replenishment of water tanks

Ensuring hot refill of water tank operations are used appropriately and conducted safely.

The aircraft operator must have Standard Operating Procedures (SOPs) that detail the procedure for rotors-running ('hot') replenishment of water tanks.

For hot refueling of the aircraft refer to Control 2.5.

In addition to the hot-refueling controls listed in Section 2.5, hot replenishment procedures should consider the following:

- Suitable landing area(s);
- Qualified, experienced and competent ground personnel; and
- Communications between flight crew and ground crew.

evidence

The aircraft operator's Operations Manual must contain procedures to be used for hot replenishment during Insulator Washing operations.

53.0: Obstacle Clearance

An aircraft accident occurs as a result of part of the helicopter or insulator washing gear impacting an obstacle

Safe working distances are variable and depend on the type/size of helicopter and the voltage of the power lines. In general terms, to avoid flashovers, the higher the voltage, the greater the distance that is needed between the lines and the helicopter.

53.1: Minimum Safe Distances

Ensuring helicopters are operated at a safe distance from live powerlines.

For all helicopter live line insulator washing operations, a minimum safe distance must be calculated in accordance with industry standards.

When a helicopter is close to a transmission line, it will, as an isolated conductor, cause a distortion of the electric field distribution. This will be particularly important around those parts of the helicopter having a small radius of curvature where the field will be high, perhaps causing localized discharges and the possibility of a breakdown between line, helicopter and ground, with the consequent dangers to helicopter, personnel and equipment.

evidence

The aircraft operator’s Operations Manual must contain procedures to be used to determine minimum safe distances when working in the powerline environment.

Courtesy: Leading Edge Helicopters

54.0: Crew Communications Breakdown

A breakdown in effective communication occurs between crew members, leading to an accident due to the ineffective response to a safety-related threat

The importance of effective communications amongst all members of an operating crew has been highlighted in many accident reports and is routinely cited as a contributing factor. The aviation industry has developed mechanisms to minimize communication breakdown, ranging from a simple checklist through to a more detailed study of interpersonal skills prerequisite to an effective crew.

54.1: Crew Resource Management

Ensuring an operating crew make effective use of all available resources to assure a safe and efficient operation, reducing error, avoiding stress and increasing efficiency.

All operational crew members are to conduct an initial and refresher Crew Resource Management (CRM) course every two years.

CRM focuses on cognitive and interpersonal skills needed to manage a flight within an organized aviation system. The interpersonal skills emphasize the need for communications and a range of behavioral activities associated with teamwork to be well executed. CRM training assists in identifying these skills and provides case studies of accidents that illustrate where ineffective use of CRM can have negative consequences, regardless of the size and complexity of the aviation activity undertaken.

See also Control 4.4.

Aircraft operators must document in their Operations Manual the requirement for all operating crew to undergo initial CRM training and biennial recurrent training.

Appendix 6: Aerial Platform Work and Structure Transfer

Helicopters provide the operational flexibility to place workers directly on, or alongside, infrastructure while in the hover by use of the helicopter skids, steps or external work platforms

The critical controls essential for the conduct of minimum-risk platform work or structure transfer operations are:

- Airworthy helicopter suitable for the task;
- Certified and airworthy equipment;
- Suitable harnesses, PPE and other safety equipment;
- Qualified, experienced, current and competent personnel;
- Effective pre-task briefings and Crew Resource Management (CRM);
- Suitable pick-up and set-down areas;
- Fuel management;
- Aircraft performance margins; and
- Normal and Emergency SOPs with accompanying training.

Expanding on and implementing these critical controls allows effective risk mitigation measures to be developed for this type of contracted activity.

Figure 8: Operational Risk Assessment Considerations for Utility and Energy Aerial Platform Work and Structure Transfer Operations

Aerial Platform Work and Structure Transfer

Equipment Failure – Platform Work
- Design and Certification
- Servicing Schedule

Incorrect Loading – Platform Work
- Weight and Balance
- Aircraft Performance

Personal Protection
- Safety Harness
- Personal Protective Equipment (PPE)

Inspection Procedure of the Structure and Wire Integrity
- Before-Start Inspection Procedure

Electrical Discharge
- Electrical Bonding
- Corona Discharge
- Electrical Protection

60.0: Equipment Failure – Platform Work

The external platform, steps or basket equipment suffers a technical failure

Specialist equipment used for platform work and structure transfer is to be appropriately designed to reduce the risk of catastrophic failures.

60.1: Design and Certification

Ensuring all modifications associated with the conduct of Platform Work and Structure Transfer operations are certified in accordance with approved engineering data.

The aircraft operator must have appropriate documentation, such as Supplemental Type Certificates (STC), for all equipment installed in the aircraft.

Where platforms and other fixed apparatus is attached to aircraft, it is critical that the modification has been certified for the purpose and accompanied by Instructions for Continued Airworthiness (ICA). All aircraft modifications must be carried out in accordance with all applicable airworthiness requirements of the responsible regulatory authority.

The design should consider:

- The effect of flight characteristics, including hover performance and autorotation/ emergency capabilities;
- Lateral and longitudinal C of G;
- Provisions for attaching safety harnesses capable of withstanding the shock load of a fall and for restraining loose equipment; and
- Crashworthiness.

For operations adjacent to live electrical lines, the design should also consider the electrical discharge (see Control 64) as well as ensuring the design is:

- Suitable for operation in an electrical environment, electrically tested for low resistance (1 ohm);
- Tested to be free from corona discharge points;
- Bonded with the airframe; and
- Provides a means for bonding to the personnel carried. (Bonding devices should protect lineman from charging current and be suitable to transfer a minimum of 400 amps charging current to the helicopter).

evidence

The aircraft operator should retain the applicable STC or Major Modification data. Inspection of the aircraft should confirm that modifications have been completed in accordance with the design data.

60.2: Servicing Schedule

Ensuring early detection of impending failure of platform equipment.

Platform Work and Structure Transfer equipment must conform to a servicing schedule that provides all necessary documentation associated with inspections, certification and serviceability. Copies of this servicing schedule must be made available to the aircraft operator's representatives in the field.

All equipment must be tracked using a documented and auditable servicing schedule. All re-certification, scheduled servicing and any other checks must be documented by the aircraft operator on an equipment register and the register must be available for reference by the staff operating in the field.

The aircraft operator must maintain records showing that all equipment has been certified for use by the helicopter or equipment manufacturer. The records must also show that the equipment has been tested and released to service by the approved maintenance organization and that it has been subject to a manufacturer's approved maintenance program.

61.0: Incorrect Loading – Platform Work

Incorrect loading of equipment or crew results in an aircraft accident

Loading errors can present a major hazard to flight safety and there have been numerous incidents where control of aircraft has been either lost or compromised, due to incorrect loading.

Aircraft loading must be conducted in a way that ensures the specified maximum allowable weights are not exceeded and that the load distribution results in the center of gravity being in, and remaining within, the permitted flight envelope for all stages of the intended flight. It is crucial that the pilot is aware of the aircraft's weight and center of gravity so that performance calculations can be accurately completed.

61.1: Weight and Balance

Ensuring all role equipment and extra personnel are accounted for in the weight and balance calculations.

The aircraft operator must ensure that the weight and balance calculations accurately account for all auxiliary equipment that is fitted to the aircraft (including platforms, steps and baskets) and additional personnel who enter or exit the aircraft.

The aircraft operator must have load information available for flight crew to accurately complete weight and balance calculations. Where applicable, lateral Center of Gravity (C of G) calculations must account for equipment and personnel being predominantly on one side of the helicopter. This also includes cargo and equipment carried in fitted baskets.

Weight and balance calculations must also consider the dynamic changes of personnel entering and exiting the aircraft via a fixed platform and/or steps.

evidence

The aircraft operator's Operations Manual must contain procedures to be used to determine the aircraft weight and balance for each flight where additional platform or auxiliary equipment is fitted as well as during structure transfer operations.

61.2: Aircraft Performance

Ensuring the aircraft has sufficient performance margins to safely complete the task.

Prior to takeoff, the Pilot-in-Command must calculate helicopter 'power available' versus 'power required' and ensure that the figures are within limits and that the required margins are maintained.

A thorough understanding of helicopter power requirements is particularly important during Hover Out of Ground Effect (HOGE) operations. The additional weight of fixed platforms, steps and baskets will potentially reduce performance margins or necessitate the carriage of less fuel. Performance calculations must also account for increased weights when transferring personnel from structures into the aircraft.

evidence

Each aircraft must have performance charts available in the Flight Manual or Pilots Operating Handbook that will permit the pilot to make an analysis of performance and adjust loading where necessary. Procedures for calculating performance should be clearly detailed in the Operations Manual and the initial training of flight crew should cover the performance aspects of the particular aircraft type. Crew competence in performance calculations and their application should be assessed during proficiency checks.

62.0: Personal Protection

Protecting task specialists working on skids, steps and platforms from injury due to falls, impacts, cuts, debris and noise

Personnel involved in platform work and structure transfers must wear appropriate protective clothing. This may include (but is not limited to) Nomex clothing (flight suit or fire nomex), hardhat or flight helmet, eye protection, hearing protection, gloves (nomex or leather), leather boots. High visibility clothing is preferable.

Additional fall protection equipment such as harnesses, body belts and anchorage connectors must also be provided.

62.1: Safety Harness

Ensuring external task specialists are equipped with a fall prevention system.

The external task specialists should wear an appropriate harness connected by a safety lanyard to a designated attachment point.

The harness/lanyard should have a quick release function readily accessible to the wearer and be designed and manufactured to a recognized standard to prevent the wearer from falling off the skid, platform or steps.

evidence

Aircraft operators should be able to demonstrate that safety harnesses incorporating a quick release function are available for use by task specialists and that the equipment meets an appropriate standard.

62.2: Personal Protective Equipment (PPE)

Ensuring task specialists are equipped with PPE that is fit for purpose.

The external task specialists should wear appropriate PPE to protect against impacts, cuts, debris and noise. In the event any part of the flight activity is conducted over water, particular attention must be made to ensuring adequate egress in the event of ditching is able to be completed with the PPE chosen for all crew members.

This will typically include protection for head, eyes, ears, hands and feet. The PPE should be designed and manufactured to a recognized standard and be secured from coming free while rotors running. Where necessary Control 64.3 also applies.

evidence

Aircraft operators must document the PPE requirements that apply to task specialists performing platform work. Such requirements should include head protection, eye protection, hearing protection, gloves, safety shoes and vests. Equipment must meet an appropriate standard.

63.0: Inspection Procedure of the Structure and Wire Integrity

An aircraft accident occurs as a result of part of inadequate pre-inspection and failure to assure asset integrity before the task has commenced

Working on old or damaged structures presents special challenges. Some structures may be unstable to place linesmen on due to damaged attachment points.

Establishing the integrity of structures and wires is essential to conducting safe platform work and structure transfer operations.

63.1: Before-Start Inspection Procedure

Ensuring all asset integrity aspects have been visually checked prior to the activity.

Prior to bonding onto, rigging from or transferring to a structure, a pre-briefed inspection procedure of the structure including the wire integrity must be completed.

Aircraft operators should have a documented pre-start inspection procedure which is utilized before commencement of any aerial platform work and/or structure transfers.

evidence

The aircraft operator's Operations Manual and/or SOPs should document the details for the conduct of Before-Start Inspection Procedures.

64.0: Electrical Discharge

When operating close to powerlines there is a risk of electrical discharge that is to be mitigated

To avoid electrical discharge (flashovers) between live lines and the helicopter and personnel, mitigating measures such as bonding and personal protective equipment must be utilized.

64.1: Electrical Bonding

Ensuring the airframe, installed equipment and external personnel are bonded to reduce the risk of electric shocks.

The airframe, installed equipment and external personnel must be electrically bonded.

For the helicopter and its installed equipment, electrical bonding will be a design consideration. The testing of the bonding and maintenance of bonding features should be covered by maintenance data and the maintenance program for the helicopter.

Bonding devices are also needed to protect external personnel and be suitable to transfer to powerline infrastructure where task specialists disembark from the helicopter in the hover. Such bonding devices should be connected to task specialists' conductive PPE and allow for a ready breakaway under shock load.

The aircraft operator's Operations Manual and/or SOPs should document the details for the electrical bonding of the aircraft, equipment and personnel and the associated procedures.

64.2: Corona Discharge

Ensuring that aircraft are appropriately designed and maintained to prevent a corona discharge event causing an incident.

The airframe and installed equipment must be proven to be free of Corona Discharge Points.

Corona Discharge Points are sharp corners where an electrically energized object creates an electrical arc due to the ionization of air around this point.

The aircraft operator should be able to demonstrate how design characteristics of equipment and operational procedures minimize the potential for Corona discharge whilst conducting aerial platform work and structure transfer.

64.3: Electrical Protection

Ensuring external task specialists have Personal Protective Equipment (PPE) to protect from electric shock.

External task specialists exposed to electric shock hazards must wear a conductive suit and other PPE.

The PPE should be designed and manufactured to a recognized standard.

The aircraft operator should be able to demonstrate that this equipment is adequate and meets an appropriate standard.

Courtesy: Leading Edge Helicopters

Appendix 7: Human External Cargo (HEC)

Helicopters provide the operational flexibility to move personnel to perform Utility and Energy tasks using human external cargo (HEC) operations

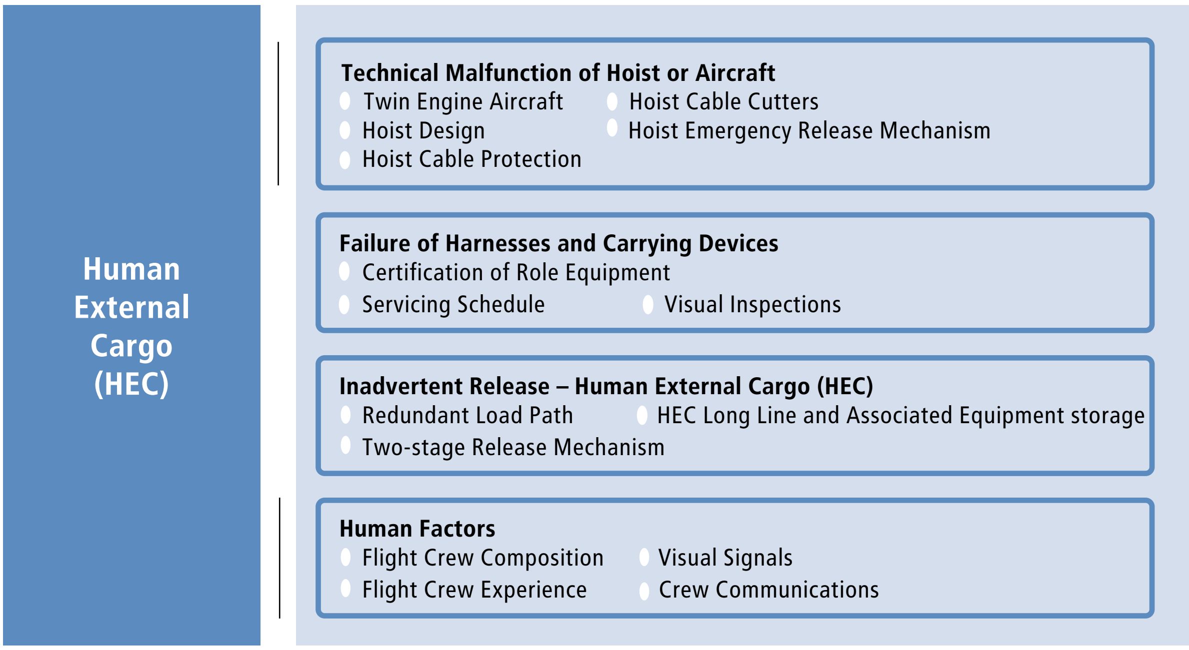
Human External Cargo (HEC) operations encompass all operations where personnel are suspended below the helicopter. HEC systems can be:

- Utilizing the helicopter hoist system;
- Suspending one or more personnel in safety harnesses from the helicopter's external load hook; and
- Suspending a Personnel Carrying Device System (PCDS) from the external cargo hook.

The critical controls essential for the conduct of minimum-risk HEC operations are:

- Certified, in-date and serviceable equipment and rigging;
- Qualified, experienced, current and competent riggers and flight personnel;
- Serviceable helicopter suitable for the task;
- Suitable pick-up and set-down areas;
- Aircraft performance margins; and
- Standard Normal and Emergency Operating Procedures with accompanying training.

Figure 9: Operational Risk Assessment Considerations for Utility and Energy Human External Cargo Operations



70.0: Technical Malfunction of Hoist or Aircraft

A technical malfunction of aircraft or hoist leads to an incident or accident

A structural, mechanical or electrical fault within the hoist system can have serious consequences, particularly if this occurs midway through HEC operations.

70.1: Twin Engine Aircraft

Ensuring the aircraft is able to maintain flight and return all personnel to safety in the event of an engine failure.

Multi-engine aircraft certified to Category A and operated in Performance Class 1 that ensures single-engine accountability throughout the flight envelope should be considered when planning Human External Cargo operations.

Engine reliability continues to increase with advances in material and design technology. However, engines will continue to fail, albeit at an increasingly lower frequency and therefore use of multi-engine aircraft will provide a level of redundancy if an engine fails.

Even a twin engine aircraft operating without 'one-engine inoperative' capability, such as a helicopter in the hover, will often enable the aircraft to descend to a less severe and 'cushioned' forced landing should one engine fail, thus reducing the risk of injury to crews.

evidence

The aircraft operator should be able to demonstrate the selection criteria and risk assessment process used when determining the aircraft type to be used for human external cargo operations.

70.2: Hoist Design

Ensuring the type of hoist system is suitable for the intended operations.

The hoist must be designed to carry the weight as required during HEC operations. This may require a capability to hoist two persons simultaneously. The system design must allow for emergency cutting of the cable if required.

The hoist system usually comprises a hydraulic or electric drive that winds a cable around a drum and includes a braking system. The hoist cable is controllable by the hoist operator in the rear of the helicopter and may also be controlled by the pilot via controls on the cyclic. Hook attachment systems should be of a design that eliminates the risk of dynamic rollout. The hoist must have a maximum load suitable for the intended operations. Hoist limitations and normal/emergency procedures must be detailed in the aircraft operator's Operations Manual.

evidence

The aircraft operator should be able to demonstrate that the hoist design and specifications are rated accordingly, in particular for the intended load capacity, dynamic rollout prevention and emergency cutting.

70.3: Hoist Cable Protection

Ensuring the protection of the hoist cable from fouling or snagging the aircraft.

Hoist cables must be protected from damaging contact with aircraft structure.

