FLIGHT SAFETY FOUNDATION

independent • impartial • international

Basic Aviation Risk Standard

Utility and Energy





Version 3, November 2024

Courtesy: Meridian

Contents

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.

All national and international regulations pertaining to aviation operations supporting Utility and Energy sector operations requirements must be followed. This Standard is designed 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'.

The information provided for every BARS Control is presented in this document in the following format:

Each BARS control and defence has been provided with a **Safety Goal** to assist users of the BAR Standard 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.

Aircraft Operator Review

This Standard is designed to be used as a primary reference for the review and approval of aircraft operators supporting companies in the utility and energy sector. Aircraft operators will be audited to the BARS Question Master List with questions drawn from this Standard and the ICAO Annexes.

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.

A diagram showing the Basic Aviation Risk Standard Variance Process is presented in Figure 2 on page 10.

Key Definitions

Company

Refers to the individual entity using this Standard to support their aviation operations.

Operator

Refers to an aircraft operating company used to provide aviation services.

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.

Non-hostile environment

An environment in which a successful emergency landing can be reasonably assured and the occupants of the aircraft can be adequately protected from the elements. Search and rescue response/capability can be provided consistent with the anticipated exposure.

Long-term contract

Any contract using dedicated aircraft for a planned duration of greater than six months.

Competent Aviation Specialist

A company designated aviation advisor or Flight Safety Foundation BARS Accredited Auditor.

Additional definitions related to the use of this Standard are listed on page 29.

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

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Recovery Measures for Utility and Energy Sector Operations.

- Fuel Storage
- Drummed Fuel

- 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

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Table 1: Operational Risk Assessment Matrix

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 • Sideways Pull • Line Plan • 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
- Electrical Protection
- Corona Discharge

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

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All Threats 1.0: Common Controls

Common controls that apply to all threats outlined in this Standard

Common Control 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.

Common Control 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.

Common Control 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.

Common Control 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.

Common Control 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.

Common Control 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.

Common Control 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).

Common Control 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.

Common Control 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.

Common Control 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.

Common Control 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.

Common Control 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.

Common Control 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.

Common Control 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).

Common Control 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.

Common Control 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 program 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.

Common Control 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.

Common Control 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.

Common Control 1.19: Briefings

Ensuring that opportunities to learn and improve are promptly identified.

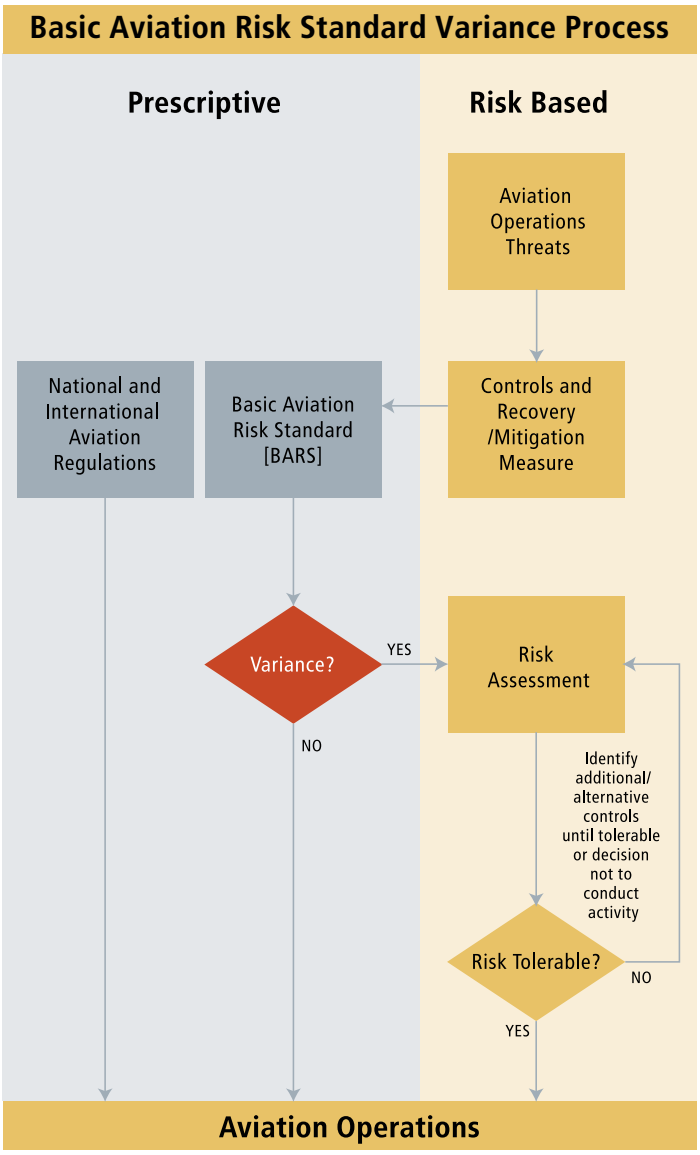
The aircraft operator must have a requirement for a structured briefing to be conducted both pre-flight and post-flight between flight crew, task specialist(s), ground crew and other personnel (as appropriate) to maximize understanding of the upcoming task, and further identify and learnings and improvements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

Common Control 1.20: Essential Crew Only

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

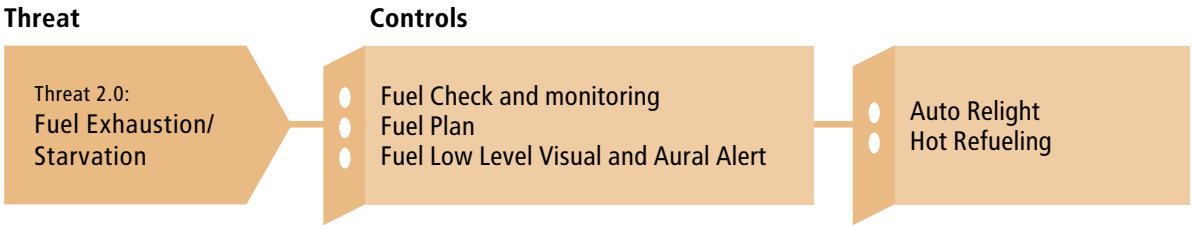
Only operating crew members such as Flight Crew, Technical Crew Member (TCM), and Task Specialists (TS) are to be carried on any flight designated an operational mission or task-related flight.

Figure 2: Variance Process



Threat 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



Control 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 take-off, and fuel state is regularly monitored throughout the flight to ensure safe landing with reserves.

Control 2.2: Fuel Plan

Ensuring sufficient fuel, including appropriate reserves, is carried on all 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).

Control 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.

Control 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.

Control 2.5: Hot Refueling

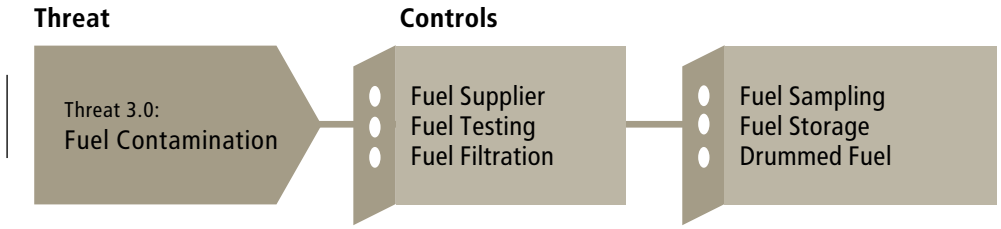
Ensuring hot refueling operations are used appropriately and conducted safely.

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;
- When refueling is completed, the Pilot-in-Command must verify that all equipment is removed, the fuel cap has been securely replaced and the aircraft is properly configured for flight; and
- Correct fuel loads must be confirmed by the Pilot-in-Command prior to departure.

Threat 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



Control 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.

Control 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.

Control 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.

Control 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.

Control 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.

Control 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 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 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.

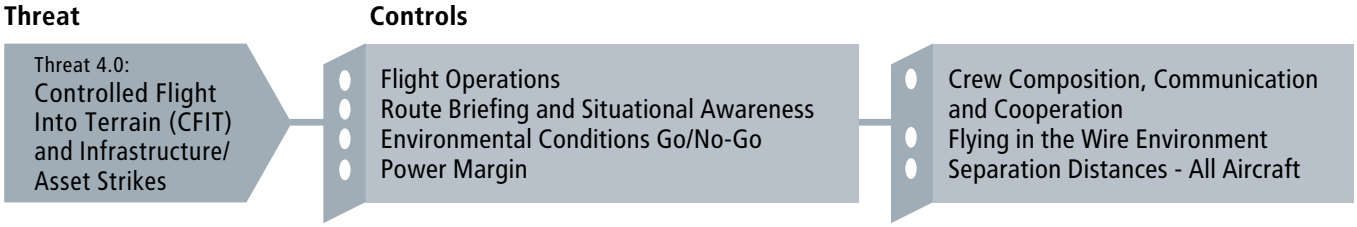
To provide optimum opportunity for any contaminants to settle, drums must be brought to the vertical three hours prior to testing. Where this is not practical (e.g. SAR, Emergency Response, etc.) all performance requirements of this control must be followed.

*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: Leading Edge Helicopters

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

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



Control 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.

Control 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.

Control 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.

Control 4.4: Power Margin

Ensuring Pilot-in-Command has suitable power margin for all phases of flight in the operating environment.

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.

Control 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.

Control 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.

