Helicopter Safety in High Voltage Work – an Industry Perspective

Thomas Verdecchio
Public Service Electric & Gas Co (Retired)
Helicopter Safety
In High Voltage Work
An Industry Perspective
Certain commercial activities may be conducted under Part 91 by operators for hire such as aerial survey, power line and pipeline patrols and aerial photography. There are definite limitations on conducting these operations without being required to hold other FAA certifications.
Line Inspections in the Wire Environment
14 CFR PART 135

If a person provides air transportation of persons or property for compensation or hire, that person must become certificated as an operator under Part 135 of the Federal Aviation Regulations.

A 135 Operator is a On Demand, Intrastate, VFR, 9 Passengers or less, Single Pilot Certification.
14 CFR PART 135 Crew Requirements

- Drug and Alcohol Program
- Crewmember training requirements
- Crew resource management training
- Crewmember emergency training
FAA Rules for Helicopters

14 CFR PART 135 Maintenance Requirements

• Responsibility for airworthiness
• Approved aircraft inspection program
• Aging aircraft inspections and records reviews
• Preventive maintenance program
• Maintenance Manual requirements
• Maintenance recording requirements
• Required inspections
Training for the Wire Environment

The “Basic Awareness’s” a low-level flight crew must have and maintain while operating in the wire environment.

- Understanding your exposure in the wire environment
- How to identify the hazards associated with wire accidents
- What are the traps waiting for untrained low-level flight crew
Training for the Wire Environment

- Crew Resource Management (What the pilot and crewmembers need to do in order to act together as a team)
- The responsibilities of each crew member
- In-flight communications about wire and obstructions
- Visibility Engineering (What you can and can't see and why) how flight crews can forecast the presence of wire long before they can actually see it.
This Part is a regulation for certifying a helicopter operator to conduct commercial for hire external load operations.

There are various classes of rotorcraft load combinations to move cargo, people or pull sockline for repairs and construction of power line systems.

The FAA operating rule establishes certification, airworthiness, training and operations limits of helicopters engaged in these activities.

No person may conduct a rotorcraft external-load operation without, or contrary to, the Rotorcraft-Load Combination Flight Manual prescribed in §133.47.
The operator is required by Title 14 of the Code of Federal Regulations (14 CFR) part 133, section 133.47 to develop a Rotorcraft-Load Combination Flight Manual.

The objective of this RLCFM is to ensure that an operator meets regulatory requirements and provides adequate procedures and guidance for safely conducting external-load operations.
Carriage of Persons

Part 133 does not provide for “passenger carrying” operations, but does provide for the “carriage of persons” in accordance with 14 CFR § 133.35.

No Class A, B, or C external-load operator may allow a person to be carried during external-load operations unless that person is a flight crewmember.
Carriage of Persons

An operator with Class D approval may be authorized to carry persons other than a crew-member or persons directly connected with the external-load operation.

The FAA inspector must ensure that external-load operations are not for passenger carrying operations conducted for compensation or hire.
§133.35

(a) No certificate holder may allow a person to be carried during rotorcraft external-load operations unless that person

(1) Is a flight crewmember;

(2) Is a flight crewmember trainee;

(3) Performs an essential function in connection with the external-load operation; or is necessary to accomplish the work activity directly associated with that operation.
§91.1081 Crewmember training requirements.

- Trained in the duties and responsibilities of crewmembers
- Trained in appropriate portions of the Rotorcraft Load Combination Flight Manual
- Emergency training
- Trained and currently proficient for the type of operation
- Trained in and qualifies in new equipment, facilities, procedures, and techniques, including modifications to aircraft.
Class A External-Loads.

Class A is an external load that cannot move freely, cannot be jettisoned, and does not extend below the landing gear.

An example of Class A operation is the carriage of supplies in an approved cargo rack, bin, or seat affixed to the exterior of the aircraft.

The FAA-approved flight manual supplement is required for the cargo rack installation specifies and the approved configuration.
An example of a Class A External-Load
Examples of a Class A Operation
A Supplemental Type Certificate (STC) is a document issued by the Federal Aviation Administration approving a product modification used on an aircraft or to modify the aircraft from its original design.

All external work platform must have a STC issued from the FAA.
The platform shall be designed and engineered by a competent person and rigidly attached to the helicopter airframe. The platform shall be electrically tested for low resistance and free from corona discharge points. The platform shall be bonded together and then bonded to the helicopter’s frame.
Corona Discharge- Sharp edges on platform or other components such as rotors and skids attached to the helicopter may compromise insulating air gap.