Preventing contact with the aircraft structure removes the responsibility of damaging either the cable or the aircraft and removes the possibility of cable snagging. Any modification should be certified.

evidence

The aircraft operator should be able to demonstrate that appropriate hoist cable protection measures are incorporated into the hoisting system and that these systems are certified accordingly if required.

70.4: Hoist Cable Cutters

Ensuring there is a back-up method of disconnecting a fouled cable from the aircraft.

Hoist operators must have ready access to manual cable cutters (separate from any cable cutting integrated with the hoist).

All helicopter hoist systems have an emergency cut function that is usually an explosive squid that severs the cable. This can be activated via an emergency switch on the pilot's controls and also an emergency switch on the hoist operator's controls.

To enable redundancy should the system fail, manual cable cutters should be readily available and stowed near the doorway and close to the hoist cable.

evidence

Inspection of aircraft and/or documentation should confirm that the aircraft is equipped with manual cable cutters.

70.5: Hoist Emergency Release Mechanism

Ensuring the hoist emergency release mechanism is serviceable, seated and latched prior to flight.

Prior to each flight, the emergency release mechanism must be checked serviceable, and the mechanism is verified fully seated and latched.

Hoist systems are usually an electrically powered system but can also be powered via the aircraft hydraulics. Prior to flights that intend to use the system, ground checks should confirm that the emergency release mechanism is serviceable.

evidence

The aircraft operator's Operations Manual and/or SOPs should document the details for the preflight checks of the hoist emergency release mechanism.

71.0: Failure of Harnesses and Carrying Devices

The Human External Cargo (HEC) carrying equipment fails in-flight causing injuries or fatalities

A failure of HEC equipment poses a serious risk to personnel. Risk mitigation strategies must consider human failures as well as technical failures, as both classes of failure have been well documented in previous accidents.

71.1: Certification of Role Equipment

Ensuring certification of Human External Cargo (HEC) equipment and compliance with the equipment manufacturer's servicing requirements.

The aircraft operator must ensure the serviceability and certified safe working load of HEC equipment is adequate for the task.

Certification of the lifting lines and other HEC equipment by personnel who have been trained in the Original Equipment Manufacturer's (OEM's) requirements is essential. Use of HEC equipment not certified or without appropriate certification documents must not be permitted.

evidence

The aircraft operator must document procedures that require all HEC equipment to be subject to a daily serviceability inspection by qualified personnel prior to use. Such procedures must contain requirements for the daily inspection to ensure the serviceability and correct operation of this equipment.

Associated records must confirm that requirements for daily inspection requirements are being carried out.

71.2: Servicing Schedule

Ensuring early detection of impending failure of HEC equipment.

HEC equipment must conform to a servicing schedule that provides all necessary documentation associated with inspections, certification and serviceability. Copies of this servicing schedule must be made available to the aircraft operator's representatives in the field.

All HEC equipment must be tracked using a documented and auditable servicing schedule. As with certification requirements of the HEC equipment, the servicing schedule relies on appropriate tagging of the equipment. Metal tags are the preferred method as synthetic nylon tags have been known to deteriorate. Most synthetic lines should not be color coded on the line itself (unless they are provided in a manufacturer's color scheme), as long-term degradation of the material in contact with the paint can occur. Color coding on steel is acceptable.

Lines associated with HEC without any form of identification or tagging must not be used and must be taken out of service until re-certification can occur.

All re-certification, scheduled servicing and any other checks must be documented by the aircraft operator on an HEC equipment register and the register must be available for reference by the staff operating in the field.

Where HEC equipment is provided by a third party, for example a contracting "client", the aircraft operator must ensure that any HEC equipment provided meets these maintenance, certification and tagging requirements.

evidence

The aircraft operator must maintain records, or have access to third party records, showing that all HEC equipment has been certified for use by the helicopter or equipment manufacturer. The records must also show that the equipment has been tested and released to service by the approved maintenance organization and that it has been subject to a manufacturer's approved maintenance program.

71.3: Visual Inspections

Ensuring servicing routines are supplemented with visual inspections prior to each use.

All HEC equipment (cables, lines, straps, PCDS, harnesses, baskets, swivels, clevises, etc.) must be inspected by qualified personnel daily prior to the flight. Any signs of wear, fraying, corrosion, kinks or deterioration must result in the equipment being withdrawn from use.

To supplement the certification process, a daily inspection by qualified personnel such as the pilot or other qualified and trained personnel in accordance with all OEM requirements will assist in mitigating the risk of equipment failure. Qualified personnel can include personnel trained by the aircraft operator, external load specialists or through accepted industry training programs. Early detection of impending equipment failure will ensure that defective equipment is removed from service and returned for repair or discarded.

All HEC activities, schedules and plans must allow adequate time for the aircraft operator's personnel to perform all necessary checks on equipment prior to the day's tasking.

evidence

The aircraft operator must document in their Operations Manual and SOPs that all HEC equipment is subject to a daily serviceability inspection by qualified personnel prior to use. Such procedures must clearly state requirements for the removal of equipment from service if found to be not in a fully serviceable condition. Associated records must confirm that requirements for daily inspections of HEC equipment are being appropriately carried out.

72.0: Inadvertent Release – Human External Cargo

The human external cargo (HEC) carrying equipment is inadvertently released in-flight causing injuries or fatalities

An inadvertent release of HEC equipment poses a serious risk to personnel. Risk mitigation strategies must consider human failures as well as technical failures as both classes of failure have been well documented in previous accidents.

72.1: Redundant Load Path

Ensuring redundancy (failsafe) lifting mechanisms in the event of failure.

All HEC equipment must be attached to the helicopter via two completely independent load bearing mechanisms. The primary system takes the normal loads during normal operations. The secondary system offers complete redundancy should there be a failure of the primary system.

There are various means of ensuring a redundant load path. The system utilized must be approved for use by the applicable aviation regulatory authority.

evidence

Inspection of aircraft HEC system and/or documentation should confirm that there is redundancy in the load bearing mechanism.

72.2: Two-stage Release Mechanism

Ensuring human external cargo (HEC) loads are not inadvertently released.

All HEC equipment systems must have a two-stage load release mechanism. Such a system requires two distinctly independent actions in order to initiate release of the HEC system from the aircraft.

In an emergency situation, it may be necessary for the pilot to jettison any lines/cargo attached to the aircraft. A dual-action system will ensure that this is an intended action and not an inadvertent release.

evidence

Inspection of aircraft HEC system and/or documentation should confirm that there is a two-stage release mechanism.

72.3: HEC Long Line and Associated Equipment Storage

Ensuring integrity maintained in the tracking and awareness of all aspects of the HEC external load equipment utilization.

Long lines (and associated equipment) dedicated to HEC operations must be kept separate to standard external load line equipment to avoid inadvertent use for operations other than HEC activities.

Long lines and associated equipment that is used for HEC operations must conform to a servicing schedule that provides all necessary documentation associated with inspections, certification and serviceability. All lifting equipment must be tracked using a documented and auditable servicing schedule. As with certification requirements of the lifting equipment, the servicing schedule relies on appropriate tagging of the equipment. Metal tags are the preferred method as synthetic nylon tags have been known to deteriorate. Most synthetic lines should not be color coded on the line itself (unless they are provided in a manufacturer's color scheme), as long-term degradation of the material in contact with the paint can occur. Color coding on steel is acceptable. Lines without any form of identification or tagging must not be used and must be taken out of service until re-certification can occur.

HEC equipment must be stowed separately to other helicopter load lifting equipment.

evidence

The aircraft operator must maintain records, or have access to third party records, showing that all lifting equipment has been certified for use by the helicopter or equipment manufacturer. The records must also show that the equipment has been tested and released to service by the approved maintenance organization and that it has been subject to a manufacturer's approved maintenance program. Inspections should confirm that HEC equipment is stored separately to other aircraft equipment.

The aircraft operator must document procedures that require all HEC lifting equipment to be subject to a daily serviceability inspection by qualified personnel prior to use. Associated records must confirm that requirements for daily inspections are being carried out.

73.0: Human Error

An instance of human error is encountered, leading to an accident due to the lack of an effective risk control framework

Human error, in various forms, is a causal factor in the majority of aircraft accidents, incidents, and safety occurrences. Highly specialized aircraft operations such as HEC are potentially prone to increased human error risks. Much of the error by professionally trained and licenced operators (Flight Crew, Air Traffic Controllers, and Aircraft/ATC Maintenance Technicians) arises from either the failure to apply standard operating procedures in the way intended or in the making of poor tactical judgements.

Mitigating human error in HEC operations involves a combination of crew composition, experience, training and standardized communications.

73.1: Flight Crew Composition

Ensuring flight crew threat and error management is optimized.

Two-crew operations should be considered for all human external cargo operations. This will enhance threat and error management, minimize human error, provide back-up for pilot incapacitation, deliver greater situational awareness and optimize successful management of emergencies. When using two-crew, SOPs for two-crew operation must be established and used by the aircraft operator.

Having two qualified pilots that comply with approved SOPs reduces the risk of human error in an environment dominated by incidents attributed to human factors. Using two-pilots helps mitigate the risk in the following ways:

- Workload distribution;
- Error recognition and trapping; and
- Reduction in fatigue.

evidence

The aircraft operator must have a documented procedure requiring that consideration is given to ensuring that HEC operations are crewed by two qualified pilots when operating for a BARS Member Organization. The aircraft operator's SOPs must clearly specify the duties that are to be performed by the second pilot and detail the crew coordination processes that apply. For aircraft that are certified to be operated by a single-pilot and where the aircraft operator chooses this option for day, VFR or non-resource company flights, a separate set of SOPs must be in place for the single-pilot role.

Flight crew files and rostering records must confirm appropriate implementation of these requirements.

73.2: Flight Crew Experience

Ensuring all flight crew are experienced in long line operations.

In addition to all experience requirements outlined in Appendix 1, the Pilot-in-Command of Human External Cargo operations must have a minimum of 500 hours long line experience.

HEC operations are a highly specialized component of external load lifting. Therefore, it is essential that pilots have considerable core long line experience prior to being assigned to operations.

evidence

The aircraft operator must document in the Operations Manual, minimum qualification and experience requirements for flight crew engaged in HEC operations. Details of the aircraft operator's training and checking program for HEC (and long line operations) must be published in the Operations Manual and follow established criteria. The program must cover requirements and procedures for initial training and approval along with the processes for conducting periodic recurrent training and checking.

73.3: Visual Signals

Ensuring all visual signals between crew are clear and unambiguous.

All crew members are to be trained and competent in the use of visual (hand) signals during HEC operations. These signals would be to supplement and/or back-up two-way radio communications.

In the event of a total radio failure, clearly understood visual signs should be able to be employed in order that safety is not compromised.

evidence

The aircraft operator's Operations Manual and/or SOPs should document details for the use of visual signals during HEC operations.

73.4: Crew Communications

Ensuring all crew communications are clear and unambiguous.

All crew members are to respond to any instructions and requests in a positive and affirmative manner that removes any doubt as to the ability to proceed, or not.

Standardized communication procedures are essential to maintaining sound crew coordination. Knowledge-based responses that include the words 'think', 'hope', 'maybe' are not conducive to positive communications required in the HEC environment. All crew communications are to be positive in the affirmative or negative, so that there is no misunderstanding between crew members of the shared view within the cockpit and outside the aircraft.

evidence

Aircraft operators must outline communications requirements in their Operations Manual or SOPs as part of HEC crew coordination procedures.

Appendix 8: Helicopter External Load Operations

Helicopters provide the operational flexibility to move cargo and/or to perform Utility and Energy construction using an external underslung load

The critical controls essential for the conduct of minimum-risk external load operations are:

- Certified, in-date and serviceable external load equipment and rigging;
- Qualified, experienced, current and competent riggers and flight personnel;
- Serviceable helicopter suitable for the load/environment;
- Fuel management;
- Suitable pick-up and set-down areas;
- Aircraft performance margins, particularly when pick-up and set down are at different density altitudes; and
- Standard Normal and Emergency Operating Procedures with accompanying training.

Expanding on and implementing these critical controls allows risk mitigation measures to be applied to any external load activity, whether onshore or offshore. Control self-assessments using the following standards helps to determine the localized controls required and provides the company with an assessment of their effectiveness.

Figure 10: Operational Risk Assessment Considerations for Utility and Energy Helicopter External Load Operations

Helicopter External Load Operations

Fuel Exhaustion
- Minimum Fuel Reserve
- Ground-based Fuel Reserve Monitoring

Equipment Failure – External Loads
- Lifting Equipment Certification
- Visual Inspections
- Servicing Schedule
- Shackles

Inadvertent Release – External Loads
- Guarded Release Switch
- Release Mechanism
- Load Construction
- Standardized Controls
- Flightpath Management

Loss of Control In-flight (LOC-I) – External Loads
- Pilot Experience
- Instrument Remote Indicators
- Pilot Daily Flight Times
- External Mirrors or Camera
- Load Weight

Line Fouling in Transit
- Weighted Lines
- Maneuver Boundary Envelope
- Never Exceed Speed

Ground Loss of Control
- Ground Briefing
- Ground Personnel

80.0: Fuel Exhaustion

The helicopter operates on minimum fuel load to maximize lifting capability and runs out of fuel and suffers an engine flame-out resulting in an accident

To improve lifting capability, the helicopter's operating weight is minimized in order to maximize the external load weight that can be carried. After the helicopter's operating weight has been reduced to a minimum by the removal of non-mission critical equipment, the only variable remaining to reduce the operating weight is fuel.

External load activities are conducted in Visual Meteorological Conditions (VMC) and are generally:

- Within relatively short distances of the operating base; and
- In close proximity to accessible refueling points.

These factors support minimizing the reserve fuel carried to maximize the external load weight capability. However, operating with reduced fuel margins can only be conducted when all fuel management controls are risk assessed and complied with as briefed and planned.

80.1: Minimum Fuel Reserve

Ensuring sufficient fuel is carried, including required reserves.

Maintain a minimum fuel reserve of 20 minutes at all times.

Unless more reserve fuel is required to be carried following the completion of a risk assessment or by the responsible regulatory authority, flight crew engaged in external load operations must ensure that a minimum "fixed" reserve of fuel is carried to allow for 20 minutes of flight.

Carriage of this reserve fuel is intended to provide for unplanned maneuvering in the vicinity of the landing site. This reserve fuel would normally be retained in the helicopter upon final landing.

For those helicopter types where illumination of the low fuel light requires the helicopter to land immediately or "as soon as practicable", a specific risk assessment should be conducted to determine the minimum fuel requirements that satisfy the intent of this control. See also Control 2.3.

evidence

Aircraft operators must include these requirements in their Operations Manual or SOPs as a responsibility of the Pilot-in-Command. The 20 minute fuel reserve must be expressed in the same terms as the helicopter fuel gauges (pounds, kilograms, gallons, liters or percentage).

80.2: Ground-based Fuel Reserve Monitoring

Ensuring fuel reserves are maintained through additional ground-based monitoring.

Ground-based personnel, ideally the ground refueler, should keep a log of times that fuel is uplifted and aircraft planned return times. A means of providing communications to the helicopter must be in place to provide advisory notification if required.

To improve lifting capability, the helicopter's operating weight is minimized in order to maximize the external load weight that can be carried. After the helicopter's operating weight has been reduced to a minimum by the removal of non-mission critical equipment, the only variable remaining to reduce the operating weight is fuel. External load activities are conducted in Visual Flight Rule (VFR) conditions and are generally:

- Within relatively short distances of the operating base; and
- In close proximity to accessible refueling points.

These factors support minimizing the reserve fuel carried to maximize the external load weight capability. However, operating with reduced fuel margins can only be conducted when all fuel management controls are risk assessed and complied with as briefed and planned.

As an additional level of safety to the pilot fuel management, a nominated ground-based person should also monitor aircraft fuel usage and advise the pilot accordingly as required.

evidence

Aircraft operators must include these requirements in their Operations Manual or SOPs and clearly outline the responsibilities of the pilot and ground personnel for fuel management during external load lifting activities.

81.0: Equipment Failure – External Loads

The lifting equipment fails and drops the load resulting in an accident on the ground

Certified, in-date and serviceable external load equipment is a critical control in any external load activity. External load equipment includes everything from the belly hook of the aircraft downwards. This incorporates the line, swivels, shackles, D-rings, straps, nets, baskets, welded lifting lugs, bags and anything used to secure or support a load.

A disciplined and rigorous assurance process using the following controls will assist in preventing failure of lifting equipment:

- Certified to manufacturer's requirements by appropriately qualified personnel, and within the certification period (in-date);
- Periodic scheduled servicing by appropriately qualified personnel in accordance with the aircraft operator's maintenance schedule;
- Each item is stamped and/or "tagged" showing its certified load rating, and its compliance with certification dates and servicing cycles;
- Assessed as serviceable by appropriate personnel after each use before return to store;
- Maintained in the aircraft operator's maintenance system in accordance with the requirements of aircraft parts;
- Assessed as serviceable before use by ground/flight crew;
- Securing shackle pins (e.g. lock-wire) to prevent accidental load release; and
- Returning the equipment to the aircraft operator immediately after use and ensuring that it is not used for any other purpose.

81.1: Lifting Equipment Certification

Ensuring certification of lifting equipment and compliance with the equipment manufacturer's servicing requirements.

The aircraft operator must ensure the serviceability and certified safe working load of lifting equipment is adequate for the task and appropriate to the material used for the line.

Failure of lifting equipment has been a significant cause in the loss of loads in-flight.

Certification of the lifting lines by personnel who have been trained in the Original Equipment Manufacturer's (OEM's) requirements is essential. Use of lines not certified or without appropriate certification documents must not be permitted.

Based on industry standards the ultimate breaking strength of rigging must be five to six times the safe working load of that rigging. The safe working load limit of the line must be a minimum of 5:1 and pre-determined as being capable of lifting the planned load prior to use. Most certified rigging equipment will be provided with a 6:1 ratio. Work Load Limit charts are available from the lifting equipment OEMs.

evidence

The aircraft operator must retain records reflecting that any lifting equipment has been certified for use by the equipment manufacturer, has been tested and released to service by the approved maintenance organization and has been subject to a manufacturer's approved maintenance program.

Associated records must confirm that requirements of the lifting equipment manufacturer's approved maintenance program are being appropriately carried out.

81.2: Servicing Schedule

Ensuring early detection of impending failure of load lifting equipment.

Lifting equipment must conform to a servicing schedule that provides all necessary documentation associated with inspections, certification and serviceability. Copies of this servicing schedule must be made available to the aircraft operator's representatives in the field.

All lifting equipment must be tracked using a documented and auditable servicing schedule. As with certification requirements of the lifting equipment, the servicing schedule relies on appropriate tagging of the equipment. Metal tags are the preferred method as synthetic nylon tags have been known to deteriorate. Most synthetic lines should not be color coded on the line itself (unless they are provided in a manufacturer's color scheme), as long-term degradation of the material in contact with the paint can occur. Color coding on steel is acceptable.