Figure 3: Separation Distances Transmission Lines – Helicopters

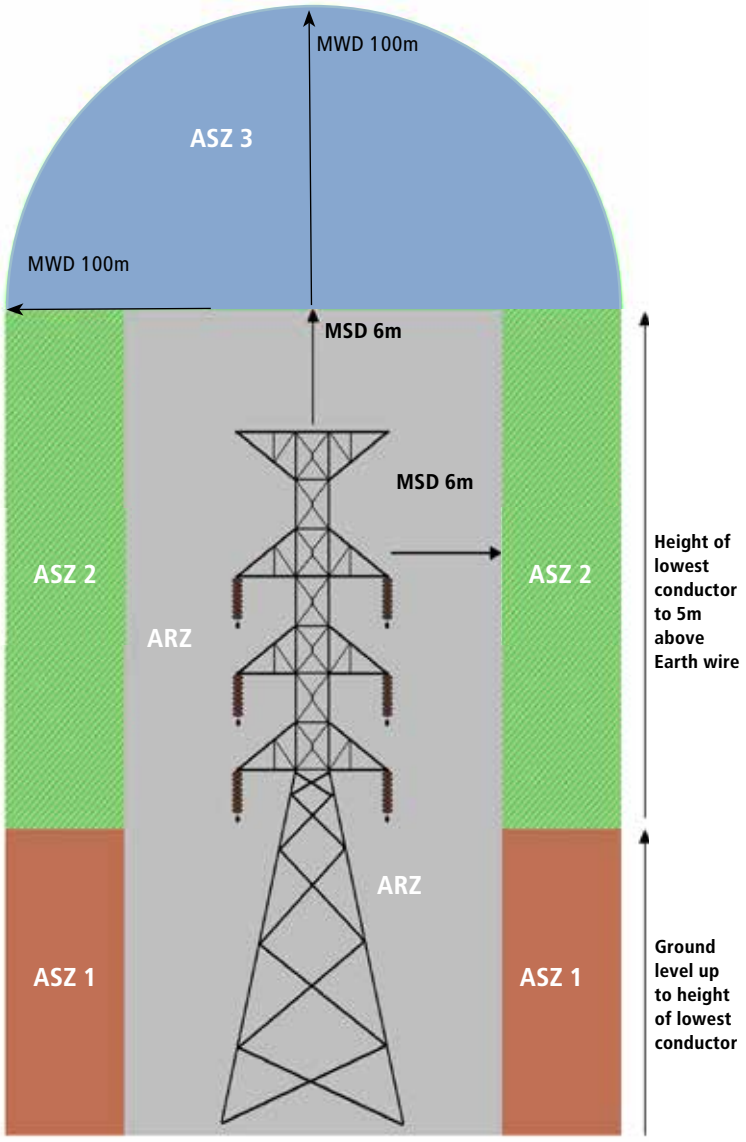


Diagram showing ASZ 1, ASZ 2 and ASZ 3 Zones applicable for helicopters operating around transmission tower type structures.

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

Control 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.

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)

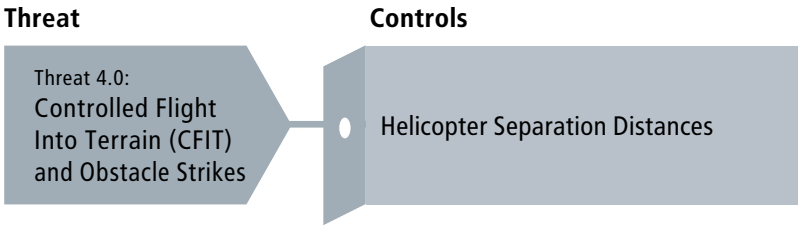
The MWD is that distance with which beyond it, the aircraft is considered outside the operational 'work area'. This is 100 meters /300 feet for both fixed wing and helicopters.

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.

Threat 4.0: (cont.)



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 manueuvring speed and power margin is adequate to provide separation from the structure and conductors.

Control 4.8: Helicopter Separation Distances

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.

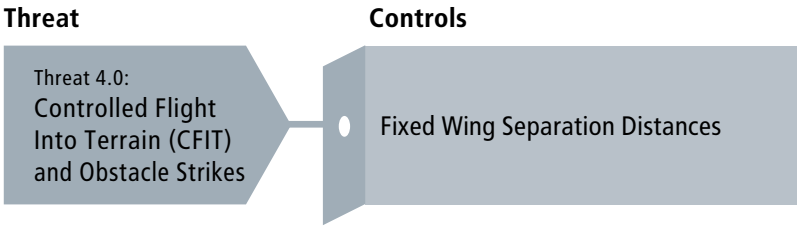


Figure 4: Fixed Wing Separation Distances – Transmission Lines

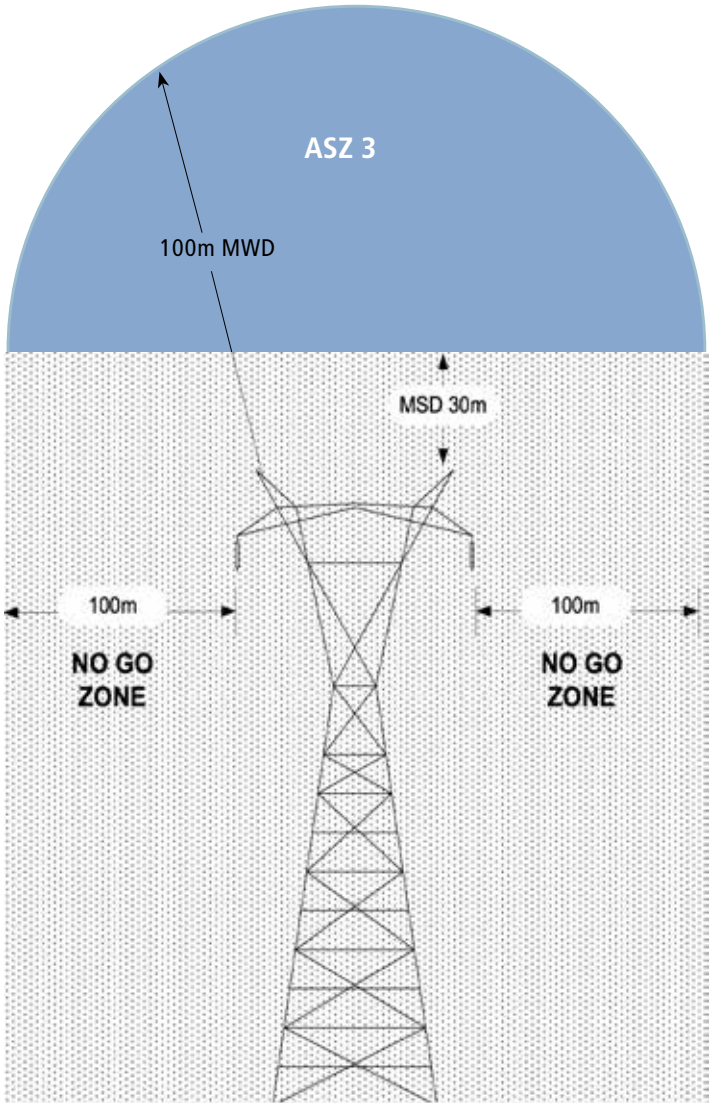


Diagram showing the No-Go Zone and the ASZ 3 Zone that applies to Fixed wing aircraft.

Control 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.

Threat 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

Control 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.

Control 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.

Control 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.

Control 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.

Control 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.

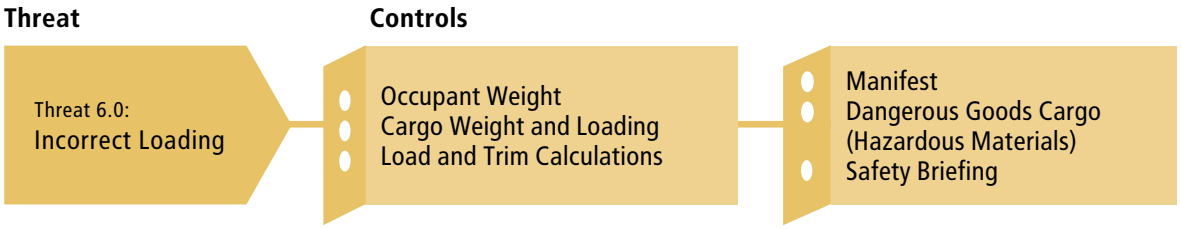
Control 5.6: Fixed-Wing Dynamic Stall

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.

Threat 6.0: Incorrect Loading

Incorrect loading results in an aircraft accident



Control 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.

Control 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 onboard the aircraft.

Control 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.

Control 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.

Control 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.

Control 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.

Threat 7.0: Collision on Ground

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

Control 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.

Control 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.

Control 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.

Control 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.

Control 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.

Control 7.6: Remote Landing Site Assessments

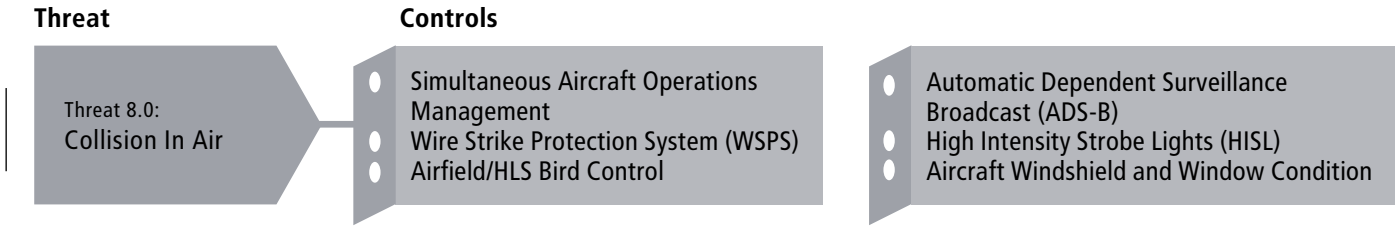
Ensuring effective assessment of remote landing sites to enable safe operations.