The insulating air space is affected by the air movement over the rotor.

Helicopter inadvertent movement could be caused by wind speed changes 15 to 20 mph this will affect translational lift (ETL) then helicopter will lift or drop several feet.
A helicopter may be properly loaded for takeoff, but near the end of a long flight when the fuel tanks are almost empty, the Center of Gravity (CG) may have shifted enough for the helicopter to be out of balance laterally or longitudinally.

Improper balance of a helicopter’s load can result in serious control problems.

In addition to making a helicopter difficult to control, an out-of-balance loading condition also decreases maneuverability of the cyclic control. (*Helicopter steering device*)
Ideally, the pilot tries to perfectly balance a helicopter so that the fuselage remains horizontal in hovering flight, with no cyclic pitch control needed except for wind correction.

Since the fuselage acts as a pendulum suspended from the rotor, changing the center of gravity changes the angle at which the aircraft hangs from the rotor. When the center of gravity is directly under the rotor mast, the helicopter hangs horizontal; if the CG is too far forward of the mast, the helicopter hangs with its nose tilted down; if the CG is too far aft of the mast, the nose tilts up.

If carrying external loads in a position that requires large lateral cyclic control inputs to maintain level flight, left or right cyclic effectiveness could be dramatically limited, this could cause Dynamic Rollover of the helicopter.
Dynamic Rollover

Full Opposite Cyclic Limit to Prevent Rolling Motion

Tail Rotor Thrust

Area of Critical Rollover

Slope

Horizontal
This is not a Class A Operation
Class B is an external-load, carried above or below the skids, which can be jettisoned and is lifted free of land and/or water by a cargo hook or winch.

An example of a Class B operation is the placement of an air conditioning unit on the roof of a tall building.
Examples of a Class B Operation
An operator with a Class B approval may be authorized to externally carry a crewmember, or a person essential to the external-load operation, with a single engine rotorcraft. The persons in the following examples may be carried as a Class B external-load, which must be jettisonable.

a) Cameramen who are involved in movie making operations.

b) Trapeze acts or clown acts at air shows or similar entertainment events.
Class B Operation

Trapeze acts or clown acts at air shows or similar entertainment events.
This is our industry’s interruption of a Clown Act

The personnel lifting device must be FAA-approved. Class B external load must be Jettisonable.
Class C External-Loads.

Class C is an external-load that can be jettisoned and a portion of the load remains in contact with land or water.

Examples of Class C operations are wire stringing, dragging a long pole, or towing a boat or barge.
Examples of a Class C Operation
Examples of a Class C Operation

Helicopter Pulling Blocks

Side Pull Kit for the Helicopter
Class D External-Loads.

Class D is an external-load other than Class A, B, or C and is approved on an individual basis through the issuance of Operations Specifications (Op Specs).

Class D allows the external carriage of a person other than a crewmember, or a person who is essential to, and directly connected with, the external-load operation, may also be carried as a Class D load.
A Class D rotorcraft load combination is the only external-load class permitting the carriage of persons.

The rotorcraft used must have been type certificated under 14 CFR part 27 or 29, Category A, for its operating weight. With one engine inoperative, it must be able to hover at that operating weight.

The personnel lifting device must be FAA-approved, and have an emergency release that requires two distinct actions to achieve release. A guard over the release must prevent the pilot from activating the switch inadvertently.

The personnel lifting device must be FAA-approved.
Examples of FAA Approved Human External Load Lifting Devices

Full Body Seat Harness  Heli-Basket
Examples of a Class D Operation

The rotorcraft must be equipped for direct radio communication among required crewmembers.

Class D external load is not Jettisonable
Rotorcraft Accidents During Human External Loads

FAA Report – May 1998
A Human Factors Perspective on Human External Loads

[Bar and pie charts showing accident causes and frequency]
External Load Safety Requirements for Rotorcraft and Crew

FAR 27.865 - provides a minimum level of safety for rotorcraft and crew to be used with operating rules such as Part 133.

Certain aspects of operations such as microwave tower and power line work may also be regulated separately by other Federal agencies such as DOE, EPA, and OSHA or by other international entities.

For operators that could come under multiple agency regulation (or regulation by other entities), special certification emphasis will be required by both, the rotorcraft owner/operator and the certifying authority to ensure all relevant safety requirements are identified and met.
Don’t Let this Happen to Your Crews