Lines without any form of identification or tagging must not be used and must be taken out of service until re-certification can occur.

All re-certification, scheduled servicing and any other checks must be documented by the aircraft operator on an external load lifting equipment register and the register must be available for reference by the staff operating in the field.

Where lifting equipment is provided by a third party, for example a contracting "client", the aircraft operator must ensure that any lifting equipment provided meets these maintenance, certification and tagging requirements.

evidence

The aircraft operator must maintain records, or have access to third party records, showing that all lifting equipment has been certified for use by the helicopter or equipment manufacturer. The records must also show that the equipment has been tested and released to service by the approved maintenance organization and that it has been subject to a manufacturer's approved maintenance program.

81.3: Visual Inspections

Ensuring servicing routines are supplemented with visual inspections prior to each use.

All lifting equipment (cables, lines, straps, baskets, swivels, clevises, etc.) must be inspected by qualified personnel daily prior to the flight. Any signs of wear, fraying, corrosion, kinks or deterioration must result in the equipment being withdrawn from use.

To supplement the certification process, a daily inspection by qualified personnel such as the pilot, Loadmaster or other qualified and trained personnel in accordance with all OEM requirements will assist in mitigating the risk of equipment failure. Qualified personnel can include personnel trained by the aircraft operator, external load specialists or through accepted industry training programs. Early detection of impending equipment failure will ensure that defective equipment is removed from service and returned for repair or discarded.

All external load activities, schedules and plans must allow adequate time for the aircraft operator's personnel to perform all necessary checks on load equipment prior to the day's tasking.

The aircraft operator must document in their Operations Manual and SOPs that all lifting equipment is subject to a daily serviceability inspection by qualified personnel prior to use. Such procedures must clearly state requirements for the removal of equipment from service if found to be not in a fully serviceable condition. Associated records must confirm that requirements for daily inspections of lifting equipment are being appropriately carried out.

81.4: Shackles

Ensuring that shackles are compliant and compatible with other load lifting equipment.

The shackles used to connect the cable to the aircraft must conform to specific Flight Manual supplements regarding the diameter of the shackle rings and their use with respective hook types on the aircraft.

Shackles provide a method of attaching load lines to the aircraft and the load line to the load itself. The shackle, ring or device used to connect the load to the hook must be compatible with the hook. A review of accidents involving under slung loads reveals that the use of the incorrect size and shape of the shackle that links the load to the hook has contributed to a number of dropped loads. An incompatible shackle raises the potential of:

- Unintended release (dynamic roll-out) where the shackle (or ring) collapses the hook "keeper", allowing the load to detach from a closed hook; and
- The load not releasing when intended due to the ring jamming on the hook assembly.

If there is no Flight Manual supplement available, a pre-start operational risk analysis should be conducted to confirm the correct shackle size is being used.

(Note: Keeperless hooks are immune from dynamic roll-out and are hence a preferred option where available for fitment.)

The aircraft operator must document procedures that require shackle rings used in external load operations to meet the design specification of the equipment fitted to the helicopter and as detailed in the applicable AFM supplement.

82.0: Inadvertent Load Release – External Loads

The load is inadvertently released in-flight, falls to the ground and causes an accident

A dropped external load poses a serious risk to personnel and ground facilities and probable destruction of the load. The risk of part of the disconnected load or external load equipment striking part of the helicopter should not be discounted. Risk mitigation strategies must consider human failures as well as technical failures as both classes of failure have been well documented in previous incidents.

82.1: Release Mechanism

Ensuring that aircraft have appropriate mechanisms for release of loads in normal and emergency situations.

The aircraft must have a serviceable cockpit manual and electric release mechanism and an external manual release at the hook. Prior to first flight of the day, both manual and electrical release must be verified and return to latched status confirmed.

Pilots releasing external loads will normally utilize the cyclic or collective mounted electrical release switch. However, if an electrical release mechanism fails or if there is a total electrical failure, the alternate system of the cockpit mounted manual release system will have to be used by the pilot. Ground crews also have the capability of releasing the load from underneath the helicopter using the hook mounted release mechanism should the need arise.

Both the manual and electrical hook release systems should be checked and functionally tested before commencing hook operations each day, and each time the hook assembly is fitted to a helicopter.

evidence

The aircraft operator must document procedures that require all lifting equipment to be subject to a daily serviceability inspection by qualified personnel prior to use. Such procedures must contain requirements for the daily inspection of manual and electrical hook releases to ensure the serviceability and correct operation of this equipment.

Associated records must confirm that requirements for daily inspection requirements are being carried out.

82.2: Standardized Controls

Removing the potential of inadvertent load release.

When practical for aircraft of the same or similar type, the aircraft operator must standardize electrical load release switches, particularly when located on the cyclic and collective controls.

Misidentification and selection of a cyclic or collective hook release switch has been a significant cause of inadvertent load release during external load activities.

Standardization of release switches will play an important role in minimizing the occurrence of human error. Aircraft operators should standardize the switches in their aircraft fleet that are to be operated by the same pilots. As a minimum, the same type and model of aircraft used on the same external load operation must have standardized switches. However, this philosophy should also extend to all aircraft of the same model and type, and where practical, to different types of helicopter if the aircraft operator's flight crew are operating more than one type.

If standardized switches have not yet been fully implemented, detailed differences training must be provided to all flight crew until such time as the standardization can occur.

Where dedicated helicopters are to be used on an external load campaign, verification and assurance of standardized controls throughout the contracted fleet should occur prior to contract start.

Inspection of a representative sample of helicopters in an aircraft operator's fleet should confirm that, in accordance with the aircraft operator's policy and equipment design requirements, the layout of all external load release switches is standardized on helicopters of the same or similar type. Where an electrical load release switch is fitted to a helicopter, it should be referenced in the AFM (possibly as a supplement or STC).

Differences training must be provided where there is still a non-standard fitment throughout the aircraft operator's fleet.

82.3: Guarded Release Switch

Removing the potential of inadvertent load release.

When available for the aircraft type, all electrical release switches must be guarded or collared to prevent inadvertent activation.

One of the design standards for aviation is that a two-stage activation process should protect critical systems. The two-stage process comes in many forms, and can involve the use of "gates" or lift-and-throw type switches. The primary design philosophy is to protect against inadvertent selection by introducing the requirement for the flight crew to go through two separate and distinct processes before a system can be activated.

To protect against inadvertent activation of the external load release switches, guards should be fitted to all electrical release switches where possible.

Whenever non-standard conditions within company operations or equipment exist, appropriate differences training on the equipment type must be developed. The training must be documented as having been provided to all flight crew involved in the external load operation.

Where dedicated helicopters must be used on an external load campaign, verification and assurance that guarded release switches are in place should occur prior to contract start.

Inspection of a representative sample of aircraft in an aircraft operator's fleet must confirm that, in accordance with the aircraft operator's policy and equipment design requirements, each electrical load release switch is guarded to prevent inadvertent activation. Where an electrical load release switch is fitted to a helicopter, it should be referenced in the AFM (possibly as a supplement or STC).

82.4: Load Construction

Ensuring that all loads are rigged by appropriately trained and qualified personnel.

The aircraft operator must ensure that all loads are rigged appropriately by qualified personnel.

The integrity of an external load can be affected by many factors including the load's rigging, shape, size, length and distribution. External loads are subject to a wide variety of forces in-flight and the aerodynamic effects on loads cannot always be anticipated. Qualified personnel must always be used during the load preparation phase as they will be best able to anticipate the load construction and restraint requirements.

While the Pilot-in-Command of a helicopter performing an external load operation has final responsibility for the acceptance of any load to be carried, only personnel who have been appropriately trained and qualified must be authorized to perform rigging of the load. Personnel such as qualified Loadmasters or aircraft operator's specialists must be trained and qualified using recognized industry training programs that utilize manufacturer standards and rigging procedures.

Electromagnetic or mechanical swivels must be used in conjunction with load equipment to allow rotational movement of the load and avoiding twisting. In an electromagnetic swivel, an electric current continuously passes through the rotary connector of the swivel. All swivels should be certified and appropriately rated for the load carried.

Aircraft operators' documentation, or third party riggers' documentation, must include guidance for rigging of loads carried by various means. This includes loads carried on pallets within nets, long loads requiring the use of pipe-hooks, use of unequal lines for slender lengthy loads liable to swing, loads containing flammable liquids or other hazardous materials, and loads likely to have aerodynamic characteristics.

evidence

The aircraft operator's Operations Manual must detail the roles and responsibilities of personnel assigned to construction and rigging of loads that must be carried in helicopter external load operations. It must also include the details of the training that must be provided to personnel appointed to these positions and the process by which their ongoing competencies are assured.

Associated records must confirm that the requirements have been applied in the training and qualification of personnel who are allocated duties associated with construction and rigging of loads that must be carried in helicopter external load operations.

Approved rigging manuals document correct rigging procedures for various load types.

82.5: Flightpath Management

Ensuring personnel below the aircraft are not impacted by release of the load.

The aircraft operator must have procedures that minimize external load flights over populous areas, dwellings and personnel. Furthermore, ground crew working with external loads must be briefed not to enter the load footprint at any stage during approach or departure of the aircraft. In the event the area is built-up and route considerations are finite, a Congested Area Plan must be established and briefed prior to the first mission.

An integral and important part of managing risks associated with external load operations is ensuring that the flightpath to be followed by the aircraft is managed in a way that minimizes and avoids where possible, over-flight of populous areas, dwellings and personnel.

Conduct of a pre-lifting reconnaissance flight is to identify the locations of populous areas, dwellings and personnel and enable external load carrying flightpaths to be appropriately defined to avoid identified areas.

The operator's procedures should ensure that all ground personnel involved with the operation are appropriately briefed regarding the expected flightpaths to and from the staging area, the precautions to be followed and need to remain clear of the load footprint.

evidence

The operator's procedures should document the requirements for adoption of flight-path management to avoid risks to persons and property on the ground and provide for a comprehensive briefing to be given to all relevant ground personnel prior to commencement of operations.

83.0: Loss of Control In-flight (LOC-I) – External Loads

Poor manipulative control in-flight results in a loss of control and an aircraft accident

The safe carriage of an external load requires strict adherence to several controls.

The manipulative handling of the aircraft by the pilot is as important as having certified, serviceable equipment supporting a well-constructed load.

The complexity of external load operations is further increased by engines and transmissions operating close to their limits, pilots being remotely located from the load and the lack of normal visual reference available during many operations.

The load itself can create handling issues for pilots especially if the load swings or oscillates or tends to "fly" causing increased pilot responses that can sometimes become impossible for the pilot to manage.

The ability to perform external load work requires specific training by flight crew to ensure that all the necessary manipulative skills are developed as well as an understanding of how to deal with unexpected load deviations in-flight.

83.1: Pilot Experience

Ensuring flight crew are adequately trained and have sufficient experience to conduct helicopter external load operations.

Pilots engaged in external load activities must comply with the following requirements:

- ***Successful completion of operator's external load training program tailored to vertical reference operations, and the long-line (<50 feet), or the short-line (>50 feet), whichever is applicable;***
- ***At least 200 hours external load operations, 100 of which must be vertical referencing (if used in that role); and***
- ***An annual long-line and/or external load base check with designated check and training personnel.***

(See also Common Control 1.5: Flight Crew Qualifications, Experience and Recency.)

The aircraft operator must not assign a Pilot-in-Command as an operating crew member of a flight engaged in external load operation unless they meet the minimum experience and recency requirements of either the BAR Standard or the responsible regulatory authority (whichever is the more stringent).

The aircraft operator must document in the Operations Manual, minimum qualification and experience requirements for flight crew engaged in external load operations that reflect both the minimum standard for the roles as defined in the BAR Standard and that may be required by the responsible regulatory authority.

Details of the aircraft operator's training and checking program for external load training (long line/short line as applicable) must be published in the Operations Manual and follow established criteria. The program must cover requirements and procedures for initial training and approval along with the processes for conducting periodic recurrent training and checking (annual long-line and/or external load base check).

Associated pilot training records must confirm that applicable requirements of the training program have been applied in the training of pilots engaged in external load operations and the ongoing annual evaluation of pilot competency (long line and/or short line as applicable).

Flight crew files and rostering records must confirm that crew assignments are appropriate to meet the task requirements.

83.2: Pilot Daily Flight Times

Ensuring that the flight crew is not impacted by fatigue.

Where the external load moves are more than three per hour, comply with the following flight times: (Note: hot refueling does not constitute a rest-break).

Single-pilot operation	Two-pilot operation
3 hour maximum flight time per flying period, followed by a 30 minute rest-break.	5 hour maximum flight time per flying period, followed by a 60 minute rest-break.
6 hour maximum flight time per calendar day.	8 hour maximum flight time per calendar day.

High repetition external load work is considered more fatiguing than normal operations due to the high levels of concentration required by the flight crew. Limitations imposed on the flight times, duty periods and rest requirements for flight crew are established to minimize the effects of fatigue and to ensure that flight crew are performing at adequate alertness levels to enable safe flight operations.

Details of the aircraft operator's Flight and Duty Time management program should be published in the Operations Manual and where helicopter external load operations are undertaken, must reflect the limitations detailed in the BAR Standard (unless the responsible regulatory authority's requirements are more stringent).

Associated Flight and Duty Time records must confirm compliance with all requirements of the Flight and Duty Time limits that are applicable. The Flight and Duty Time records that are maintained must be consistent with information provided in other documents such as aircraft flight records.

83.3: Instrument Remote Indicators

Ensuring that flight crew can adequately monitor critical aircraft operational limits at all times.

For single-pilot operations using vertical referencing techniques and where the aircraft instruments are not in the pilot's scan, remote indication of fire warning light and torque gauge shall be fitted where possible for the aircraft type.

Where single-pilot, external load operations involving vertical referencing (long-line) are to be conducted, instruments and/or indicators that enable the pilot to monitor critical aircraft operational limits should be provided in a position that is within the pilot's field of view when observing the load. Provision of a remote First Limit Indicator (FLI) or remote torque gauge and fire warning lights can considerably reduce risks and pilot workload during an operation that is demanding. Audio outputs indicating the same parameters routed through the pilot's headset may be considered as an adequate alternative.

evidence

Inspection of the aircraft operator's helicopter fleet should confirm that remote FLI or fire warning lights and torque gauges that facilitate monitoring during single-pilot, vertical referencing external load operations are fitted. Where a remote FLI or fire light and torque gauge are fitted to a helicopter, it should be referenced in the AFM (possibly as a supplement or STC).

83.4: External Mirrors or Camera

Ensuring enhanced situational awareness of the external load at all times.

Where available for the helicopter type, external mirrors or camera showing the hook area must be fitted to the aircraft. Where fitted, the mirror or camera must not interfere with the design and operation of the Wire Strike Protection System (WSPS).

The provision of external mirrors enables the flight crew to gain the necessary assurance that the hook area and line attachment are correctly configured and operating normally. It provides a final check to the flight crew that the load is securely attached and electrical connections (if fitted) are correctly made.

evidence

Inspection of the aircraft operator's helicopter fleet should confirm that external mirrors that permit viewing of the hook area during external load operations are fitted in accordance with the aircraft operator's policy.

Where external mirrors are fitted to a helicopter, they should be referenced in the AFM (normally as a supplement or STC).

83.5: Load Weight

Ensuring accurate load weights are known and within aircraft limits.

All loads must have accurate weights provided to the pilot before each lift. Standard load plans can be used as long as the weights are accurately known. A load meter must be fitted to the aircraft if considered necessary during the pre-start risk assessment.

(See also Control 6.2: Cargo Weight and Loading, Control 6.3: Load and Trim Calculations.)

Control of the weight of external loads is essential for the safe conduct of each operation. The weight of external loads must be made available to the Pilot-in-Command before each flight. Care must be taken to ensure that the weight of straps, slings, hooks, swivels, etc. is included in the total weight to be lifted.

When a load meter is fitted to the aircraft type, it must be positioned such that the load information is in view of the flight crew whilst maintaining control of the aircraft.

evidence

The aircraft operator's documented procedures must include the requirements and processes to determine the weight of the external load to be lifted for each flight and the procedure to ensure that accurate weight information is provided to the pilot before each lift.

Where standard loads are carried, the aircraft operator's Operations Manual must specify the circumstances under which standard load information may be used to ensure that standard load weights are only used when accurately known.

84.0: Line Fouling In Transit

The load becomes detached from the line or the line is flown empty which, when above a certain speed, causes it to stream up and rearwards into the tail rotor resulting in an accident

A long-line is any line that is 50 feet or greater in length.

A short-line by definition is less than 50 feet in length, but should also have the added restriction of not being able to reach the tail rotor of the aircraft type being flown.

Long lines are inherently unstable when flown above certain speeds. Unweighted lines will always drop vertically down from the hook when the helicopter is hovering and will begin to trail behind the helicopter as the speed is increased. The angle at which they trail is proportional to the forward airspeed of the aircraft, as too is the instability of the line.

The aerodynamics of an unweighted line are unpredictable and there have been many accidents caused when the long line has streamed to a position where contact with the tail rotor has occurred with the subsequent loss of control of the helicopter.

84.1: Weighted Lines

Ensuring helicopter systems cannot be fouled by unweighted lines.

The long-line must be weighted to prevent potential fouling with the tail rotor if the long-line is to be flown without a load attached. Implement pre-takeoff checks which are designed to ensure flight crew involved in repetitive load operations are aware of when the line is attached.

Transit with a short-line must be risk assessed and only permitted when (1) sufficient weight is applied to the line to prevent fouling with the aircraft and (2) maximum transit airspeed is briefed and applied at all times during the activity.

The most common risk mitigation strategy to prevent long line streaming into the tail rotor is to add a minimum weight to a long line, in order to alter the mass and aerodynamic characteristics.

The short-line should never be able to reach the tail rotor of the helicopter type being used, and should never be flown without a load attached.

evidence

The aircraft operator should have published in its Operations Manual a restriction on flying with unladen long lines and publish a minimum mass that is required to be attached to a long line when the line is flown without a load attached.

Pre-takeoff checks must include confirmation of a long line attachment to the aircraft.

Observation of flight operations where possible can confirm compliance with the aircraft operator’s procedures and that transit with a long-line and no load attached is prohibited unless the minimum mandatory weight is attached.

84.2: Never Exceed Speeds

Ensuring that the external load remains stable and controllable at all times.

All applicable speed limitations must be briefed and understood by all flight crew prior to the commencement of operations. If the aircraft Air Speed Indicator (ASI) is calibrated in different units of measurement than the documented speed limitations, a separate risk assessment must be conducted and reviewed with a Competent Aviation Specialist prior to start.

The maximum airspeed achievable with varied external cargo shapes is limited by controllability. Care should be taken when carrying external cargo as handling characteristics may be affected due to size, weight, and shape of cargo load.