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


Courtesy: Heliservices HK

Threat 8.0: Collision in Air

An aircraft and object collide in air



Control 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.

Control 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.

Control 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.

Control 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.

Control 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.

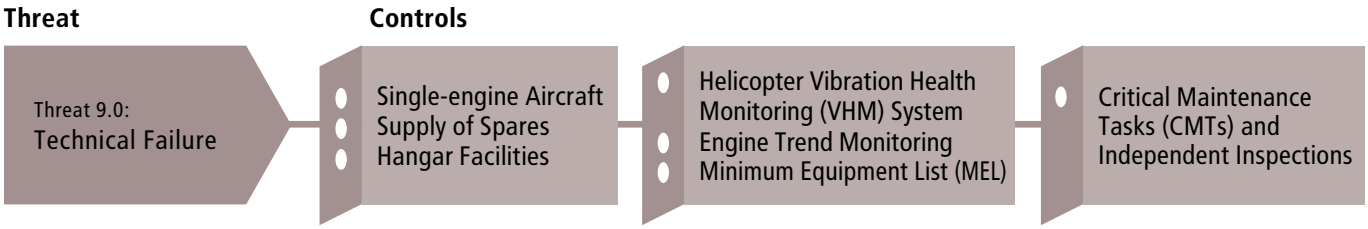
Control 8.6: Aircraft Windshield and Window Condition

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.

Threat 9.0: Technical Failure

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



Control 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.

Control 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 conditionfor safe operation.

Control 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.

Control 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.

Control 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.

Control 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.

Control 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.

Threat 10.0: Weather

Adverse weather conditions cause an accident

Control 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.

Control 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.

Control 10.3: Thunderstorm Avoidance

Ensuring safe operations in the vicinity of thunderstorms.

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

Control 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.

Courtesy: Leading Edge Helicopters

Defences 19.0: Aircraft Accident

Mitigating defences in the event of an aircraft accident

Defence 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.

Defence 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.

Defence 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.

Defence 19.4: Survival Kit

Ensuring that in the event of an emergency, aircraft occupants have access to resources that aid in survival suited to 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.

Defence 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.

Defence 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.

Defence 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.

Defence 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.

Defence 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.

Defence 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.

Defence 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.

Defence 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.

Defence 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.

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

<table>
<tr><th>Equipment</th><th>Multi-engine</th><th>Single-engine</th></tr>
<tr><td>Two VHF Transceivers</td><td colspan="2" rowspan="9">Required</td></tr>
<tr><td>One HF Transceiver, if VHF coverage is not available for the entire area</td></tr>
<tr><td>Mode C or S Transponder</td></tr>
<tr><td>TSO 126 ELT</td></tr>
<tr><td>Upper Torso Restraints</td></tr>
<tr><td>First-Aid Kit</td></tr>
<tr><td>One Fire Extinguisher</td></tr>
<tr><td>Survival Equipment, tailored to environment</td></tr>
<tr><td>Wire Strike Protection Systems (helicopters only)</td></tr>
<tr><td>TCAS</td><td rowspan="6">Required for dedicated long-term contracts</td><td rowspan="6">Optional</td></tr>
<tr><td>TAWS</td></tr>
<tr><td>Satellite Flight Following (hostile environment)</td></tr>
<tr><td>CVR/FDR, or as required by local CAA</td></tr>
<tr><td>HUMS, UMS or VMS</td></tr>
<tr><td>FDM</td></tr>
<tr><td>External Mirrors or Camera for situational awareness (helicopters only)</td><td colspan="2">Optional</td></tr>
<tr><td>Crash Resistant Fuel Systems</td><td colspan="2">Required where available for aircraft type</td></tr>
<tr><td>High Visibility Pulse Lights – in areas of traffic</td><td colspan="2">Required for dedicated long-term contracts</td></tr>
<tr><td>ADS-B</td><td colspan="2">Required for dedicated long-term contracts</td></tr>
<tr><td>Engine Trend Monitoring Systems</td><td colspan="2">Required for single-engine long-term contracts
Optional for multi-engine</td></tr>
</table>

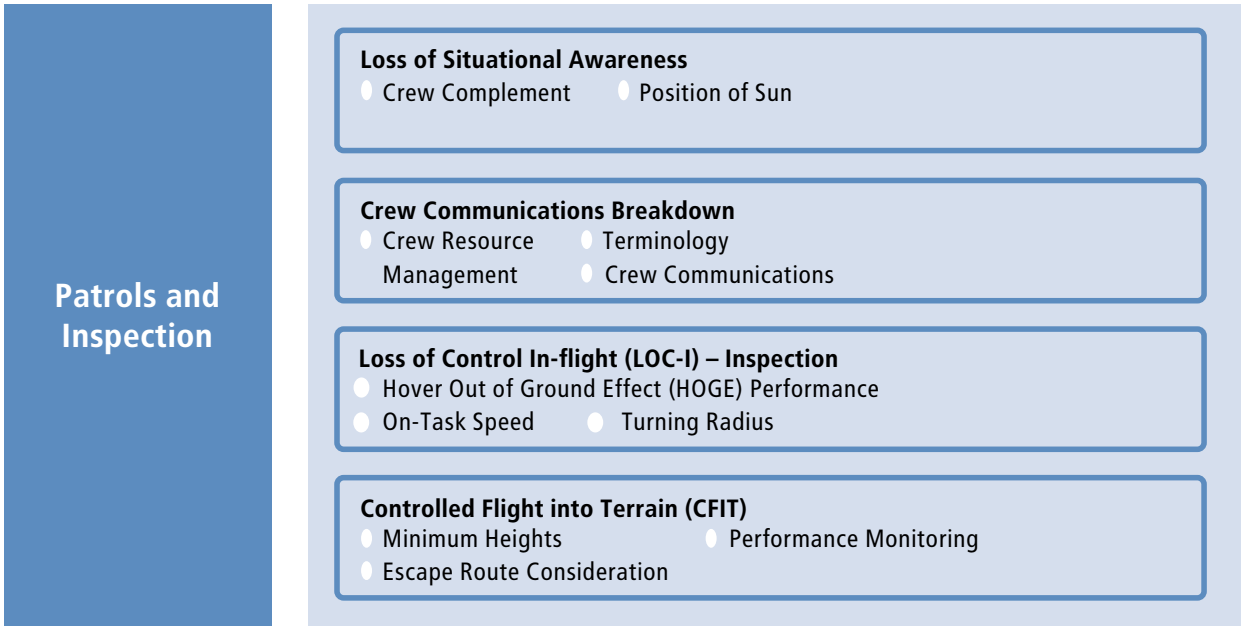
Abbreviations

ACAS	Airborne Collision Avoidance System
ADF	Automatic Direction Finder
ADS	Air Drop System
AELTS	Aviation English Language Test Services
AFCS	Automatic Flight Control System
AGL	Above Ground Level
ALAR	Approach and Landing Accident Reduction
AMSL	Above Mean Sea Level
AP	Autopilot
APU	Auxiliary Power Unit
ARZ	Aerial Restricted Zone
ASI	Air Speed Indicator
ASZ	Aerial Surveillance Zone
ATC	Air Traffic Control
ATPL	Air Transport Pilot Licence
AWOS	Automated Weather Observation System
BARS	Basic Aviation Risk Standard
BIG	BARS Implementation Guidelines
CAA	Civil Aviation Authority
CBT	Competency Based Training
C of G	(Aircraft) Center of Gravity
CFIT/W	Controlled Flight into Terrain/Water
CMT	Critical Maintenance Task
CPL	Commercial Pilot's Licence
CRFS	Crash Resistant Fuel System
CRM	Crew Resource Management
CVR	Cockpit Voice Recorder
DG	Dangerous Goods
DME	Distance Measuring Equipment
DZC	Drop Zone Coordinator
DZ	Drop Zone
ELT	Emergency Locator Transmitter
EPIRB	Emergency Position Indicating Radio Beacon
ERP	Emergency Response Plan
FAA	Federal Aviation Authority (USA)
FDM	Flight Data Monitoring
FDR	Flight Data Recorder
FLI	First Limit Indicator
GA	General Aviation
GPS	Global Positioning System
HEC	Human External Cargo
HF	High Frequency
HISL	High Intensity Strobe Lights
HOGE	Hover Out of Ground Effect
HUET	Helicopter Underwater Escape Training
HUMS	Health and Usage Monitoring System
IAGSA	International Airborne Geophysics Safety Association
IATA	International Air Transport Association
ICA	Instructions for Continued Airworthiness
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
LSALT	Lowest Safe Altitude
MAP	Missed Approach Point
MEL	Minimum Equipment List
MSD	Minimum Separation Distance
MWD	Maximum Work Distance
NDB	Non-Directional Beacon
NVIS	Night Vision Imaging System
NVFR	Night Visual Flight Rules
OEI	One Engine Inoperative
OEM	Original Equipment Manufacturer
OPGW	Optical Ground Wire
ORA	Operational Risk Assessment
PCDS	Personnel Carrying Device System
PCN	Pavement Classification Number
PCO	Passenger Control Officer
PIC	Pilot-in-Command
PLB	Personal Locator Beacon
PPE	Personal Protective Equipment
RPAS	Remote Piloted Aircraft System
SAR	Search and Rescue
SMS	Safety Management System
SoM	System of Maintenance
SOP	Standard Operating Procedure
STC	Supplementary Type Certificate
SVFR	Special Visual Flight Rules
TAWS	Terrain Awareness Warning System
TCAS	Traffic Collision Avoidance System
TEM	Threat and Error Management
TSO	Technical Standards Order
UMS	Unit Monitoring System
UTR	Upper Torso Restraint
VFR	Visual Flight Rules
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VMS	Vibration Monitoring System
VOR	VHF Omni Directional Range Navigation System
VSI	Vertical Speed Indicator
V_Y	Best Rate of Climb Speed
V_1	Decision Speed on Takeoff
WSPS	Wire Strike Protection System

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

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

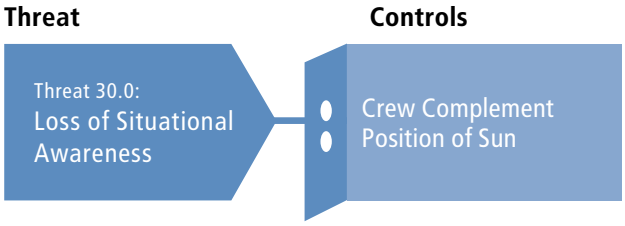


BARS BASIC AVIATION RISK STANDARD FLIGHT SAFETY FOUNDATION

Version 3, November 2024

Threat 30.0: Loss of Situational Awareness

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



Control 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.

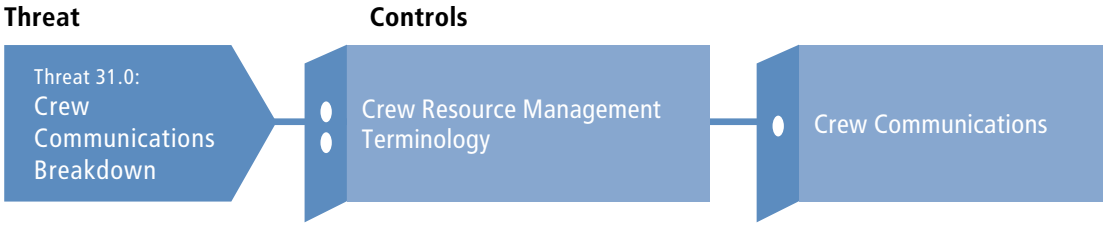
Control 30.2: Position of Sun

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.

Threat 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



Control 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.

Control 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.

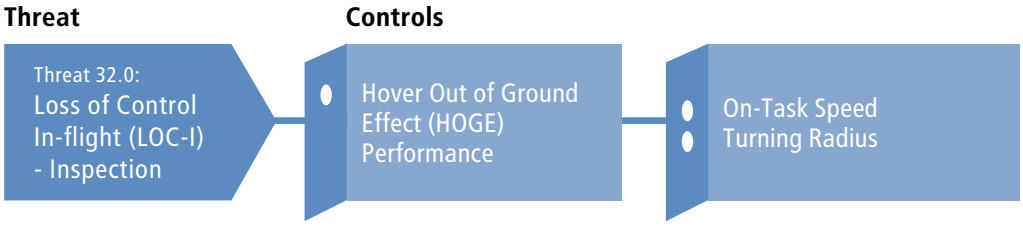
Control 31.3: Crew Communications

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.

Threat 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



Control 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.

Control 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.

Control 32.3: Turning Radius

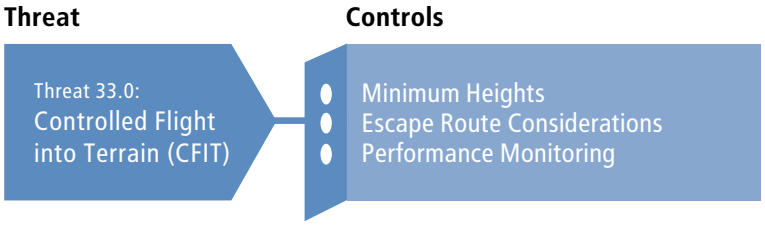
Ensuring appropriate limitations on aircraft turns during patrols and inspections.

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.


Courtesy: Leading Edge Helicopters

Threat 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



Control 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.)

Control 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.

Control 33.3: Performance Monitoring

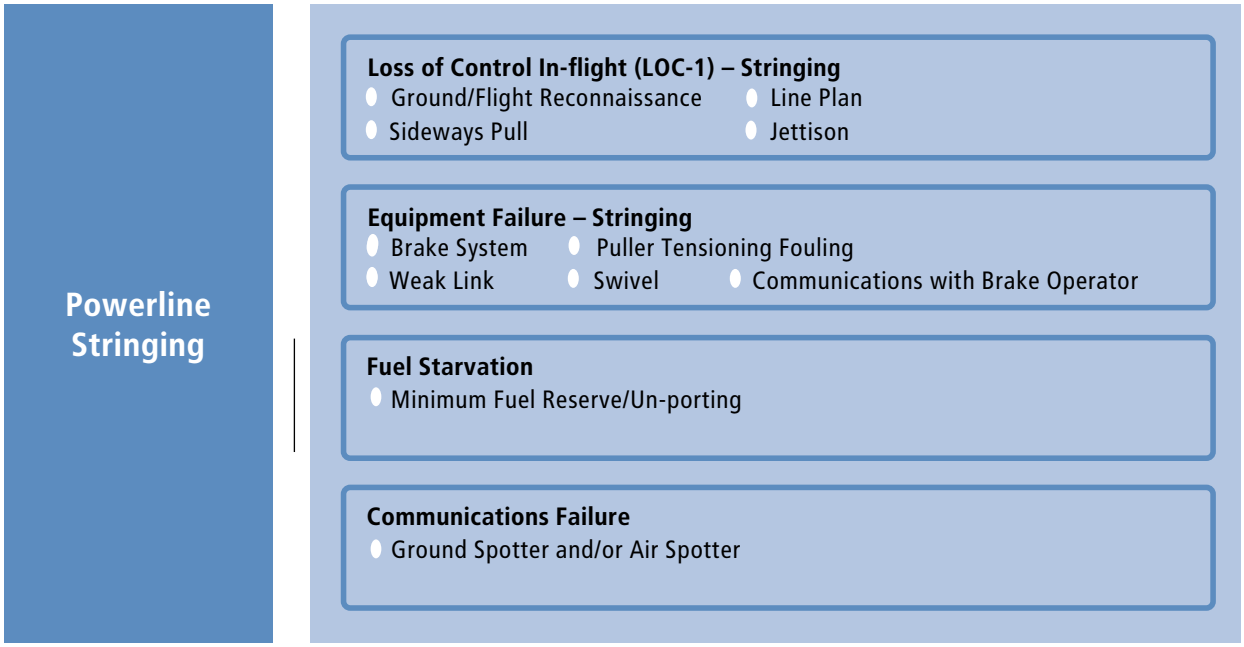
Ensuring compliance with patrol and inspection parameters.

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.

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

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



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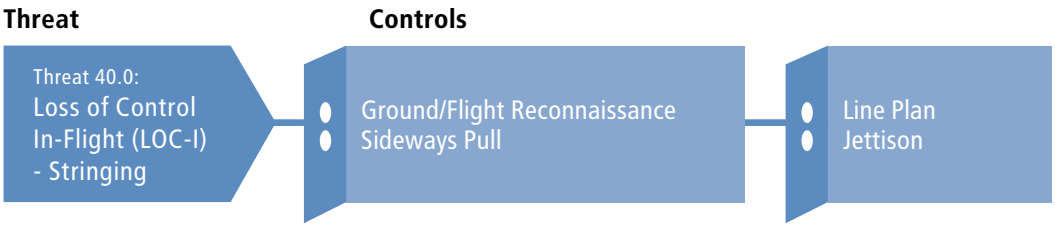
Threat 40.0: Loss of Control In-Flight (LOC-I) - Stringing

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



Control 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.

Control 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.

Control 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.

Control 40.4: Jettison

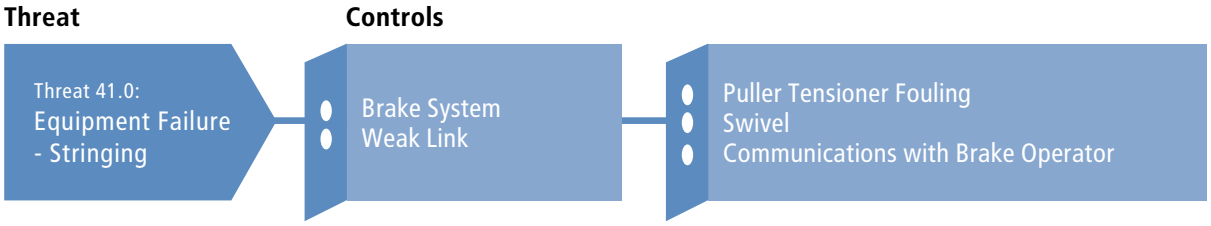
Ensuring each helicopter conducting stringing operations is equipped with a line jettison feature.

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

Courtesy: Leading Edge Helicopters

Threat 41.0: Equipment Failure - Stringing

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



Control 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.

Control 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.

Control 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.

Control 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.

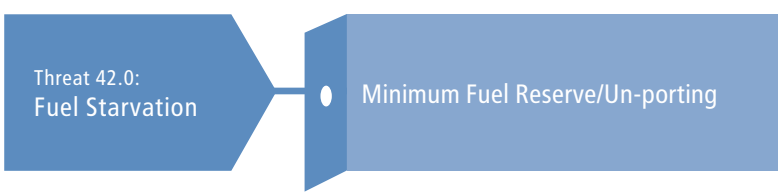
Control 41.5: Communications with Brake Operator

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.