The V_{NE} for carriage of external loads set by the manufacturer is usually derived from the aircraft's response after releasing a load in-flight due to emergency.

Some loads have a natural tendency to "fly", such as boats or flat packs that can act like a wing. In these cases the stated V_{NE} may be too excessive and the pilot must reduce the maximum forward airspeed as required. Maximum operational air speed with external loads is dependent upon the load configuration and sling length and it is the aircraft operator's responsibility to establish the maximum operational speed for each specific configuration.

evidence

The aircraft operator must publish the V_{NE} speeds applicable to all helicopter types in its inventory capable of conducting external load operations. The V_{NE} speeds published must comply with manufacturer's data, extracted from the AFM. The Operations Manual should also include the process for determining a safe transit speed during all external load operations. The process must detail an incremental increase in airspeed based on load stability and the recovery measures to be used if the load becomes unstable.

Observation of flight operations where possible, can confirm compliance with the aircraft operator's published procedures and limitations.

84.3: Maneuver Boundary Envelope

Ensuring that the external load remains stable and controllable at all times.

All safe transit speeds, the maximum angle of bank, the maximum allowable rate of descent and general handling associated with stable load operations must be briefed and understood by all flight crew prior to the commencement of operations.

Carrying an external load attached to a helicopter degrades stability and handling qualities, and reduces the operational flight envelope by comparison to a helicopter with no load. The safety of an external load operation relies on flight crew having a full knowledge and understanding of the way in which carriage of an external load will affect the handling characteristics and limitations of the helicopter.

The aircraft operator's SOPs must clearly specify a requirement for all flight crew to have a full knowledge and understanding of the way in which carriage of an external load will affect the handling characteristics and limitations of the helicopter. In multi-crew operations, the aircraft operator's documented SOPs should detail how the crew work together, including specific detail on the conduct and content of preflight briefings to ensure that crew members are aware of, and understand the effect of, an external load on the helicopter's operational envelope. For single-pilot operations, the aircraft operator's SOPs should provide details of the relevant self-brief that should be completed by the pilot prior to commencing a flight. Load performance in-flight should also be addressed during an aircraft operator's External Load Training Program.

Observations of flight operation where possible, can confirm the suitability of the aircraft operator's procedures and compliance with them.

85.0: Ground Loss of Control

A departure from normal operations on the ground results in loss of control of the load and aircraft and resulting in an aircraft accident

Helicopter external load operations by necessity are conducted while the helicopter is running. Risk factors such as noise, downwash, vibration, raised dust/snow/debris and turn-around time pressures all contribute to the high-risk nature of the activity.

Defences used in this high risk environment include training, qualification, experience and awareness of all personnel including both ground and flight crew. To ensure the levels of situational awareness are adequate, a clear understanding of the activity's purpose, associated procedures and individual and team accountabilities and responsibilities must be understood.

85.1: Ground Briefing

Ensuring all personnel involved in the external load lifting operations are comprehensively briefed.

The pilot must ensure all personnel involved in the external load activity are briefed prior to the commencement of operations. This brief must include all emergency scenarios that could involve the ground crew.

The pilot should ensure a full and comprehensive preflight briefing is conducted with all personnel involved in an external load operation. An integral component of the briefing should be an assessment of identifiable risks that may be unique to that specific operation.

The briefing should:

- Cover all aircraft emergency scenarios and actions required by pilots and ground personnel;
- Include the assigned Loadmaster, hook-up person and marshaller (if required) and identification of same vests;
- Identify antennae, skid gear and other fuselage parts that can cause injury to personnel or damage to the helicopter;
- Discuss load sequencing with the Loadmaster, pilot and crew on size, shape and weight with respect to the fuel burn and turn-around time;
- Reiterate how sling gear can get entangled on skids or other obstacles;
- Discuss potential static discharge and how to avoid it;
- Review wind direction and flightpaths;
- Discuss the importance of areas being clear of debris and loose materials that can blow away, be sucked into rotors or cause injury to personnel;
- Confirm hand signals procedures;
- Confirm radio terminology to be used;
- Emphasize that no crew member should turn their back on the line or the load during all approach, hook-up and departure operations;
- Emphasize that all crew members should maintain eye contact with the line and/or load at all times during the final approach, maneuvering, and departure phases of the operation;
- Make it clear that ground personnel not essential to the hook-up operation must stay in recognized safe areas when the helicopter is operating;

- Make it clear that the load must be securely attached, and all ground members must be clear before the signal is given for the pilot to depart; and
- Make it clear that all ground members must wear appropriate PPE.

The aircraft operator's Operations Manual must specify a requirement that prior to commencing external load operations, the pilot must conduct a briefing with all personnel involved with the operation. This briefing should include all known aircraft emergency scenarios that could involve ground crew and encourage discussion of identifiable risks associated with the planned operation.

85.2: Ground Personnel

Ensuring ground personnel have appropriate personal protection.

Ground personnel must wear appropriate Personal Protective Equipment (PPE) including hard hats with chin straps, impact resistant goggles, gloves, safety shoes, high visibility vests and a means of ground-to-air communications with the flight crew.

Access to, and movements within, a lifting or dropping site should be strictly controlled and non-essential personnel must not be allowed to work in, or cross, the operating area when external load operations are taking place. All ground personnel who are required to perform functions supporting the external load operation must be provided with PPE to ensure that the risk of sustaining personal injuries during the operation is minimized. Although not stated in the control, the PPE requirements should include hearing protection such as helmets with incorporated hearing defenders.

The aircraft operator must document the PPE requirements that must apply to ground personnel involved in external load operations. Such requirements should include hard hats with chin straps, impact resistant goggles, hearing protection, gloves, safety shoes and a high visibility vest.

Where operations must be conducted in dusty conditions or if the load to be carried is likely to give rise to significant or harmful dust, ground personnel must be provided with suitable respiratory protection.

Appendix 9: Aerial Sawing and Grapple Sawing

Helicopter aerial sawing involves large aerial saws that are suspended below a helicopter and used to trim vegetation around infrastructure such as roads, railways, pipelines and powerlines

Helicopter grapple sawing involves a large aerial grapple that grabs hold and cuts a tree when it is located in close proximity to power lines

The design of an aerial saw involves several large diameter circular saw blades mounted on a vertical shaft. The circular saw blades are driven by a small, self-contained petrol engine. The engine turns the blades at varying speeds, controlled by the pilot. The vertical shaft is attached to a long aluminum boom (or beam), then attached to the helicopter external cargo hook.

The critical controls essential for the conduct of minimum-risk aerial sawing operations are:

- Certified, in-date and serviceable equipment;
- Qualified, experienced ground and flight personnel;
- Serviceable helicopter suitable for the load/environment;
- Thorough planning and briefing;
- Fuel management;
- Suitable pick-up and set-down areas;
- Aircraft performance margins; and
- Standard Normal and Emergency Operating Procedures with accompanying training.

Figure 11: Operational Risk Assessment Considerations for Utility and Energy Aerial Sawing Operations

Aerial Sawing and Grapple Sawing

Lack of Communication
- Air to Ground Communications
- Ground Spotters
- Briefing

Equipment Failure – Aerial Sawing
- Design and Certification
- Maintenance

Saw Fouling
- Saw Remote Operation
- Release Mechanism

Obstacle Clearance
- Flightpath Planning
- Long Line Experience
- Minimum Height

90.0: Lack of Communication

A breakdown or lack of effective communication occurs between crew members, leading to an accident due to the ineffective response to a safety-related threat

The importance of effective communications amongst all members of an operating crew has been highlighted in many accident reports and is routinely cited as a contributing factor. The aviation industry has developed mechanisms to minimize communication breakdown, ranging from a simple checklist through to a more detailed study of interpersonal skills prerequisite to an effective crew.

90.1: Air to Ground Communications

Ensuring pilots and ground crew can communicate effectively.

All personnel involved in aerial sawing operations must have good two-way radio communications.

Clear and unambiguous communications must be employed between the helicopter and the ground crew involved in sawing operations. Standard terminology should be used to avoid any confusion. Consideration should be given to mandating standard visual signals to be used in the event of a total radio failure

evidence

The aircraft operator's Operations Manual and/or SOPs should document details of standardized communications for aerial sawing and grapple sawing operations. It is preferable that these procedures also specify back-up visual signals.

90.2: Briefing

Ensuring detailed briefings with all involved personnel prior to commencement of operations.

Pilots engaged in aerial sawing operations must conduct a detailed briefing prior to commencement of operations. Topics for briefing should be detailed in the aircraft operator's Operations Manual.

Policy and procedures regarding the conduct of pre-operations briefings should be detailed in the aircraft operator's Operations Manual.

evidence

Aircraft operators must include these requirements in their Operations Manual or SOPs as a responsibility of the Pilot-in-Command.

90.3: Ground Spotters

Ensuring personnel engaged in ground spotting have clear line of sight.

All personnel involved in ground spotting duties must be positioned as best as practicable to make best use of visual vantage points.

The entire aerial sawing crew should be on a dedicated radio channel, thereby enabling open and distraction free radio communications. The key to maintaining clearance from fixed obstructions is the employment of a Ground Spotter equipped with a radio. The Ground Spotter should be positioned so as to best observe potential hazards to the helicopter and aerial saw. In the event that safety clearances are breached, the Ground Spotter should immediately inform the pilot so that appropriate maneuvering can be completed to move the helicopter out of the hazard zone.

evidence

Aircraft operators must include Spotter requirements in their Operations Manual and accompanying Aerial Sawing SOPs. These should include responsibilities, communications, normal and emergency procedures. Appropriate training should be in place for Ground Spotters.

Courtesy: Heliservices HK

91.0: Equipment Failure – Aerial Sawing

The aerial sawing equipment fails leading to an accident

Certified, in-date and serviceable aerial sawing equipment is a critical control in any aerial sawing activity. Equipment includes everything from the belly hook of the aircraft downwards. It also includes control cables and control systems that are situated in the cockpit.

A disciplined and rigorous assurance process using the following controls will assist in preventing failure of aerial saw equipment:

- Certified to manufacturer's requirements by appropriately qualified personnel, and within the certification period (in-date);
- Periodic scheduled servicing by appropriately qualified personnel in accordance with the aircraft operator's maintenance schedule;
- Maintained in the aircraft operator's maintenance system;
- Assessed as serviceable before use by ground/flight crew; and
- Securing shackle pins (e.g. lock-wire) to prevent accidental release.

91.1: Design and Certification

Ensuring certification of aerial sawing equipment and compliance with the equipment manufacturer's servicing requirements.

The aircraft operator must ensure that certified aerial sawing equipment is adequate for the task.

Failure of aerial saws has been attributed to incidents and accidents during aerial sawing operations.

Certification of the equipment by personnel who have been trained in the Original Equipment Manufacturer's (OEM's) requirements is essential. This may be the pilot or other dedicated ground crew. Use of uncertified saws without appropriate certification documents must not be permitted.

The aircraft operator must retain records reflecting that aerial sawing equipment has been certified for use by the equipment manufacturer, has been tested and released to service by the approved maintenance organization and has been subject to a manufacturer's approved maintenance program.

Associated records must confirm that requirements of the aerial saw equipment manufacturer's approved maintenance program are being appropriately carried out.

91.2: Maintenance

Ensuring early detection of impending failure of aerial sawing equipment.

Aerial sawing equipment must conform to a servicing schedule that provides all necessary documentation associated with inspections, certification and serviceability.

All sawing equipment must be tracked using a documented and auditable servicing schedule.

All re-certification, scheduled servicing and any other checks must be documented by the aircraft operator on an equipment register and the register must be available for reference by the staff operating in the field.

Where aerial sawing equipment is provided by a third party, for example a contracting 'client', the aircraft operator must ensure that any equipment provided meets these certification and maintenance requirements.

evidence

The aircraft operator must maintain records, or have access to third party records, showing that all aerial saw equipment has been certified for use by the helicopter or equipment manufacturer. The records must also show that the equipment has been tested and released to service by the approved maintenance organization and that it has been subject to a manufacturer's approved maintenance program.

92.0: Saw Fouling

The aerial saw becomes snagged on vegetation or an obstacle resulting in an aircraft accident

Aerial saws are complex pieces of equipment. In order to prevent fouling, the saw must be operated at different speeds depending on the type and thickness of vegetation to be cut.

92.1: Saw Remote Operation

Ensuring pilots can control the operation of the saw from the cockpit.

ON/OFF control and variable speed application of the aerial saw must always be readily available inside the cockpit to the Pilot-in-Command.

Aerial saws are operated at varying speeds, with the required speed of the circular saws being dependent on the type and density of vegetation. The pilot controls saw speed via a control box in the cockpit. Saw fouling can be alleviated by varying the saw speed as required.

evidence

The aircraft operator's Operations Manual and/or SOPs should document details for the use of aerial saw controls including methods to employ to avoid saw fouling.

92.2: Release Mechanism

Ensuring the aerial saw can be released from the helicopter in the event of an emergency.

The hook release function must be serviceable at all times during aerial saw operations.

As with any external load, the aircraft must have a serviceable cockpit electric and manual release mechanism and an external manual release at the hook.

evidence

Aircraft operators must include these requirements in their Operations Manual or SOPs.

93.0: Obstacle Clearance

An aircraft accident occurs as a result of part of the helicopter or aerial saw impacting an obstacle

To prevent damage to the saw and/or an aircraft accident, it is imperative that the operating saw does not come into contact with non-vegetation (powerlines, pylons, etc). Thorough preflight planning and identification of potential hazards is essential.

93.1: Flightpath Planning

Ensuring the planned cutting path is thoroughly planned to identify potential hazards.

In consultation with client requirements and ground crews, pilots engaged in aerial sawing operations must carefully plan the route to be flown, taking into consideration pick-up and set-down areas as well as identifying potential hazards.

Planning must also include documenting and briefing proper clearances from energized conductors.

Detailed pre and post flight briefings are a critical part of the procedure.

evidence

Aircraft operators must include these requirements in their Operations Manual or SOPs as a responsibility of the Pilot-in-Command.

93.2: Minimum Height

Ensuring the helicopter remains clear of hazards during cutting operations.

The flight crew must always maintain the lowest part of the helicopter (eg skids/ wheels) above the highest adjacent conductor during sawing operations.

Additional mitigation strategies should be considered during risk assessment.

As an example, if the required clearance to prevent ARC or inadvertent contact is five feet, then a minimum factor of 3 x separation should be applied (15 feet in the example used).

Aircraft performance parameters (including flight attitude) should be reviewed and risk assessed prior to operations commencing. Deviations below minimum survey parameters should be investigated, and corrective action taken to ensure that safety margins are not compromised.

evidence

The aircraft operator's Operations Manual and/or SOPs should document the details for the preflight operational risk assessments. These should include the operating heights and separation distances to infrastructure.

93.3: Long Line Experience

Ensuring pilots are adequately trained and have sufficient experience to conduct helicopter aerial sawing operations.

Pilots engaged in aerial sawing operations must comply with the following requirements:

- ***Successful completion of operator's aerial sawing training program tailored to vertical reference operations;***
- ***At least 200 hours external load operations, 100 of which must be vertical referencing; and***
- ***An annual long-line/external load/aerial sawing base check with designated check and training personnel.***

(See also Common Control 1.5: Flight Crew Qualifications, Experience and Recency.)

In addition to specific skills relating to operating the aerial saw, the fundamental pilot skills and experience required for aerial sawing operations relate to long lining of an external load.

The aircraft operator must not assign a Pilot-in-Command as an operating crew member of a flight engaged in aerial sawing operations unless they meet the minimum experience and recency requirements of either the BAR Standard or the responsible regulatory authority (whichever is the more stringent).

evidence

The aircraft operator must document in the Operations Manual, minimum qualification and experience requirements for flight crew engaged in aerial sawing operations that reflect both the minimum standard for the roles as defined in the BAR Standard and that may be required by the responsible regulatory authority.

Details of the aircraft operator's training and checking program for aerial sawing must be published in the Operations Manual and follow established criteria. The program must cover requirements and procedures for initial training and approval along with the processes for conducting periodic recurrent training and checking.

Associated pilot training records must confirm that applicable requirements of the training program have been applied in the training of pilots engaged in aerial sawing operations and the ongoing annual evaluation of pilot competency.

Appendix 10: Operating in Close Proximity to High Voltage Lines

Operations in close proximity to high voltage lines is a key feature of energy and utility activity, and requires clear and specific guidance for safe operations

Aircraft operations in the vicinity of high voltage lines is a hazardous activity. A thorough operational risk assessment (ORA) is essential prior to any flying operations commencing. Equipment, training and communications must be analyzed as part of the ORA.

Figure 12: Operational Risk Assessment Considerations for Utility and Energy Operations in Close Proximity to High Voltage Lines

Operating in Close Proximity to High Voltage Lines

Inadequate Communications
- High Voltage Live Work Management Plan
- Asset Owner Approval
- Preflight Risk Assessment

Equipment and Training
- Helicopter and Associated Equipment
- Training

100.0: Inadequate Communication

An aircraft accident occurs as a result of arcing from high voltage lines through poor communication

Standardized communication procedures are essential to maintaining sound crew coordination in the wire environment. Communications with all stakeholders must be a key feature of the preflight risk assessment and Live Work Management Plan.

100.1: High Voltage Live Work Management Plan

Ensuring an approved plan is in place that manages all hazards associated with high voltage live work.

The aircraft operator must develop a High Voltage Live Work Management Plan in accordance with the table below and present it to the Asset Owner's representative for review and approval in accordance with all relevant local regulations. The plan must also include any training competencies required for electrical workers performing the HV live work task.

Note in the table specific requirements to Live Networks:

- ***Platform operations – Powerline Maintenance on a live network;***
- ***Platform Operations – Marker Ball installation on a live network; and***
- ***Powerline Cleaning on a live network.***

When conducting live work, a comprehensive High Voltage Live Work Management Plan, including network controls, must be documented, approved and implemented.

evidence

The aircraft operator's Operations Manual and/or SOPs should document details of the requirement for an approved High Voltage Live Work Management Plan.

Aerial Work Operations	HV Live Work	HV Risk Assessment Approval	Live Work Manual Required?
Powerline/Pipeline Inspection	No (Working Near)	Not Required	No
Platform Operations – Powerline Maintenance	Yes	Required	Yes
Platform Operations – Powerline Maintenance - De-Energized	No	Not Required	No
Platform Operations – Marker Ball Installation	Yes	Required	Yes
Platform Operations – Marker Ball Installation - De-Energized	No	Not Required	No
Platform Operations – Structure Transfer - De-Energized	No	Not Required	No
Sling Load Operations – Precision Slinging	No (Working Near)	Not Required	No
Powerline Stringing – De-Energized	No	Not Required)	No
Powerline Cleaning on a Live Network	Yes	Required	Yes
Powerline Cleaning – De-Energized	No	Not Required	No
Aerial and Grapple Sawing	No (Working Near)	Not Required	No

100.2: Asset Owner Approval

Ensuring the Asset Owner is aware and approves of all high voltage live work.