Threat 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



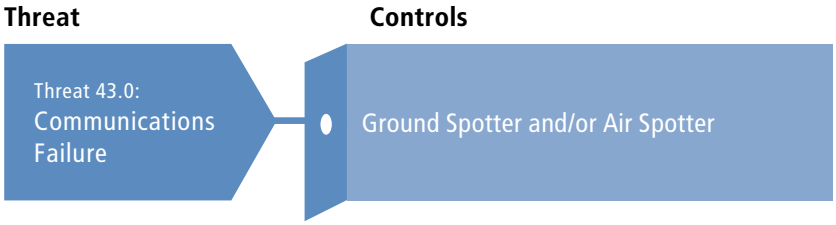
Control 42.1: Minimum Fuel Reserve/Un-porting

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.

Threat 43.0: Communications Failure

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



Control 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.

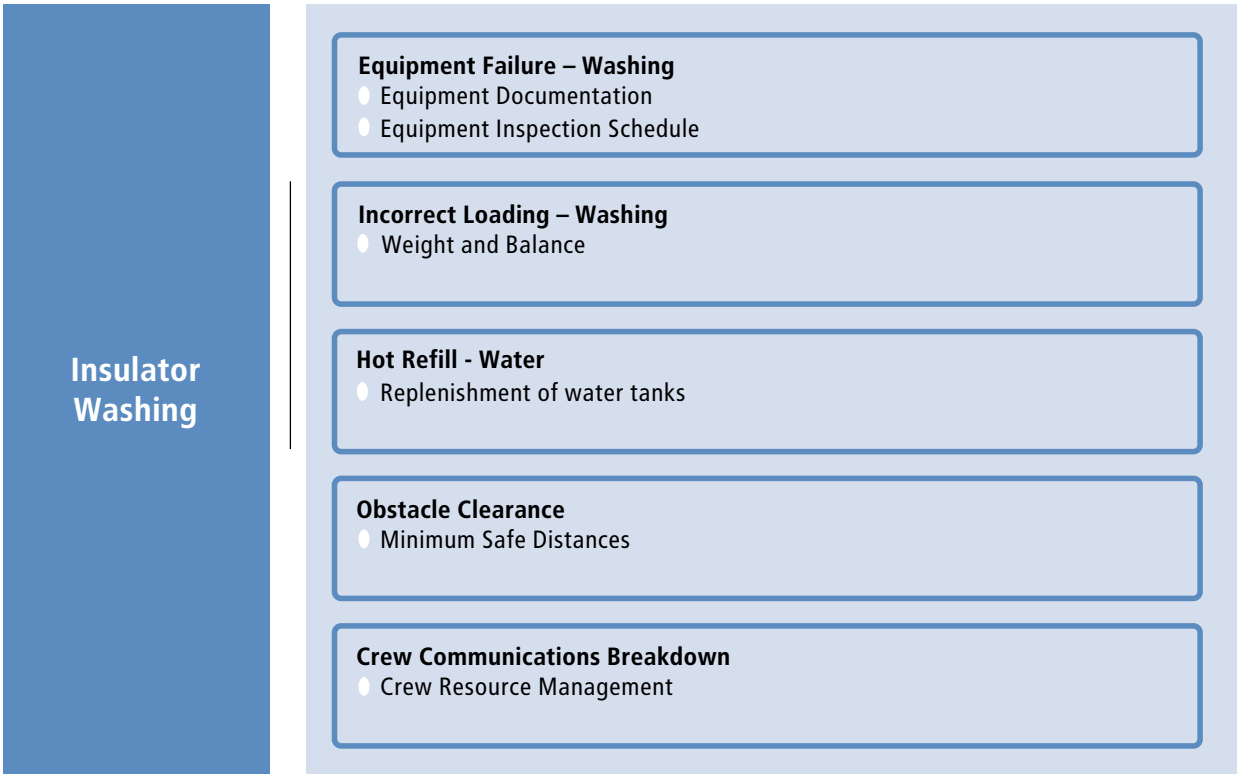

Courtesy: Meridian

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

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



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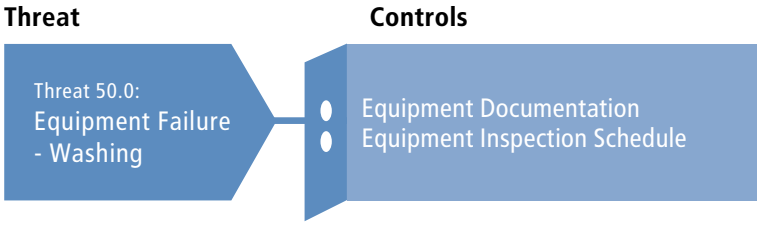
Threat 50.0: Equipment Failure - Washing

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



Control 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.

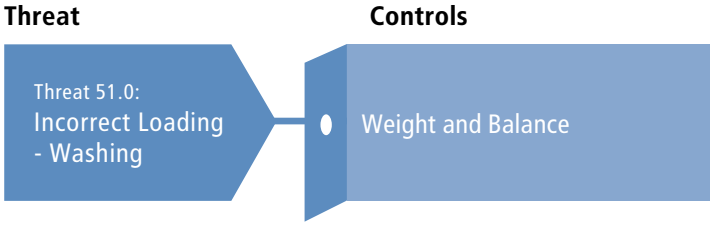
Control 50.2: Equipment Inspection Schedule

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.

Threat 51.0: Incorrect Loading - Washing

Incorrect loading of equipment or consumables results in an aircraft accident



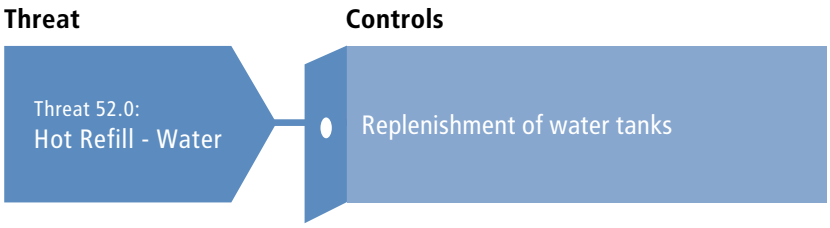
Control 51.1: Weight and Balance

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.

Threat 52.0: Hot Refill - Water

An incident during replenishment of water impacts on aircraft safety



Control 52.1: Replenishment of water tanks

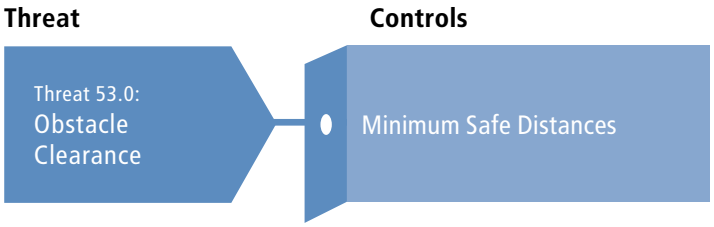
Ensuring hot refill of water tank operations are used appropriately and conducted safely.

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.

Threat 53.0: Obstacle Clearance

An aircraft accident occurs as a result of part of the helicopter or insulator washing gear impacting an obstacle



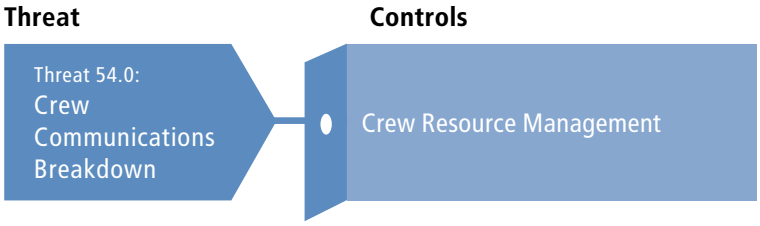
Control 53.1: Minimum Safe Distances

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.

Threat 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



Control 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.

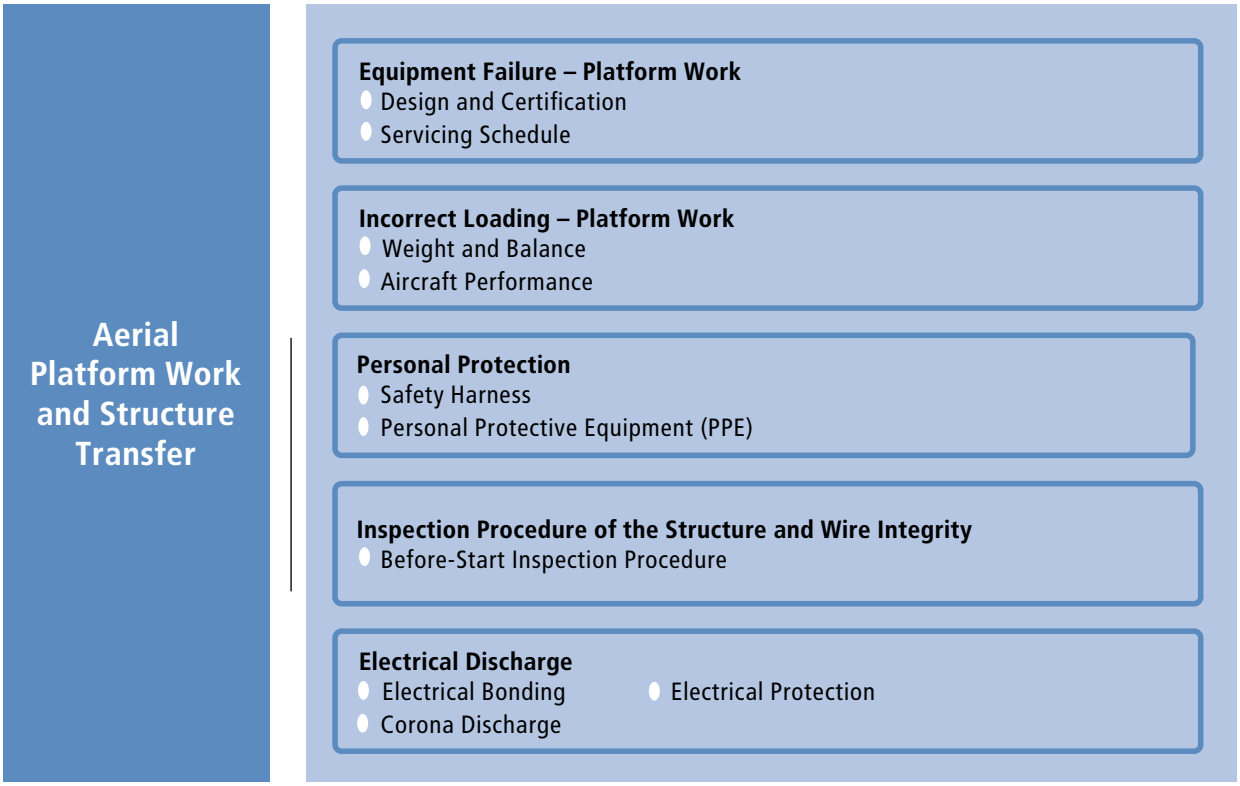
Courtesy: Heliservices HK

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

Figure 8: Operational Risk Assessment Considerations for Utility and Energy Aerial Platform Work and Structure Transfer Operations