Prior to live work commencing, the Asset Owner pre-start approval must include a review and documented acceptance of:

- ***High Voltage Live Work Management Plan (Control 100.1);***
- ***High Voltage Live Work techniques, practices and procedures;***
- ***Insulated or Conductive tools and equipment, maintenance and carriage/ transporting procedures;***
- ***Tool and workers electrical bonding;***
- ***HV Live work Protective clothing (as required); and***
- ***Preflight risk assessments relating to electrical hazards.***

Prior to any operations commencing, the Asset Owner must approve the High Voltage Live Work Management Plan.

evidence

The aircraft operator's Operations Manual and/or SOPs should document that the Asset Owner must approve the High Voltage Live Work Management Plan prior to operations commencing.

100.3: Preflight Risk Assessment

Ensuring the preflight risk assessment is communicated to all stakeholders.

The aircraft operator is to complete a preflight risk assessment addressing live voltage live work considerations, and communicate this to the Asset Owner.

Any newly developed live work procedures must be proven on a de-energized line to verify safe and reliable operations can be conducted prior to going live. Notwithstanding, the aircraft operator may be required to conduct a demonstration flight for each aircraft type to be used for live work if requested to by the Asset Owner.

The demonstration flight for live work, if requested, will involve a review of the aviation and Line Worker functions.

Aircraft operators must conduct a risk assessment, including mitigation controls, before commencing operations for any new or existing aviation activity. Risk assessments are an essential element in identifying and mitigating risks to any operation. The aircraft operator should have a well-developed risk assessment process as part of their SMS and it should be used to review all activities undertaken on both a routine and exceptional basis.

evidence

The aircraft operator's Safety Management System should detail the requirement for the assessment and management of operational risks as an integral part of preflight planning. Documented evidence must be available to demonstrate that the assessment and management of operational risks is being conducted before commencing any new operations.

101.0: Equipment and Training

An aircraft accident occurs as a result of high voltage event through inadequate equipment or training

Having suitable, purpose designed equipment is essential for avoiding incidents and accidents in the high voltage live work environment. Not all helicopters are ideally suited for the role and careful selection criteria should be applied during the initial planning stages.

In addition to having the right equipment, specific and detailed training is required to ensure that both flight crew and task specialists have the knowledge and skills to perform this highly specialized task.

101.1: Helicopter and Associated Equipment

Ensuring the helicopter does not introduce electrical hazards.

Helicopters and associated role-specific equipment must be adequately bonded and appropriate for use in a live line environment.

All equipment must have demonstrated history of operating effectively within the live environment, and confirmed as not introducing any new hazards.

Helicopter type and capability must be considered during the initial planning stages. All ancillary equipment used must be confirmed as suitable and appropriately rated for the task.

evidence

The aircraft operator must maintain records, or have access to third party records, showing that all equipment specific to high voltage live wire work has been certified for use by the helicopter or equipment manufacturer. The records must also show that the equipment has been tested and released to service by the approved maintenance organization and that it has been subject to a manufacturer's approved maintenance program.

101.2: Training

Ensuring the all training requirements adequately address the risks of high voltage live work.

The aircraft operator must ensure that Live Workers, whether employed by the aircraft operator or Asset Owner, have the knowledge and training to conduct High Voltage Live Work from the aircraft and their competency has been maintained as per the High Voltage Live Work Management Plan.

The aircraft operator must provide task training for pilots, qualified crew members and qualified Asset Owner staff conducting live work in accordance with the High Voltage Live Work Management Plan.

The aircraft operator's training system must ensure that pilots have knowledge of the electrical and flight clearances required for the live work working techniques being used and the behaviour of conductors under the range of expected conditions of wind, temperature and load.

It is required that HV Live Workers performing powerline maintenance and/or marker ball installation have the necessary training qualifications as required by localized regulatory environment.

Working in the high voltage live wire environment is a highly specialized task. Both flight crew and line workers must have undergone detailed training courses prior to conducting such work. The aircraft operator's training system must include all relevant training and be in conformance with the local regulatory authority as well as the Asset Owner requirements.

evidence

The training syllabus and/or details of training arrangements for high voltage live work should be published in the relevant manual. Personnel training and competency assessment records should be maintained and show when further training and competence assessment is due.

Annexes

Annex A: Helipad Guidance

The helicopter operating area used for takeoff and landing is a critical control in the conduct of safe helicopter operations. Utility and Energy Sector companies will often become involved in preparing helicopter operating areas for contracted service providers and it must be understood that poorly designed and/or located helipads will contribute towards the likelihood of a significant event occurring or the imposition of operating restrictions.

Purpose

The purpose of providing helipad guidance is to assist both the aircraft operator and the Utility and Energy company in addressing the key threats that this control addresses in a risk-based fashion.

Helipad Types

To assist in the risk-based approach, two types of helipads will be considered:

1. Manned helipads. Helipads typically in support of exploration fly-camps, fixed facilities, production plants, fixed-base drill sites and static operational bases. Aircraft operator and/or Utility and Energy company personnel are based at this location and able to receive and dispatch helicopter movements.
2. Normally Unmanned Helipads. These helipads are typically used in support of seismic, exploration, stream sampling, community support, wildlife support and other ad-hoc requirements. Personnel are not normally based at these helipads and they are used for short-term and ad-hoc requirements.

The delineation of manned and unmanned helipads assists when distinguishing the differing equipment requirements supporting the helipad.

While the guidance contained within this section refers to onshore helipads, all offshore helicopter landing areas should continue to refer to the relevant documents of ICAO Annex 14 Vol 2 Heliports, UK CAP 437 Helideck Standards and ICS Guide to Helicopter/Ship Operations.

Helicopter Performance Class

The Performance Class of a helicopter provides a definition around the performance capability of the helicopter and in general provides a quick understanding whether:

1. The helicopter can fly away on one engine after the other engine has failed, or;
2. Whether it will have to land because the single-engine performance (or lack of two-engines) means the aircraft cannot stay airborne under the Weight, Altitude and Temperature combinations.

The definitions are as follows:

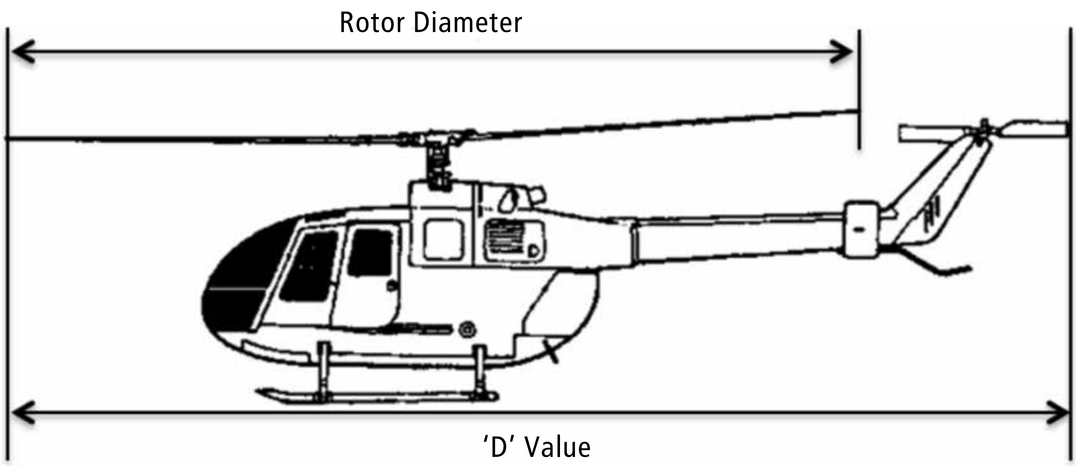
- **Performance Class 1.** Operations with performance such that, in the event of a critical engine failure, a helicopter is able to safely continue the flight to an appropriate landing area, unless the failure occurs prior to reaching the Takeoff Decision Point (TDP) or after passing the Landing Decision Point (LDP), in which case the helicopter must be able to land within the rejected takeoff or landing area;
- **Performance Class 2.** Operations with performance such that, in the event of a critical engine failure, a helicopter is able to safely continue the flight to an appropriate landing area, unless the failure occurs early during the takeoff maneuvers or late in the landing maneuvers, in which case a forced landing may be required; and
- **Performance Class 3.** Operations with performance such that, in the event of an engine failure at any time during the flight, a forced landing will be required.

(JAR-OPS 3.480a)

Helicopter Dimensions

Key dimensions of the helicopter (including weights) are as follows:

- **D Value** – The largest overall dimension of the helicopter when rotors are turning. This dimension will normally be measured from the most forward position of the main rotor tip path plane to the most rearward position of the tail rotor tip path plane (or the most rearward extension of the fuselage in the case of Fenestron or Notar tails);
- **RD** – The Diameter of the Main Rotor; and
- **MTOW** – The Maximum Takeoff Weight of the helicopter.



A table of common Utility and Energy sector helicopter weights and dimensions is presented below:

Helicopter Type	Rotor Diameter (m)	D Value (m)	MTOW (kg)
MD 500	8.10	9.40	1,361
Bell 206 series	10.16	12.11	1,451
Bell 206L series	11.28	12.91	1,882
AS 350 series	10.70	10.93	2,250
Bolkow Bo105	9.84	11.86	2,400
Agusta 109	11.00	13.04	2,600
MBB BK117	11.00	13.00	3,200
Bell 212	14.63	17.46	5,080
Bell 412	14.02	17.13	5,397
Mil Mi8/17	21.29	25.24	13,000

Figures provided as a guide only. Individual models may vary. Check with aircraft operator for specific aircraft details.

Helipad Design

The purpose of the helipad is to provide an area suitable for the helicopter in use to takeoff or land. In addition to having suitable clearance, the area must be capable of supporting the weight of the helicopter when on the ground and supporting the air-loads encountered during hovering. The basic design will be influenced by the size and weight of the helicopter, as well as the Performance Class. The key components of helipad design and construction are presented in Table One and discussed in this section:

1. Helipad size	5. Rejected Area
2. Surface	6. Taxiways
3. Buffer Area	7. Parking Area
4. Approach and departure paths	8. Obstacle marking

Table 1: Helipad Design Requirements

A1: Takeoff and Landing Area Size:

- Performance Class 1 helicopters – the takeoff and landing area dimensions will be defined in the Flight Manual. If not defined, the area should have a minimum diameter of 1D; and
- Performance Class 2 and 3 helicopters – the takeoff and landing area dimensions should be a minimum of 1D for helicopters greater than 3,175kg MTOW and 0.83D for helicopters of less than 3,175 kg.

(ICAO Annex 14 Vol 2)

Where space permits, a width of 2D should be considered. Helipads sited at high-density altitudes may need a larger area to allow for the increased momentum and reduced handling qualities in the event of engine malfunction.

Hint: If the approach and landing dimensions are based on the largest helicopter type that is every likely to use the helipad, then all smaller helicopter types will automatically be capable of utilizing the helipad.

Surface

The takeoff and landing area surface must be:

- Level as possible, but not exceed 3% slope in any direction;
- Free from irregularities that affect operations;
- Strong enough to support the dynamic load of the helicopter; and
- Able to withstand rotor downwash and provide some ground effect.

(ICAO Annex 14 Vol 2)

In practice, dynamic load calculations should be based on 2.5 x the MTOW of the helicopter to account for an emergency landing.

(CAP 437)

A2: Buffer Area

A safety buffer area is also normally provided outside the takeoff and landing area that is clear of obstacles in accordance with the following:

- At least 3m or 0.5D from the edge of the takeoff and landing area (0.25D is acceptable for PC1 operations);
- Each external side of the buffer should be 2D where the takeoff and landing area is quadrilateral or be 3D diameter for circular takeoff and landing areas;
- The edge of the buffer should be clear of obstacles to a distance of 10m rising at a slope of 45 degrees from the edge of the buffer area; and
- If obstacles are required on the buffer area to manage risk (e.g. lights for night operation), they should be less than 250mm high at the edge of the takeoff and landing area and not penetrate a plane that extends outwards rising at 5% slope.

(ICAO Annex 14 Vol 2)

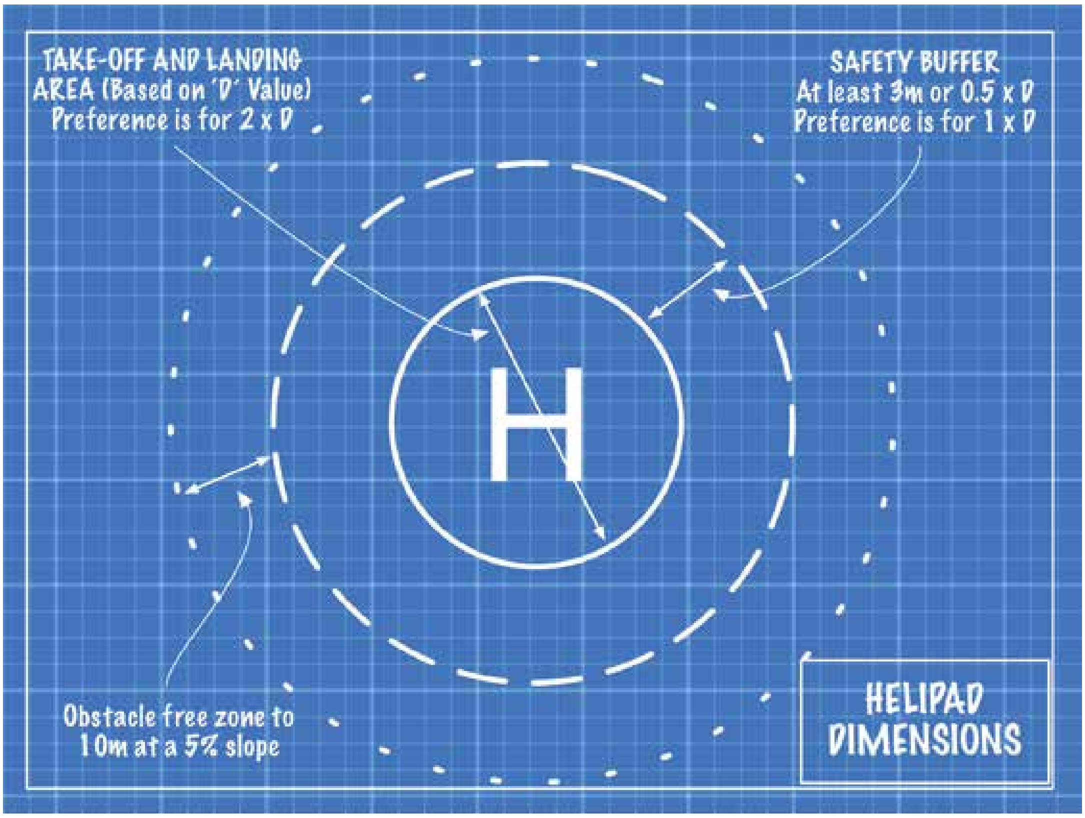


Figure 1: Helipad Safety Buffer

Where practicable, an obstacle in the buffer area should not exceed 50mm.

(FAA AC 150/5390-2C)

A3: Approach and Departure Paths

From a general design perspective, the helipad and the approach/departure paths should be clear of persons, objects, animals and debris. In particular special attention should be taken to ensure camp facilities, fuel caches and areas where personnel are working are avoided. Normally two paths should be provided, not less than 150° apart. This will allow for changes in wind direction to allow selection of the most appropriate landing and takeoff direction and additionally provide egress alternatives to the flight crew in the event a landing needs to be aborted.

The Approach and Departure segments begin at the edge of the takeoff and landing area and should extend outwards from the takeoff and landing area with a slope of 7.5° (1:8 ratio) to 500 feet elevation above the helipad.

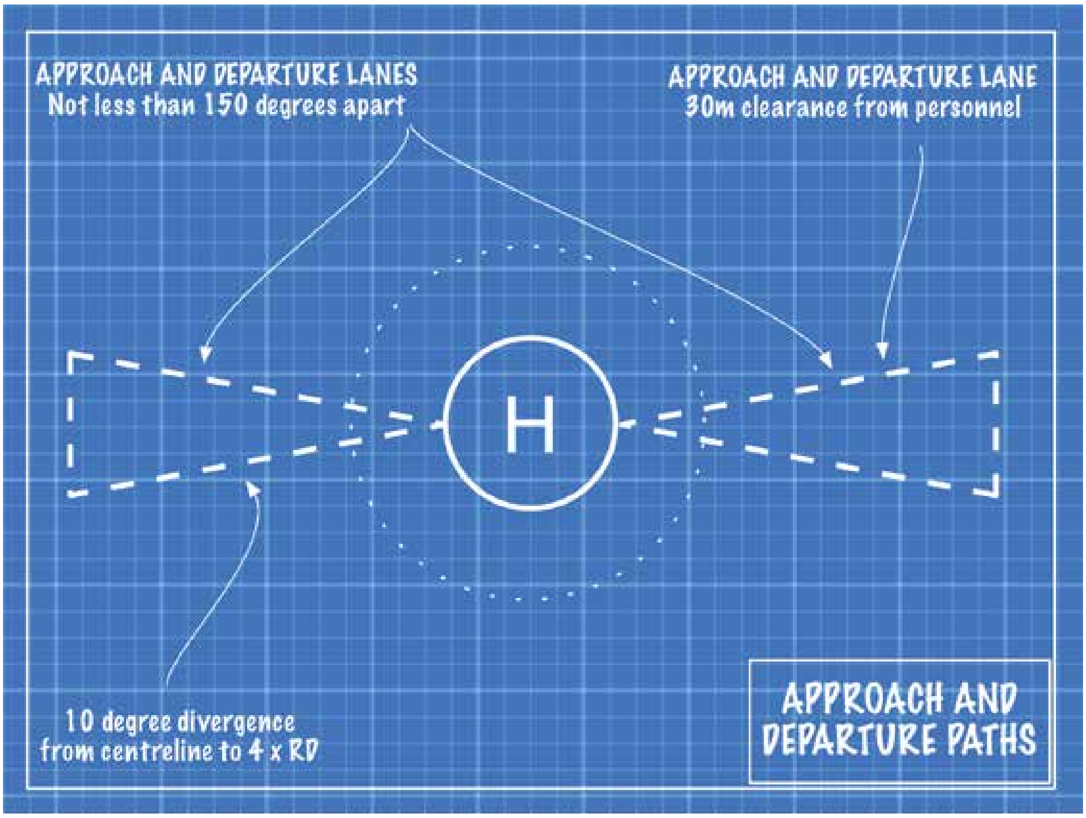


Figure 2: Vertical Approach and Departure Paths

The edges of the Approach and Departure segment should diverge at an angle of 10° to a width of 4xRD for the largest helicopter in use.

(FAA AC 150/5390-2C)

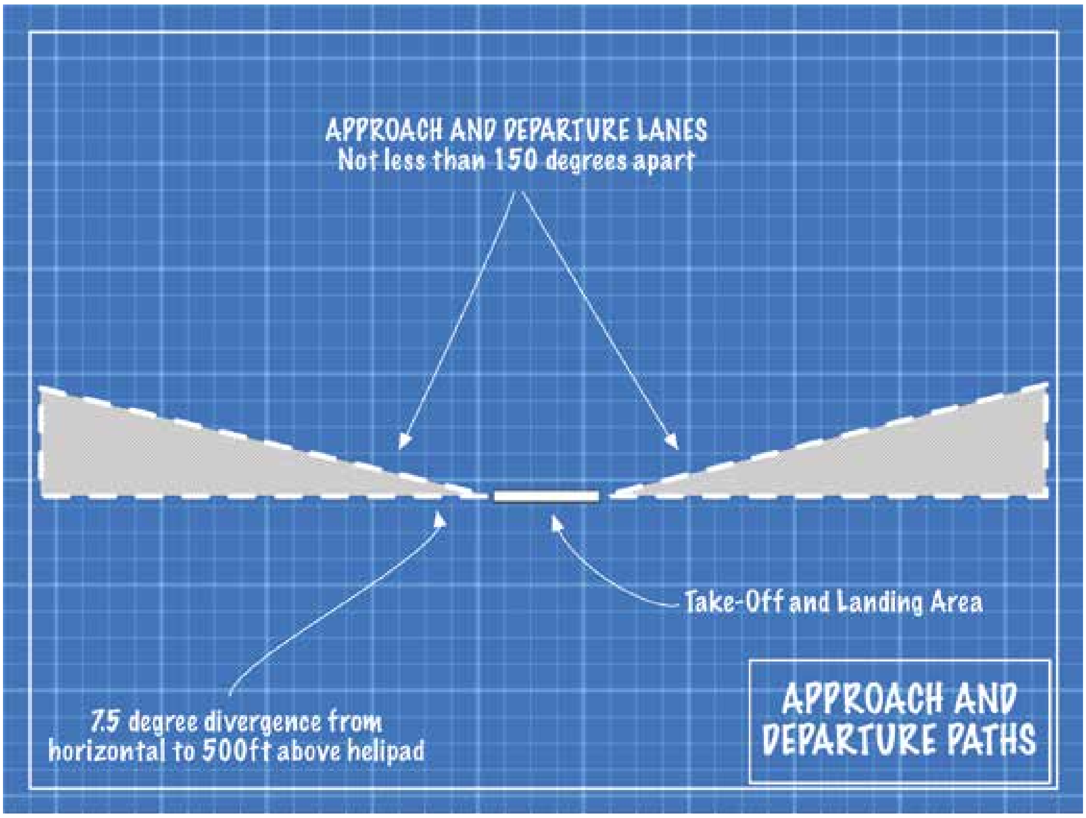


Figure 3: Horizontal Approach and Departure Paths

In high Density Altitude areas, the approach and departure paths take on a more critical role and should be a major consideration during the siting of the helipad.

Unless required to directly support the operation, personnel should remain a minimum of 30m away from the helipad in the course of operations.

A4: Rejected Takeoff Area (or 'Flyway')

For Performance Class 1 and 2 operations supporting manned helipads, a Rejected Takeoff area (or 'Flyway') should be provided to provide an area where a departure can be aborted in the event of an engine failure prior to safe single-engine fly-away speed. The distance required for the flyway will vary depending on the ambient conditions and the aircraft type. In those cases where the helipad forms part of the flyway, it will be of a rectangular design.

In all cases the approach and departure paths should be aligned with the prevailing winds as much as possible and should form a key part of the initial siting and design. Correct design and construction of the flyaway areas will also limit the time where a helicopter is exposed to the 'Avoid Area' of the Height/Velocity diagram.

A5: Taxiways

If the final parking position of the helicopter is not co-located with the takeoff and landing area (e.g. where a flyway is used for takeoff and landing, but parking is on a separate designated helipad), then helicopter taxiways need to be provided. Taxiways dimensions used should be based on the following:

Ground Taxi (using wheeled helicopters):

- Width not less than 1.5 times the wheel track; and
- Clearance from obstacles - 1.5 times rotor diameter.

Air Taxi (skid/wheeled helicopters):

- Width not less than 2 times wheel track; and
- Clearance from Obstacles 2 times rotor diameter.

(ICAO Annex 14 Vol 2)

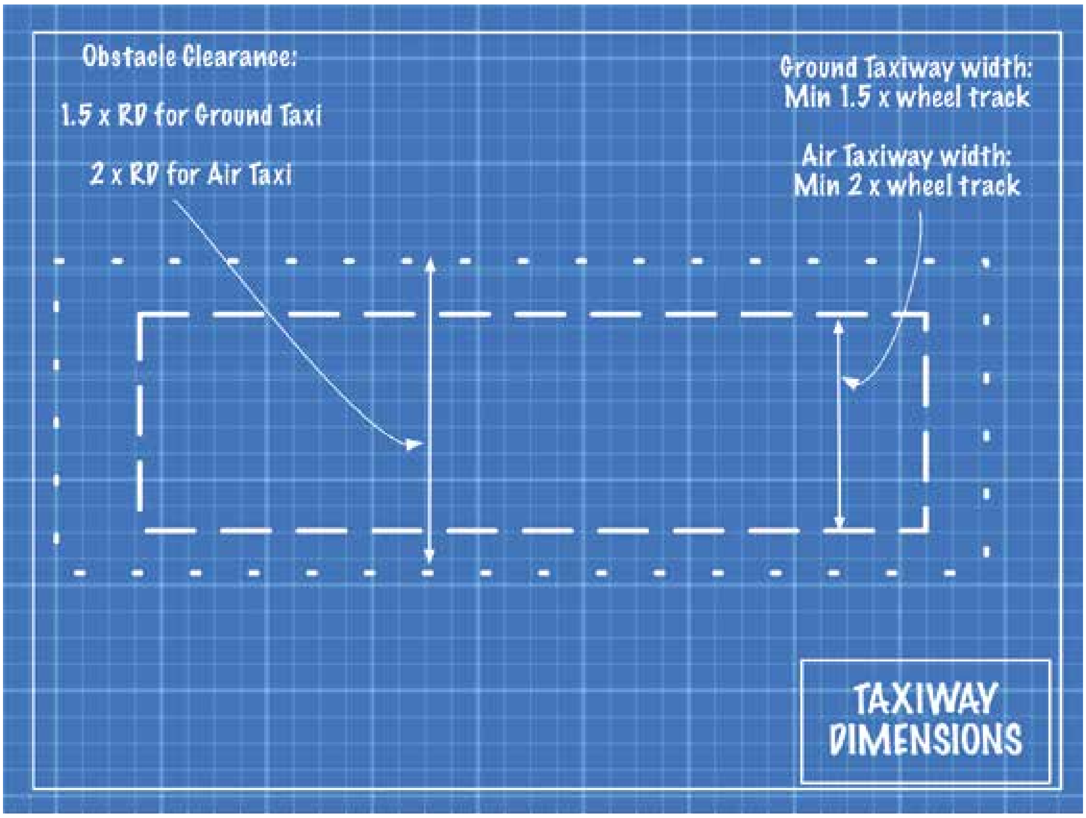


Figure 4: Helicopter taxiways

A6: Parking Area

The parking area should be a flat, level area of less than 2% slope and of sufficient strength to support the static and dynamic weight of the helicopter. The area should have a minimum of 1.2D of obstacle clearance and preferable 2D if turning is required over the parking position.

(ICAO Annex 14 Vol 2)

Separation of passengers and cargo is also a necessary consideration.

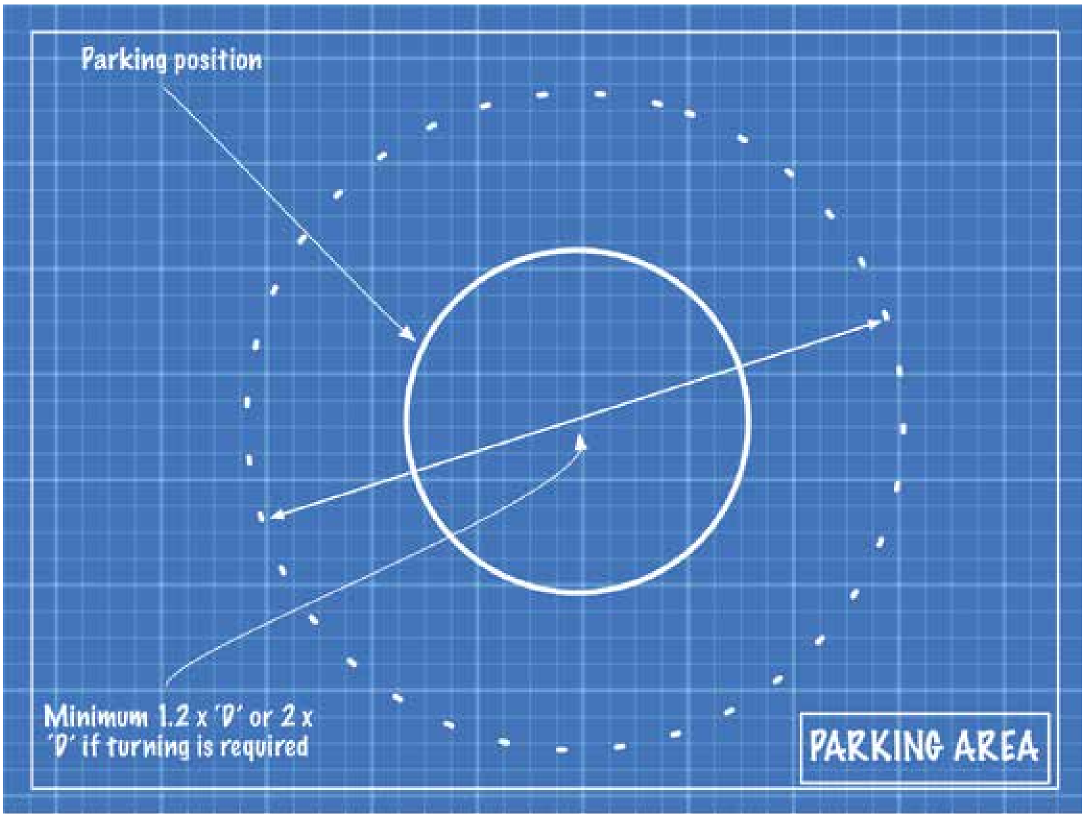


Figure 5: Helicopter Parking Area

A7: Obstacle Marking

For manned helipads, any obstacles in the area close to either the approach/departure paths or the helipad itself should be painted in a high contrast paint scheme. The preferred paint schemes are black and white, black and yellow or red and white, chosen as necessary to provide the best contrast with the surrounding environment. Paint stripes should be not less than 500mm thick and no more than 6m in length.

For night operations, a steady red obstruction light should be attached to obstacles greater than 15 meters in height.

(CAP 437)

A8: Siting Considerations

The site of the helipad should be selected in order to minimize the amount of obstacle clearance required for the helipad and flyaway. It must take into consideration all maneuvering requirements of the helicopter(s) being used.

Engaging the contracted aircraft operator and/or an aviation specialist is always recommended at the siting stage for helipads.

Wind Indicator

A windsock should be provided for all manned helipads. Where the windsock is in place it should be of sufficient diameter and length to indicate wind strength and direction. It must be sited clear of the approach and departure paths, but be readily visible to pilots on approach and departure.

Marking

For permanent helipads, see ICAO Annex 14 Volume 2 for the dimensions of required markings including the perimeter and 'H'.

Where regular passenger movements occur, a passenger walkway should be marked to the takeoff and landing area.

Unmanned helipads will normally not be painted, but should be easily identifiable. Solutions include the cutting of grass to ground level, the placement of planks or logs in the appropriate locations and the placement of appropriate sized flat stones/rocks.

Lighting

Lighting should be provided for night operations, with the following lighting standard recommended:

- Takeoff and landing area – on permanent helipads, green perimeter lights or floodlights, adjusted so as not to dazzle the pilots. If either of these light systems is not practicable, either luminescent panels or segmented lights may be used. If perimeter lights are in place, they should not be more than 1.5m from the edge of the takeoff and landing area and be spaced not more than 5m apart. For circular takeoff and landing area, there should be a minimum of 14 lights. For temporary helipads, it would be normal to use portable battery powered lights to define the takeoff and landing area;
- Additional lighting should be provided unless the departure/approach and takeoff/landing areas are practically coincident. For quadrilateral shaped departure/approach areas, there should be a minimum of four equally spaced white lights, including one at each corner. For circular departure/approach areas, a minimum of 10 white lights at a maximum of 5m spacing. Portable lighting is the norm for temporary operations;
- Lead in lights (2 x green or 1 x white) should be provided along the axis of the approach path if obstacles are likely to pose a collision risk on final approach; and
- If ambient lights make the heliport difficult to identify, a procedure should be in place to extinguish these lights for night operations.

(ICAO Annex 14 Vol 2)

Construction

The construction of the helipad should be sufficient to support 2.5 x the maximum weight of the helicopter to account for emergency landings.

Permanent helipads should be constructed of concrete or asphalt and be marked with paint.

Temporary helipads may be sited on the natural surface, where this provides adequate separation from obstacles and suitable access to the area.

Where either of the above issues is present, a platform helipad should be considered, elevating the helipad above the local area. Platform helipads are normally constructed of wood where the resource is available and would not normally exceed 0.5RD height above the local surface, otherwise a loss of Ground Effect will occur. Timbers used in this type of construction should be positioned with minimum gap to reduce the possibility of a skid or wheel being caught in the gap.

Wooden helipads need to be closely monitored, particularly in tropical environments. Both loss of surface friction and loss of structural integrity are major risks to safe operations. Wood fungus and wood rot can be insidious and lead to helicopters sliding off or breaking through affected helipads. Operators should thoroughly inspect and consider these types of pads during their Operational Risk Assessment process and apply operational restrictions as necessary.

The helipad surface should be as firm as possible and natural surface may need reinforcing (timber, Marsden Matting, crushed rock, etc.) to support the skids or wheels of the helicopter. The touchdown surface should be cleared for a minimum of 2 x the footprint of the helicopter.

Operations

If multiple helicopter operating areas are provided, the safety buffer areas must not overlap if simultaneous operations are planned.

(ICAO Annex 14 Vol 2)

Fuel

Fuel equipment and storage should be protected from any flying shrapnel that may be ejected during a helicopter roll over. Suggested separation distances are 50ft for equipment and 100ft for fuel storage.

Hot refuel operations will trigger additional considerations.

Sling Load Operations

Where the helipad is also to be used for sling load operations, additional clearances and appropriate laydown areas will also need to be considered during the design phase. It is critical that the Operator or aviation specialist is consulted to determine the minimum design criteria they will accept for sling load operations.

First Response to Aircraft Incident on Airfield

Rescue Firefighting capability should be subject to a risk assessment.

There are a number of reference documents related to applicable firefighting standards. While the ICAO recommended Rescue and Firefighting (RFF) capability is based on the length of the helicopter (see table below), this capability would only be expected for consideration when supporting a manned helipad with continuous ongoing operations. For short term operations (e.g. seismic campaigns) into unmanned helipads the same solution is not practical.

The following guidance should be considered for manned helipads.

Fire retardant should consider water and foam, plus one of the complementary agents (Dry Chemical, Halon or CO_2). An example of ICAO requirements is as follows:

Category	**Overall length of helicopter**	**Water and Foam (lt)**	**Dry Chemical (kg)**	**Halon (kg)**	**CO_2 (kg)**
H1	15m or less	500/250	23	23	45
H2	15-24m	1,000/500	45	45	90
H3	>24m	1,600/800	90	90	180

(ICAO Annex 14 Vol 2)

A crash box meeting the requirements of BARS Defence 19.13 should also be provided at all manned helipads, as well as ready access for Emergency Response crews.

Maintenance and Management

All helipads should be effectively managed with an inspection and maintenance program to ensure ongoing suitability for operations. Permanent concrete and asphalt helipads require little upkeep, other than to ensure that markings and obstacles remain clear and readable to support operations.

In tropical environments wooden helipads should be inspected more frequently to take into account wood fungus and rot. A life limit may be appropriate and in some cases have been known to be as little as three months. It is recommended that engineering advice and the input from the helicopter operator be sought regarding construction and ongoing structural integrity inspection requirements. Natural surface helipads should be monitored weekly to confirm they are still suitable for ongoing operations.

Every helipad should have a single point of accountability appointed to oversee the operation and serviceability of the helipad. This can be the Utility and Energy company or the helicopter operator. This single point of accountability should be responsible for the conduct and upkeep of risk assessments, confirmation that the above requirements are in place, and that an inspection schedule and associated record keeping is undertaken.

Annex B: Short-Term or Emergency-Use Airstrip Operations

Aerodrome requirements outlined in the BAR Standard are considered appropriate for long-term (greater than six months) facilities owned and/or operated by companies and are associated with production operations

This section is aimed at addressing short-term and emergency-use only airstrip requirements, where it is not generally practical or possible to impose the higher level of requirements that exists for regular use aerodromes. This guidance is aimed at those owned and operated airstrips supporting exploration and construction operations, or airstrips whose sole purpose is for emergency medical evacuation (medevac).

This section is provided as a minimum standard for such airstrip operations that have the following characteristics:

- Owned and/or operated by the company, supports exploration and/or short-term construction and/or emergency use;
- For use during day, visual operations for passenger, freight or aerial work;
- Night, visual operations for emergency medevac only (See Section 5.6 for lighting requirements);
- Instrument approach procedures to a landing minima for the airstrip are not available; and
- Aircraft used are limited to those less than 5,700kg maximum takeoff weight, unless reviewed as being suitable for the dimensions presented (for example King Air 350, Twin Otter, Beech 1900).

The six critical controls associated with remote airstrip operations are:

1. Design
2. Obstacle clearance
3. Siting
4. Construction
5. Operations
6. Maintenance

Where the company is utilizing a government or third-party owned strip for short-term purposes, this section is intended to provide a baseline for risk assessment purposes by the company and aircraft operator.

Companies should conduct a thorough risk assessment dedicated to the design, use and expectations of a remote airstrip supporting any Utility and Energy sector activity. The assessment must involve representatives from the aircraft operator likely to use the airstrip, in addition to company and aviation specialist involvement.

The assessment should be conducted with sufficient time remaining for any actions to be incorporated prior to operational start-up and first use.