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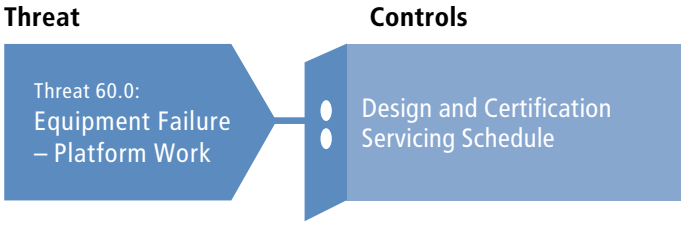
Threat 60.0: Equipment Failure – Platform Work

The external platform, steps or basket equipment suffers a technical failure



Control 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.

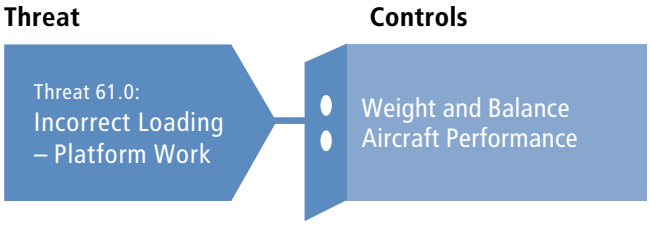
Control 60.2: Servicing Schedule

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.

Threat 61.0: Incorrect Loading – Platform Work

Incorrect loading of equipment or crew results in an aircraft accident



Control 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.

Control 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.

Threat 62.0: Personal Protection

Protecting task specialists working on skids, steps and platforms from injury due to falls, impacts, cuts, debris and noise

Control 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.

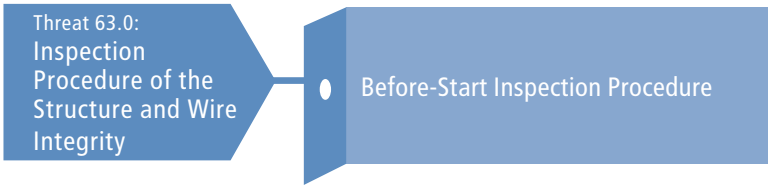
Control 62.2: Personal Protective Equipment (PPE)

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.

Threat 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



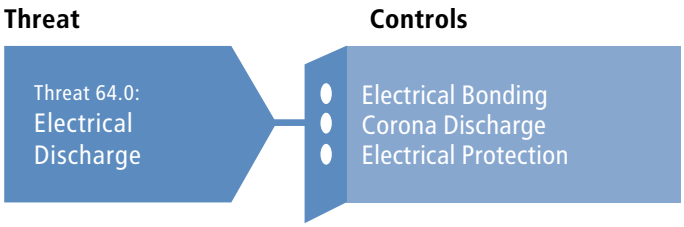
Control 63.1: Before-Start Inspection Procedure

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.

Threat 64.0: Electrical Discharge

When operating close to powerlines there is a risk of electrical discharge that is to be mitigated



Control 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.

Control 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.

Control 64.3: Electrical Protection

Ensuring external task specialists have Personal Protective Equipment (PPE) to protect from electric shock.

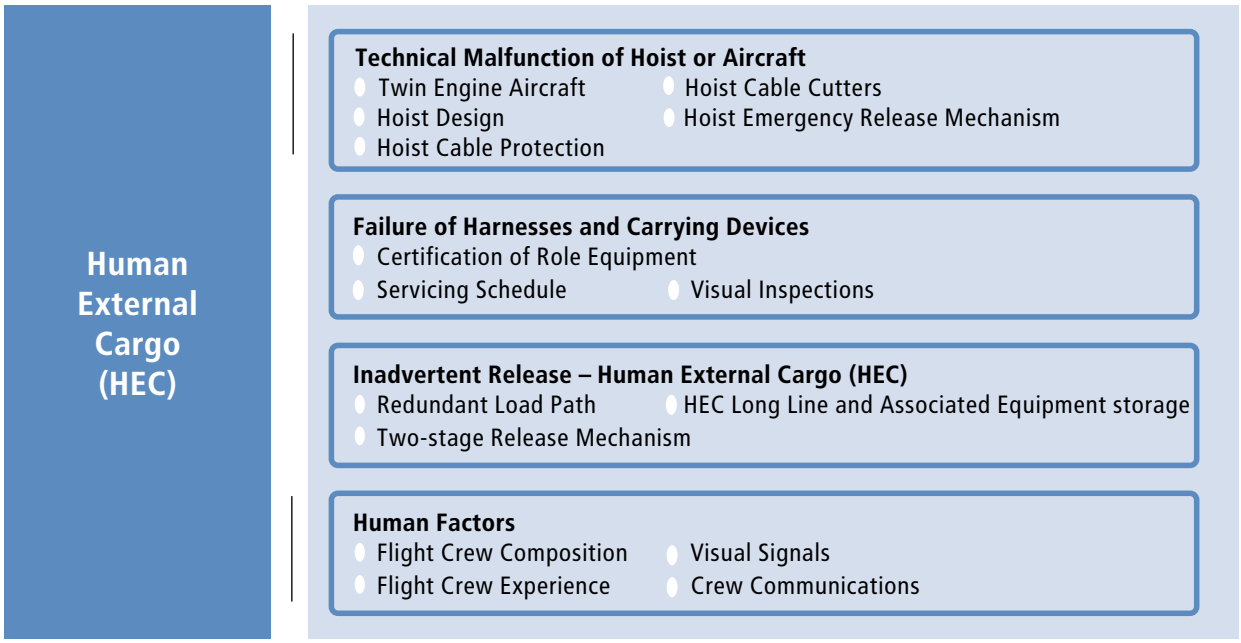
External task specialists exposed to electric shock hazards must wear a conductive suit and other PPE.

Courtesy: Leading Edge Helicopters

Human External Cargo (HEC)

Helicopters provide the operational flexibility to move personnel to perform Utility and Energy tasks using human external cargo (HEC) operations

Figure 9: Operational Risk Assessment Considerations for Utility and Energy Human External Cargo Operations



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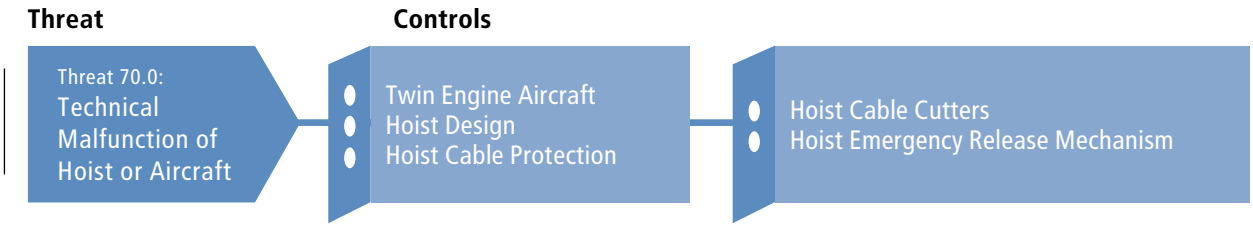
Threat 70.0: Technical Malfunction of Hoist or Aircraft

A technical malfunction of aircraft or hoist leads to an incident or accident



Control 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.

Control 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.

Control 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.

Control 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).

Control 70.5: Hoist Emergency Release Mechanism

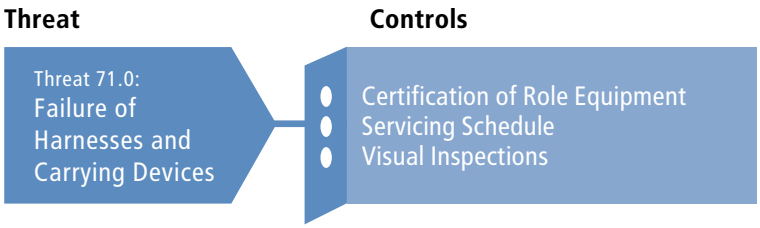
Ensuring the hoist emergency release mechanism is serviceable, seated and latched prior to flight.

Prior to each flight, the emergency release mechanism must be checked serviceable, and the mechanism is verified fully seated and latched.


Courtesy: Heliservices HK

Threat 71.0: Failure of Harnesses and Carrying Devices

The Human External Cargo (HEC) carrying equipment fails in-flight causing injuries or fatalities



Control 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.

Control 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.