B1: Design of the Short-term Airstrip

Minimum airstrip design comprises six main elements to create a safe area for aircraft to land, takeoff, park and taxi (ground maneuver).

- Runway: the only part of the aerodrome on which aircraft can land and takeoff. It consists of a rectangle of land constructed or cleared to be a smooth, firm surface of sufficient size to accommodate an operating aircraft;
- Runway Strip: this is the area surrounding the runway that acts as a buffer zone for aircraft that may veer off the centerline, either while on the ground or in the air. The surface of the runway strip needs to be smooth and free from objects sticking into the air. The portion of the runway strip beyond the end of the runway is also commonly known as the clearway;
- Taxiway: this area provides a link between the runway and the apron. It is typically constructed or cleared in the same manner as the runway;
- Apron: this is where aircraft park to board and de-board passengers, handle baggage and freight, and for refueling. The apron is generally the same construction as the runway and taxiway, although consideration may be given to increasing the strength of parking pads due to the increased static standing loads of parked aircraft. It also needs to be big enough for the number and type of aircraft which use the airstrip;
- Wind Indicator: the wind indicator or windsock consists of a sleeve of conspicuous color attached to a pole in a manner that enables it to indicate the wind direction; and
- Signal Circle: this is a small circular area near the wind indicator that is black and marked with cones. In this area, signals to aircraft are positioned when airstrip serviceability is compromised.

Airstrip Dimensions

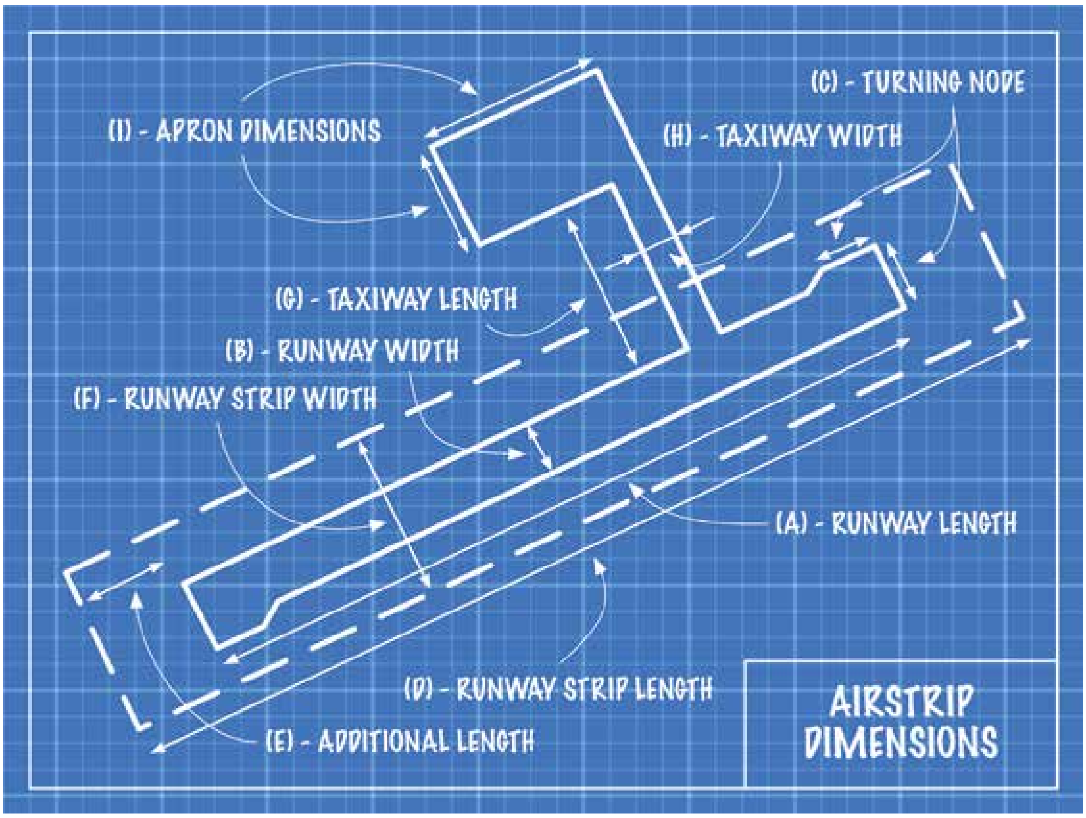


Figure 1: Geometric layout of short-term or emergency use airstrip.

The above facilities should meet standards relative to the size of the aircraft which use the airstrip. While standards vary according to different systems of categorizing aircraft (for example the ICAO code reference system), the following dimensions are offered as a guideline for aircraft operating in the ICAO Aerodrome Reference Code 2 classification (e.g. Beechcraft King Air 200, DHC-6 Twin Otter, Cessna 441 Conquest, etc).

Airstrip Facility	Dimension
Runway	
Length (m)	1,200(m)
Width (m)	23(m)
Turning Node (mxm)	25x25(mxm)
Runway Strip	
Length (m)	1,320(m)
Additional Length at each end (m)	60(m)
Width (m)	80(m)
Taxiway	
Width (m)	10.5(m)
Apron	
Size (mxm)	30x50(mxm)

Aircraft of ICAO Aerodrome Reference Code 3 (e.g. Metro 23, Jetstream 31/32, etc.) may require a larger runway to support their operations.

Companies should consult with the aircraft operator and/or aviation specialists prior to contracting a specific aircraft type or proceeding with airfield construction. This will ensure all relevant factors are considered.

B2: Obstacle Clearance

In addition to physical aspects of the airstrip, obstacle clearance requirements from the end and the sides of the airstrip should be considered during airstrip siting and be met during construction and maintenance. The prescribed areas should aim to be clear of objects that project higher than the clearance surfaces.

These clearance areas project out from each end and from the sides of the runway strip. The takeoff/approach areas (TOAA) protect the aircraft during climb-out and approach. The transitional areas protect aircraft that deviate off the runway centerline.

Takeoff/Approach Area Dimensions

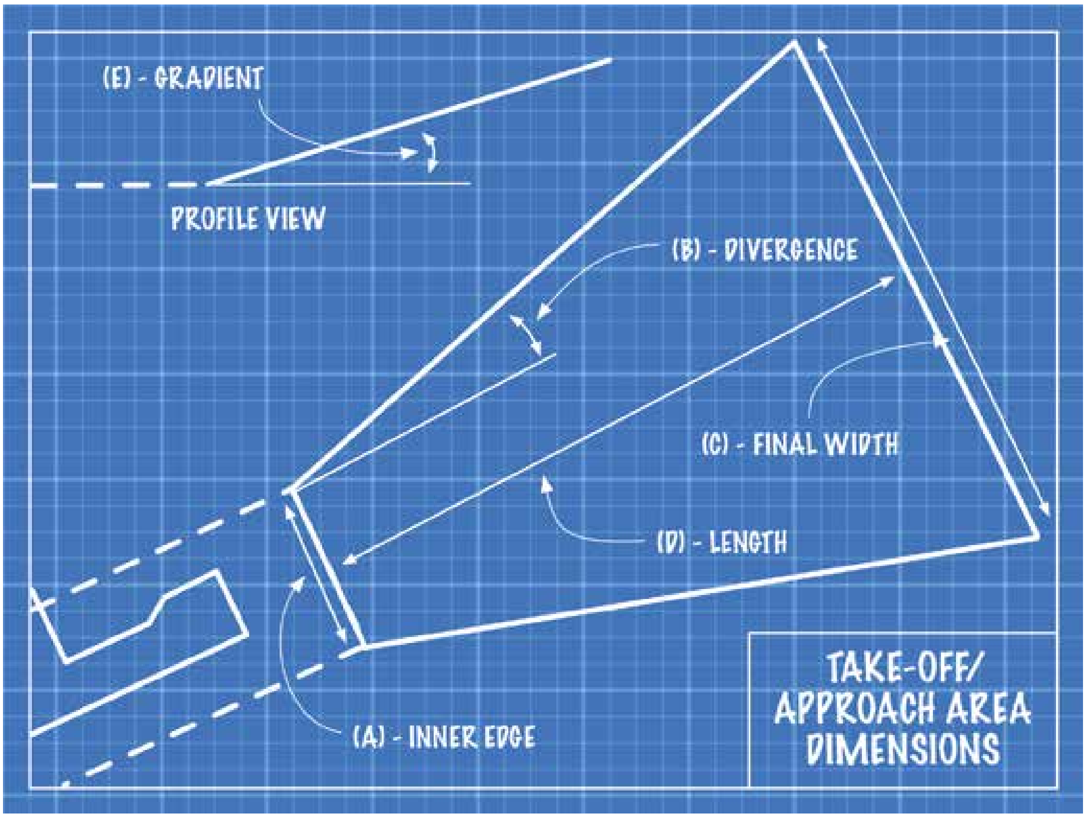


Figure 2: Takeoff/approach area (TOAA) schematic.

Transitional Area Dimensions

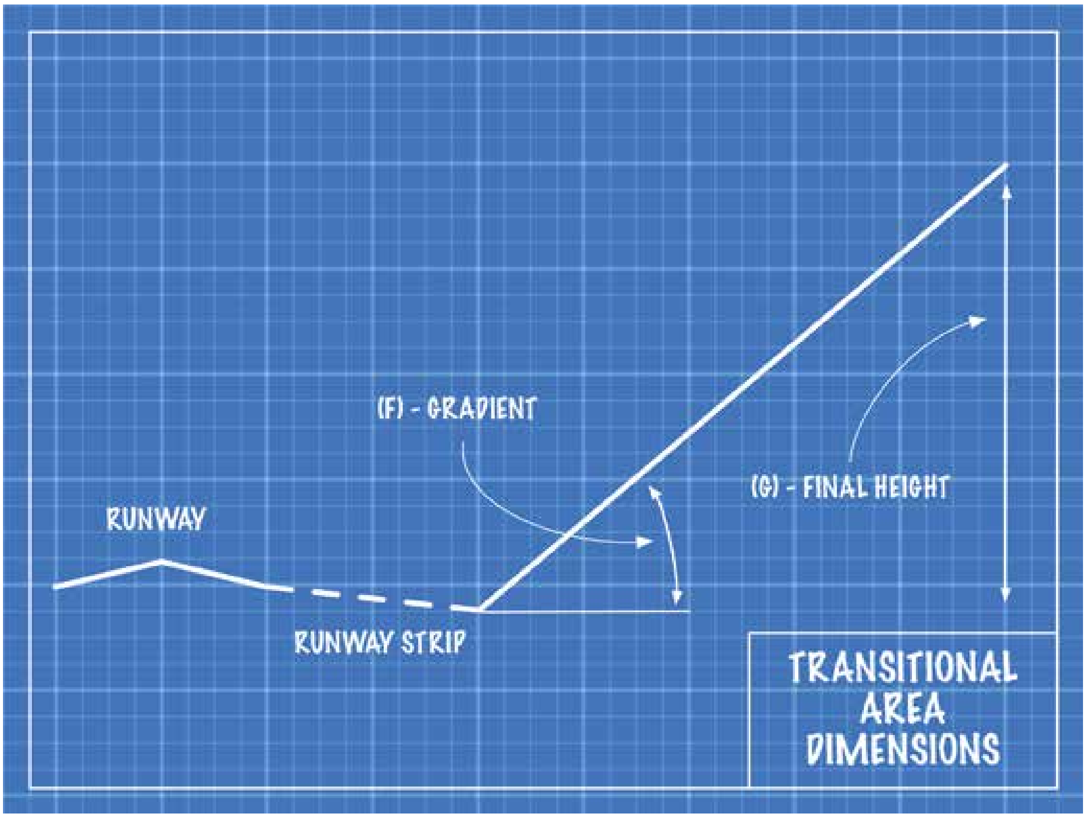


Figure 3: Transitional area schematic.

Much like the physical design standards, obstacle clearance requirements vary depending on aircraft size and performance capability. The following table sets out minimum clearance standards for the typical aircraft used:

Clearance Area	Schematic	Requirement
Takeoff/Approach Areas		
Inner Edge (m)	A	80 meters
Divergence (%)	B	10%
Length (m)	D	2,500 meters
Gradient (%)	E	4%
Transitional Areas		
Gradient (%)	F	20%
Final Height (m)	G	45 meters

Objects above 45 meters outside of these areas and within 2.5km of the airstrip also need to be identified for marking and/or lighting.

B3: Airstrip Siting

Using the above dimensions as a template, siting an airstrip must consider the following:

- Prevailing wind direction: the runway should be aligned, as much as possible, to the dominant wind direction;
- Surrounding terrain and other potential obstacles:
  - obstacle clearance requirements must be met according to the standards set out above;
  - power line and radio antenna location require special consideration;
- Surface characteristics:
  - natural surface qualities such as strength, smoothness and slope should be considered prior to construction;
  - areas with effective drainage, gentle and consistent slopes and surfaces that are capable of withstanding regular traffic should be assessed;
  - sandy and rocky surfaces as well as those surfaces that becomes slippery when wet should be avoided;
- Proximity to mining operations:
  - the airstrip should be located in a position where mining operations will not impact on aircraft safety and vice versa;
  - the takeoff and approach tracks must be clear of mining activity, with particular consideration given to any blasting activity that may produce fly rock; and
- Site access: safe and efficient access to the airstrip is critical, especially in an emergency situation.

B4: Airstrip Construction

Construction of the airstrip will involve clearing, shaping land and installing markers as a minimum standard. Optional work may include constructing a pavement and installing lights if the airstrip must be used for night medevac flights.

The construction of each area should meet the following requirements.

Runway

The runway should be cleared, made smooth and sloped to promote drainage of surface water. The objective of the runway is to consistently support aircraft movements.

A central crown is preferred although a cross-fall within the limits detailed in the table presented at the end of the section is also permitted. A cross-fall is when the slope of the runway (or road) surface falls from one side to the other rather than falling away from the center. Longitudinal slopes should also remain within these limits and abrupt changes must be minimized.

While natural surfaces can accommodate smaller aircraft, a constructed surface can improve operating condition and resistance to weather.

For dry-land-based runways, gravel pavements provide good support and should consist of a mixture of stone sizes no larger than 25mm with fines/dust such that a tightly bound surface results. Sealing the runway surface is also an option to provide wet weather capability.

For other types of runway surfaces (for example, ice or lake-bed), a suitably qualified airport engineer should be engaged to assess the natural surface and provide advice on constructed pavements.

Regardless of the final surface, the runway should be free of defects that may impact aircraft ride and controllability. Surface smoothness can be tested with a stiffly-sprung vehicle traveling at speed (approximately 70-80km/h), if the ride is comfortable, the surface is smooth enough for aircraft.

Short-term company airstrip

Runway Strip

The runway strip should also be cleared, made smooth and sloped to provide drainage. The objective of this surface is to support aircraft in the event of it departing the runway. The aircraft should come through such an event undamaged.

The transition from the runway to the runway strip should be near seamless with a minimum drop-off from sealed runways to the runway strip. Wind-rows and subsidence should be eliminated.

The shape of the runway strip should fall away from the runway within the limits outlined below. Open drains should not be established within the runway strip and abrupt changes in slope minimized.

Taxiway

Like the runway, the taxiway is a cleared, smooth and shaped area which is clear of obstacles and capable of supporting the aircraft during taxi. Slopes should be within the limits set for runways and special consideration should be made of runway strip slopes in the vicinity of the taxiway.

Apron

Aprons are also cleared, smoothed and graded for drainage. Consider constructing an apron of a suitable size, able to support the static loads of a parked aircraft and protect propeller blades from stone damage when aircraft are stationary.

Airstrip Facility	Requirement
Runway, Taxiway and Apron	
Maximum Longitudinal Slope (%)	2%
Maximum Transverse Slope (%)	2%
Minimum Transverse Slope (%)	1%
Runway Strip	
Maximum Transverse Slope (%)	3%
Wind Indicator	
Height (m)	6.5(m)
Sleeve Length (m)	3.65(m)
Ground Circle Diameter (m)	15(m)
Signal Circle	
Ground Circle Diameter (m)	9(m)

Wind Indicator

The wind indicator consists of a conspicuous color PVC sleeve attached via hinge to a vertical pole according to the requirements below. The ground surface surrounding the pole is blackened and marked. The wind indicator must be positioned such that it is visible from the apron and runway ends.

Signal Circle

The signal circle is simply a blackened circle of the required diameter that is positioned near (and typically on the runway side of) the wind indicator.

Obstacle Clearance Areas

Trees in the designated Obstacle Clearance Areas should be cleared such that obstacle clearance requirements are maintained. The distance out from the runway strip that clearing must extend will depend on the height of the trees and whether the ground rises or falls from the runway.

Markers

All aircraft facilities must be marked in accordance with the following requirements:

If markers cannot be positioned flush with the surrounding surface, they must be constructed of frangible material and are normally cone shaped. Markers will be either white or yellow in color. Smaller cones are used on the runway and taxiway edges and larger cones on the runway strip, apron, wind indicator and signal circle. The specific dimensions are:

- Small Cones: 400mm base diameter and 300mm height; and
- Large Cones: 750mm base diameter and 500mm height.

These cones are laid out on the corners and along the edges of the airstrip's facilities as follows:

- Corners consist of an "L" pattern of five cones;
- Edges with markers spaced at 90m for runway/runway strip edges and 10m for taxiway/apron edges;
- White cones are used on the runway and strip; and
- Yellow cones are used on the taxiway and apron.

Large white cones are also placed around the wind indicator and signal circle with 15 and six cones used respectively.

Remote Airstrip Marker and Signal Specifications

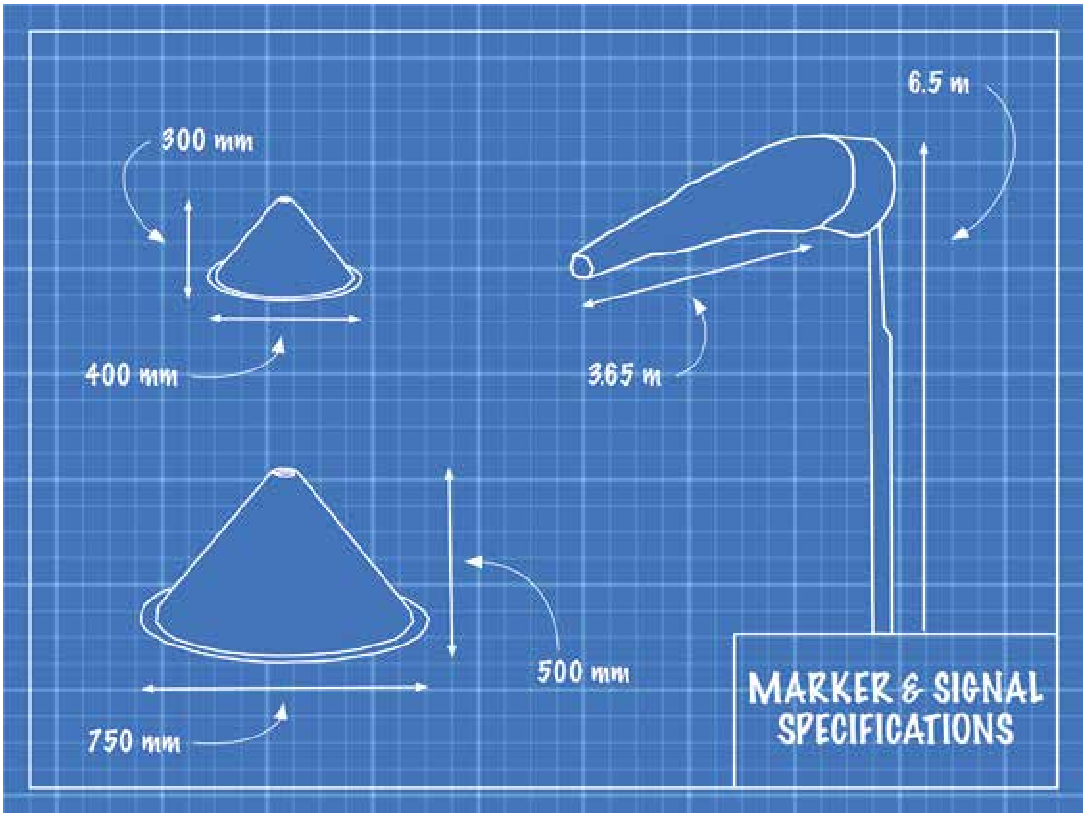


Figure 4: Marker and signal specifications.

Remote Airstrip Marker Layout

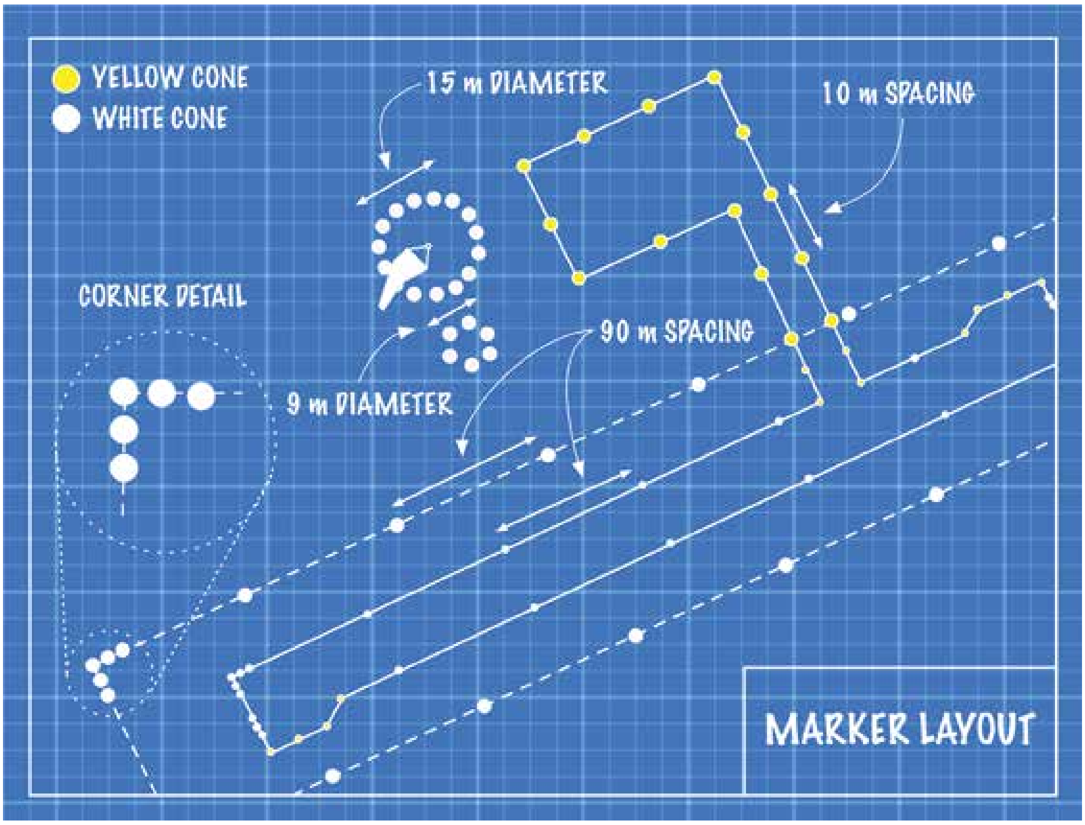


Figure 5: Marker Layout.

Lighting

Lighting should only be used where night medevac operations are planned. The lighting system should consist of a set of quality lights which are suited to the environment, durable and colored as per below.

A network of discrete lights appropriately secured in place provides a good mix of output quality and flexibility in design and maintenance. A fixed system with a ground wire fed by mains or on-site generator should be designed and constructed to international or local standards appropriate for larger aerodromes.

The basic guidelines for airstrip lighting are:

- Runway Ends: thresholds are identified by a pattern of six lights spread about the runway centerline. The pattern consists of six bi-directional red/green lights with the red lights facing the runway;
- Runway Edge: edge lights consist of white lights spaced 30 meters laterally and approximately 90 meters longitudinally, although they must be evenly spaced from runway end to end;
- Taxiway and Apron Edge Lights: these are blue lights spaced at 14 meters laterally and approximately 10 meters longitudinally;
- Wind Indicator Lighting: The windsock must be lit by appropriate floodlighting; and
- Obstacle Lights: All obstacles above 45 meters within 4,000 meters of the airstrip should be lit by steady red lights.

All light fittings in the runway environment must be frangible to avoid damage to the aircraft in the event of runway/taxiway excursion.

Remote Airstrip Lighting Layout

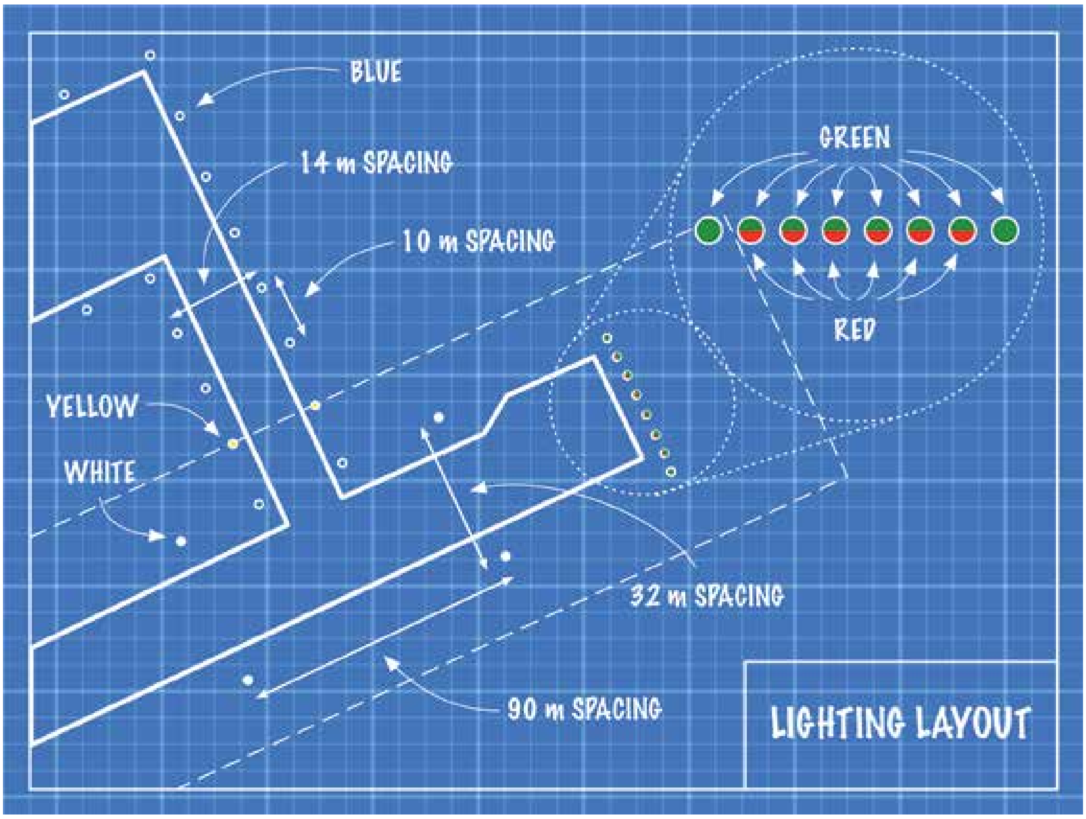


Figure 6: Lighting Layout.

Fencing

Due to the risk to aircraft posed by wildlife, some form of airport fencing should be installed unless a formal risk assessment dictates otherwise. The specifics of the fencing will vary depending on the hazards present, but care must be taken to ensure the fence does not infringe the obstacle clearance areas.

B5: Airstrip Operations

Successful short-term airstrip operation depends on preflight airstrip inspections and documented reporting of its serviceability. Flight monitoring, passenger control, weather reporting and emergency response in varying forms will also need to be considered.

Preflight Inspections

Prior to each aircraft movement, the airstrip should be inspected and confirmed serviceable.

The inspection should be conducted by a suitably trained person driving a vehicle to assess the condition of the airstrip. The results of all inspections must be recorded in a logbook or appropriate file. The airstrip inspection should review:

- The runway surface to confirm that it is smooth and firm with minimal loose material, no vegetation and no standing water;
- The runway strip should be relatively smooth and firm with limited loose material, vegetation and standing water;
- The taxiway and apron surfaces should be in a similar condition to the runway and surface transitions observed to be within limits;
- Airstrip markers to ensure they are in position, visible and secure;
- Lights serviceability and availability (if applicable);
- The wind indicator to confirm serviceability;
- That the signal circle shows the airport’s current status;
- Obstacle clearances to ensure that they have not been compromised; and
- The presence of bird and/or animals and confirm that they do not pose a risk to aircraft operations.

The following table outlines specific standards for surface serviceability:

Airstrip Facility – Inspection Item	Required Standard
Runway, Taxiway and Apron	
Surface Softness	Vehicle ruts no greater than 25mm
Debris/Loose Material	No greater than 25mm in diameter
Surface Defects	No greater than 50mm wide and 25mm deep
Vegetation	Nil
Standing Water	Nil
Surface Roughness	Comfortable @ 70–80km/h whilst driving a vehicle (preferably 3-tonne)
Runway Strip	
Debris/Loose Material	No greater than 50mm in diameter
Surface Defects	No greater than 80mm wide
Vegetation – should be no obstruction to markers or lights	If Lush – no more than 100mm high If Thin – no more than 250mm high If Sparse – no more than 450mm high
Runway Surface Transition to runway strip	No greater than 25mm drop

Surface Test

If conditions at the airstrip (recent rain etc.) indicate a strong likelihood that the runway surface is unserviceable, the surface test exercise should not be attempted as it may lead to long-term surface damage.

In marginal conditions, surface strength can be tested using a test vehicle (ideally, a 3-tonne truck) along a portion of the runway surface and checking the ruts left in the runway. The areas selected for testing should be those most likely to degrade first.

The typical maximum rut depth is outlined in the table. However, care should be taken when dealing with aircraft with small, high-pressure tires as the maximum rut depth may be lower.

Other methods, such as dry-to-depth and Clegg Hammers/penetrometers may also be used, and specialist advice should be sought to investigate use if required.

Unserviceability

When serviceability issues are encountered, the individual designated as accountable for the airstrip should attempt to rectify the problem immediately. If rectification is not possible and the issue is significant enough to warrant closure of the airstrip, the airstrip must be marked as unavailable with a white cross in the signal circle and at each end of the runway. The aircraft operator contracted to support the activity must be notified.

The white cross consists of two rectangles 6m x 0.9m secured to the ground.

Reporting

The condition of the airstrip should be reported (whether serviceable or not) to the aircraft operator prior to any operation. This reporting should involve direct communication, which can include phone calls prior to departure, or via air-band radio to the pilot prior to arrival. If fax or email is used for communication purposes, a positive reply acknowledging receipt must be obtained by the individual sending the serviceability report.

Annual Checks

Longer term airstrips (for example, emergency use airstrips supporting production operations) should be inspected by a qualified person annually. This inspection should involve:

- Checking the accuracy of aerodrome information provided to pilots;
- Looking into matters of a volatile nature, e.g. new obstacles or tree growth, changes in the movement area or the marking and lighting of the movement area, as a result of new aerodrome development;
- Inspecting matters that are subject to damage or deterioration;
- Checking the competency of aerodrome personnel involved in safety functions, and whether they are clear of their duties and responsibilities;
- Reviewing any concerns raised by the aircraft operator and pilots; and
- Reviewing whether there is any deficiency in the day to day operation of the aerodrome.

The output of this inspection should be a formalized documented report that: (1) provides a clear status of the airstrip; (2) details any rectification works; (3) provides succinct recommendations for improvement.

Flight Monitoring

Responsible personnel should be in attendance for all flights 30 minutes before the scheduled arrival through to 15 minutes following departure.

Passenger Control

The airport officer, while in attendance, should monitor the activity of passengers and intervene where safety is compromised. Access on the “airside” apron area should be strictly managed and passengers escorted at all times.

Weather Reporting

Using appropriate weather equipment, the responsible personnel may be requested to provide a weather report to incoming aircraft over the radio. It must be made clear what the basis of this information is prior to the flight.

Emergency Response

The responsible personnel may be required to assist in and coordinate an emergency response. The airport officer should be provided with appropriate tools, relevant information and necessary training to carry out this task. They should also be supported with appropriate procedures.

Responsible personnel located at the airstrip may be required to assist in and coordinate an emergency response. Support must be provided in the form of:

- An up-to-date and current Emergency Response Plan;
- Crash Box (BAR Standard 19.13);
- Rescue Firefighting (BAR Standard 19.14);
- Communication (satellite phone or other); and
- Aircraft operator contact details (or ERP Bridging Document).

B6: Maintenance

Maintenance works should be carried out according to schedule and as the result of a preflight inspection or annual check. These tasks will vary but may involve:

- Dragging unsealed surfaces to repair minor defects;
- Grading unsealed surface to repair larger defects (such as scouring);
- Slashing/mowing vegetation to ensure surface smoothness and marker/light visibility;
- Cleaning markers and lights;
- Replacing broken markers, lights and worn windsocks;
- Repairing fences; and
- Clearing and trimming trees.

These works should be planned and conducted in a manner that does not impact on aircraft operations. Works should be conducted outside of flight periods with the airstrip marked as closed.

Annex C: Utility and Energy Company – Relevant Controls

C1: Company Awareness

Accident and Incident Notification

As part of their SMS, the aircraft operator must advise the company of any incident, accident or non-standard occurrence related to the services provided to the company that has, or potentially has, disrupted operations or jeopardized safety.

Operational Risk Assessment

Aircraft operators must conduct a risk assessment, including mitigation controls, before commencing operations for any new or existing aviation activity. Contact the Flight Safety Foundation for information on how to conduct a risk assessment.

C2: Airfield and Helipad Requirements

Airfield and Helipad Design

Where local guidance is unacceptable to the company, use ICAO Annex 14 Aerodromes, Volume I ('Aerodrome Design and Operation') and ICAO Annex 14, Volume II ('Heliports') for design considerations when constructing, or performing major rework, to permanent long-term company owned and operated airfields and helipads supporting operations.

Consider prevailing winds and the location of mining/facility infrastructure in relation to the proposed airfield or helipad departure and approach splays.

BARS Implementation Guidelines (BIG) Annex B provides additional guidance for short-term or emergency use airfields whilst Annex C provides additional guidance for helipad standards.

Airfield Inspections

In addition to reviews required by regulators, all company owned and/or operated airfields must have an annual operational control and safety review conducted by a company approved Competent Aviation Specialist.

Airfield Control

All company owned and operated airfields must have personnel who are responsible for overseeing and managing the airfield and operating standards. Responsibilities include having a basic understanding of the local aviation regulatory system, certification requirements of the airfield and daily airfield reporting officer duties.

Destination Weather Reporting

For company owned and operated airfields and helidecks, communicate the following data to arriving aircraft by either an Automatic Weather Observation System (AWOS) and/or trained weather observer:

- Wind direction and speed;
- Temperature;
- Barometric pressure; and
- Cloud ceiling height and visibility.

Maintain all equipment on a current calibration register.

Passenger Terminal Area

Company owned and operated airfields must have a waiting area for passengers offering security, basic amenities, protection from the elements and a barrier from the aircraft movement area. Incoming and outgoing passenger routes must be designated.

Designated Freight Area

Company owned and operated airfields, helipads and helidecks must have a designated and secure freight area that provides a controlled environment clear of the aircraft movement area and public thoroughfare.

Passenger Control

A designated Passenger Control Officer (PCO) or Helideck Landing Officer (HLO) who is in a position to communicate with the crew at all times must control all passenger movements to and from the designated aircraft movement area. The PCO can be provided by the company or aircraft operator, and may be a crew member in a multi-crew operation.

The PCO and HLO must be identified using a distinguishing vest if they are not a crew member of the aircraft.

Parking Apron

For all company owned and operated airfields, the parking apron area must be assessed by the aircraft operator as being suitable for their type of aircraft. Consider other transient aircraft traffic, helicopter operations, refueling, and the Pavement Classification Number (PCN). For long-term operations where practical, taxi lines specific to the contracted aircraft type must be painted in the apron area for obstacle-clearance maneuvering purposes.

Perimeter Fence

Construct a perimeter fence around all company owned and operated airfields to prevent access by livestock, other animals and traveling pedestrians.

Airfield Bird Control

Conduct active bird control at all company owned and operated airfields when required and record the presence of birds periodically. Where possible, birds are must be dispersed or removed in accordance with local wildlife regulations. Seeding grass, open waste disposal and water ponds must be restricted to remove attractions for birds.

Where bird activity exists, aircraft operators must minimize the risk of bird strike during all operations.

Emergency Response Plan

All aircraft operations (including company owned or operated airports) must have an Emergency Response Plan (ERP) commensurate with the activity undertaken that covers: documented land-before-last-light limitations, exposure considerations, local Search and Rescue (SAR) capabilities, and hazards associated with the surrounding environment.

The ERP must be exercised annually for all long-term operations and include a bridging document detailing lines of communications between the company and aircraft operator.

Crash Boxes

Company owned and operated landing sites supporting long-term operations must have a crash box accessible to personnel at the airfield or primary helipad.

First Response to Aircraft Incident on Airfield

All company owned or operated helipads or airfields must have a means of providing a fire response capability commensurate with the potential risk. Personnel must receive training on the equipment provided.

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BARS

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