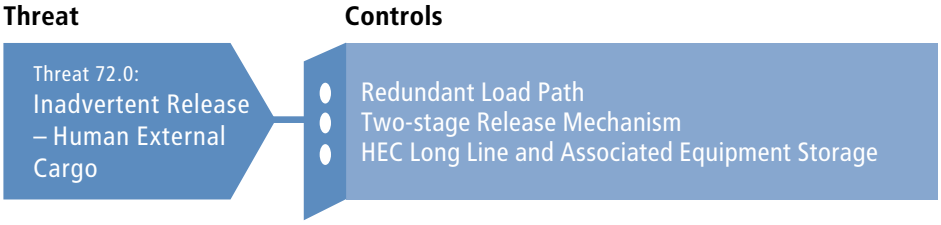
Control 71.3: Visual Inspections

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.

Threat 72.0: Inadvertent Release – Human External Cargo

The human external cargo (HEC) carrying equipment is inadvertently released in-flight causing injuries or fatalities



Control 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.

Control 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.

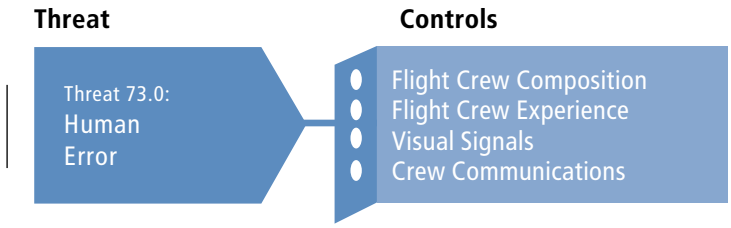
Control 72.3: HEC Long Line and Associated Equipment Storage

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.

Threat 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



Control 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.

Control 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.

Control 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.

Control 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.

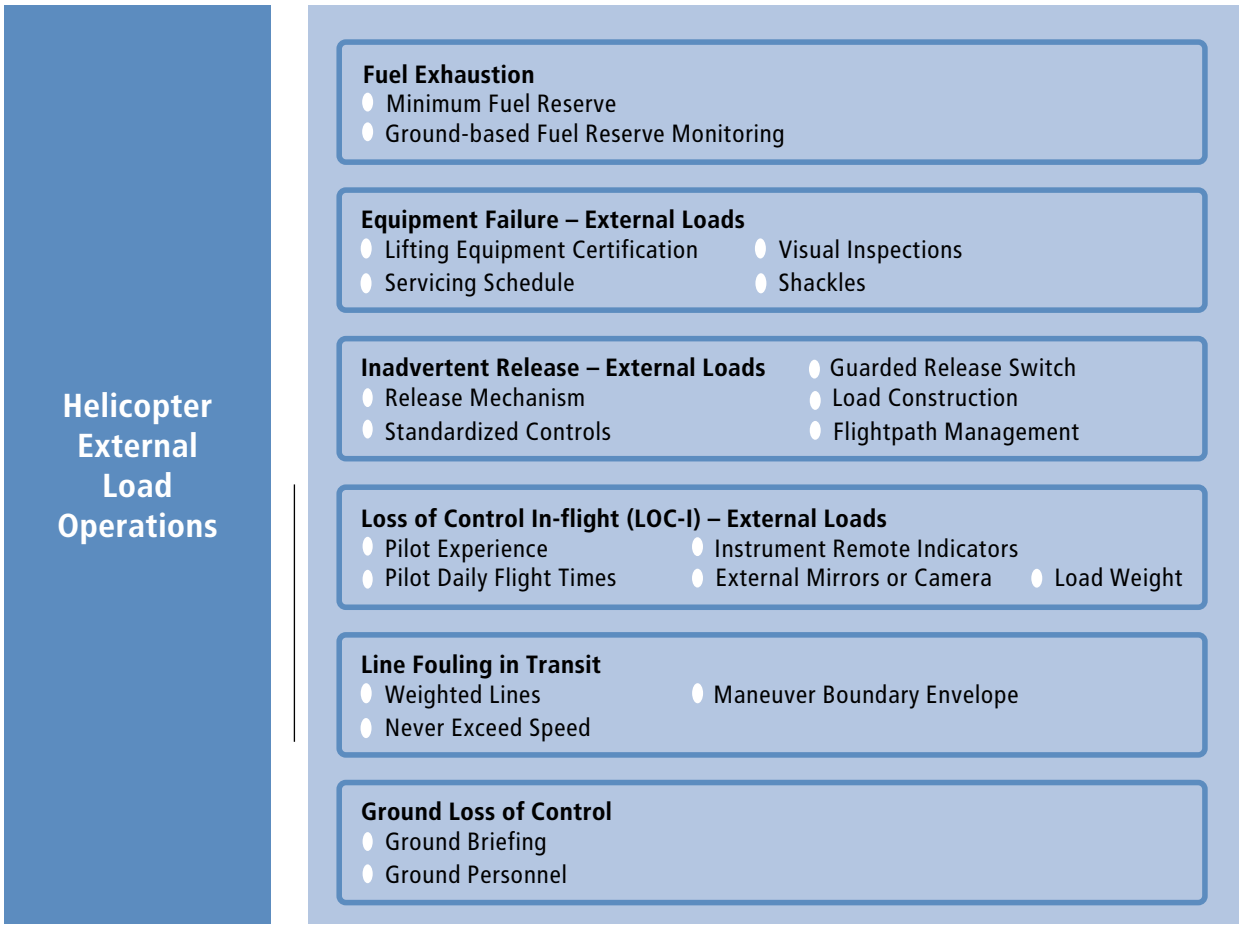

Courtesy: Leading Edge Helicopters

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

Figure 10: Operational Risk Assessment Considerations for Utility and Energy Helicopter External Load Operations



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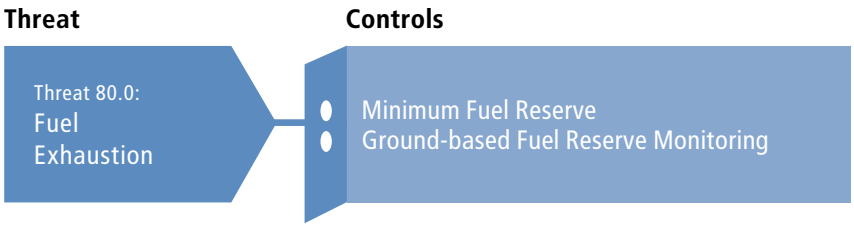
Threat 80.0: Fuel Exhaustion

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



Control 80.1: Minimum Fuel Reserve

Ensuring sufficient fuel is carried, including required reserves.

Maintain a minimum fuel reserve of 20 minutes at all times.

Control 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.

Threat 81.0: Equipment Failure – External Loads

The lifting equipment fails and drops the load resulting in an accident on the ground

Control 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.

Control 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.

Control 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.

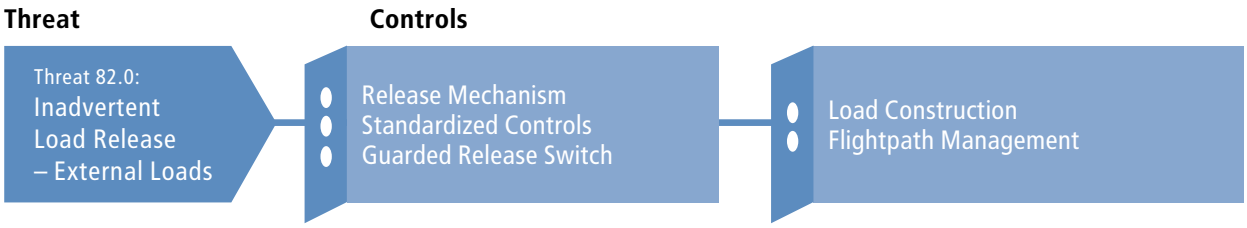
Control 81.4: Shackles

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.

Threat 82.0: Inadvertent Load Release – External Loads

The load is inadvertently released in-flight, falls to the ground and causes an accident



Control 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.

Control 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.

Control 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.

Control 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.

Control 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.


Courtesy: Heliservices HK

Threat 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

Control 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.

Control 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.

Control 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.

Control 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).

Control 83.5: Load Weight

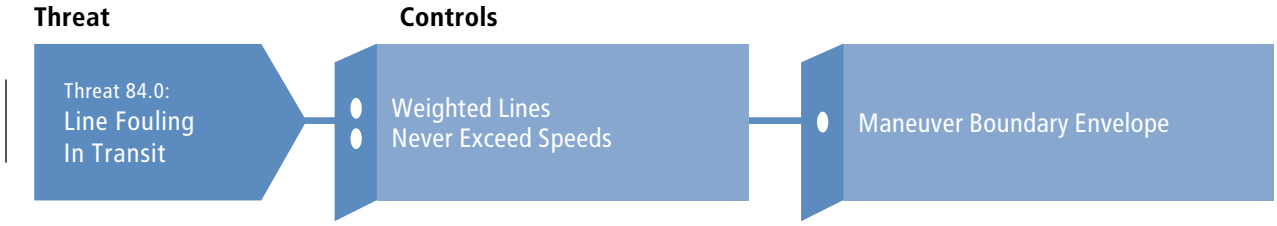
Ensuring accurate load weights are known and within aircraft limits.

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.

Courtesy: Heliservices HK

Threat 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



Control 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.

Control 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.

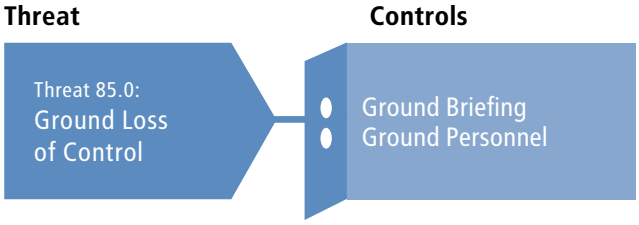
Control 84.3: Maneuver Boundary Envelope

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.

Threat 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



Control 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.

Control 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.

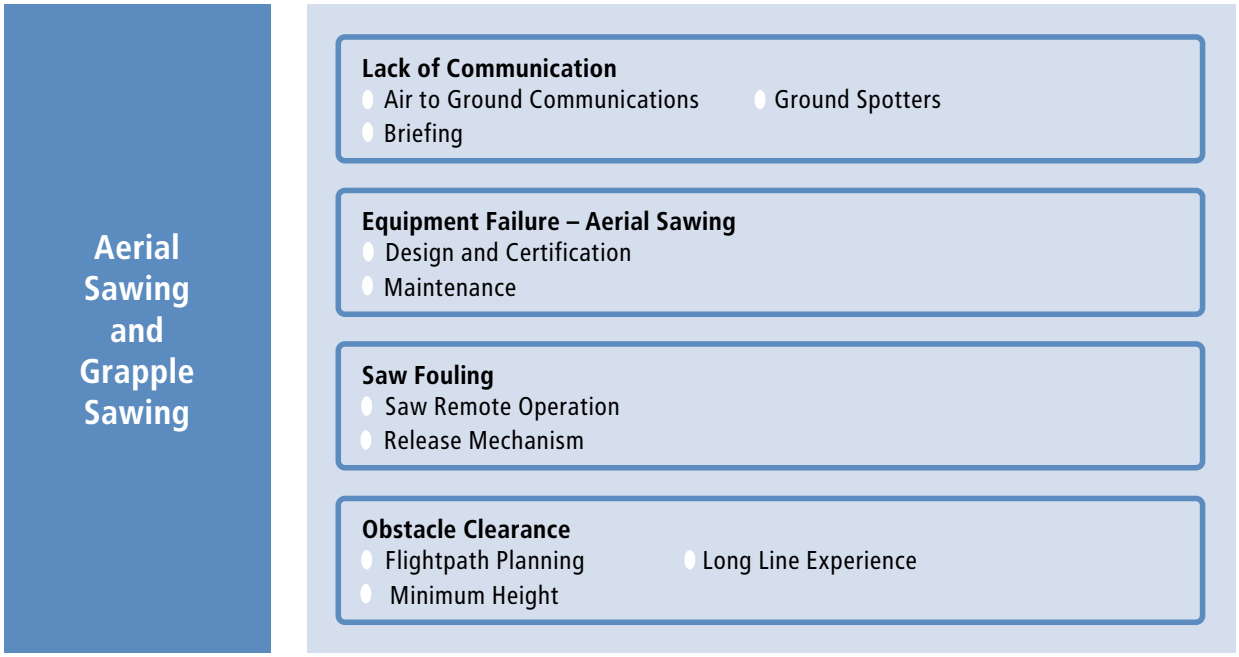
Appendix 9:

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

Figure 11: Operational Risk Assessment Considerations for Utility and Energy Aerial Sawing Operations



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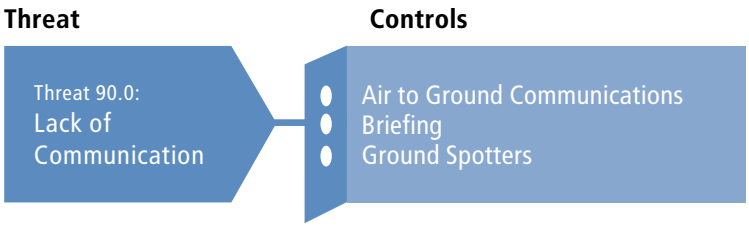
Threat 90.0: Lack of Communication

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



Control 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.

Control 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.

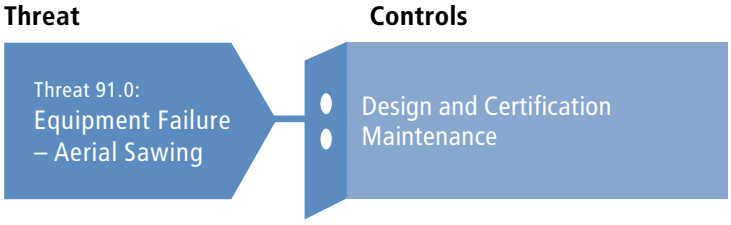
Control 90.3: Ground Spotters

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.

Threat 91.0: Equipment Failure – Aerial Sawing

The aerial sawing equipment fails leading to an accident



Control 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.

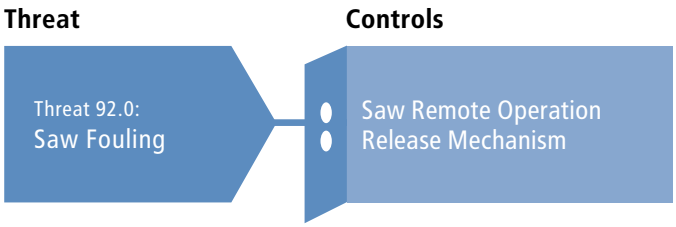
Control 91.2: Maintenance

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.

Threat 92.0: Saw Fouling

The aerial saw becomes snagged on vegetation or an obstacle resulting in an aircraft accident



Control 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.

Control 92.2: Release Mechanism

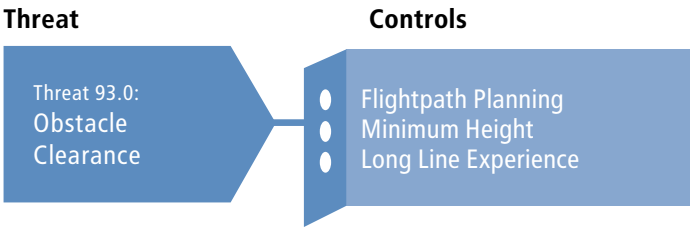
Ensuring the aerial saw can be released from the helicopter in the event of an emergency.

The hook release function must be serviceable at all times during aerial saw operations.

Courtesy: Heliservices HK

Threat 93.0: Obstacle Clearance

An aircraft accident occurs as a result of part of the helicopter or aerial saw impacting an obstacle



Control 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.

Control 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).

Control 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.

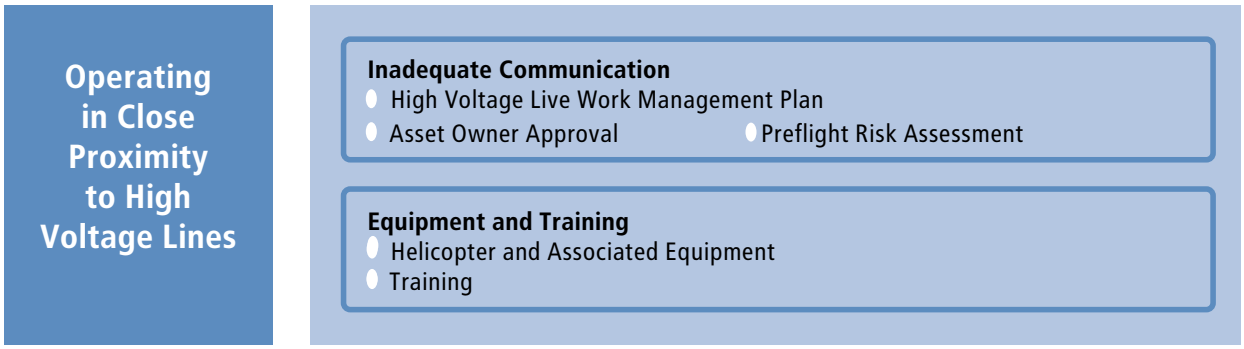
Courtesy: Leading Edge Helicopters

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

Figure 12: Operational Risk Assessment Considerations for Utility and Energy Operations in Close Proximity to High Voltage Lines



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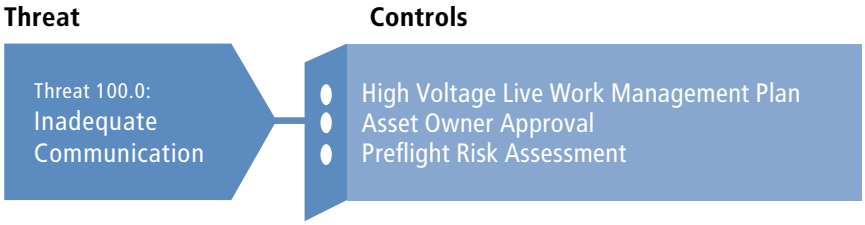
Threat 100.0: Inadequate Communication

An aircraft accident occurs as a result of arcing from high voltage lines through poor communication



Control 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.

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

Control 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.

Control 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.

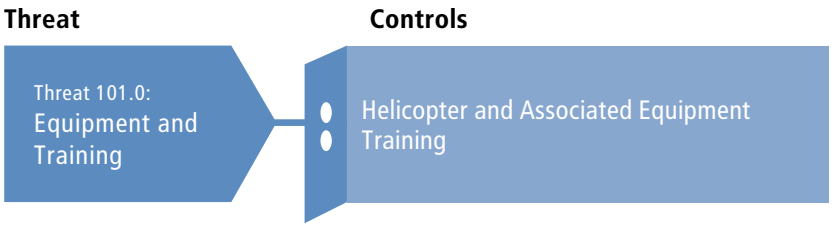
Any newly developed live work procedures must be proven on a de-energized line to verify safe and reliable operations can be conducted prior to going live. Notwithstanding, the aircraft operator may be required to conduct a demonstration flight for each aircraft type to be used for live work if requested to by the Asset Owner.

The demonstration flight for live work, if requested, will involve a review of the aviation and Line Worker functions.

Courtesy: Heliservices HK

Threat 101.0: Equipment and Training

An aircraft accident occurs as a result of high voltage event through inadequate equipment or training



Control 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.

Control 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.

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