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How to Employ Recumbent Transport, Perform a Simple Vertical Lift, and Perform Proper Helicopter Slingload of Horses

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Improved alternatives for the successful technical rescue and transport of horses to veterinary facilities are available to practitioners. One of the most commonly needed techniques, vertical lift of horses (i.e., temporary recumbence caused by slick surfaces, falls into swimming pools, septic tanks, muddy areas, ice, or steep ravines, or geriatric degeneration/weakness), is performed with locally available equipment and webbing. Recumbent transport of viremic, recumbent, geriatric, and severely injured horses on a Rescue Glide sked requires minimal personnel and training, and it provides an efficient means of movement. Helicopter slingload of horses trapped in remote, inaccessible areas (floodwater, steep ravines, etc.) during a disaster or emergency may be accomplished using the Anderson Sling [[a](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refa)], but use of this device requires significant planning, resources, and personnel training for safe employment.

**1. Introduction**

**Vertical Lift**

Because of prey instincts, great weight, and sensitive nature, horses are difficult to remove from the environment of mud, swimming pools, septic tanks, and steep ravines. Downed or recumbent horses will experience difficulty breathing, depression, gut motility decline, and/or self-injury struggling to rise. There is little information in the scientific or veterinary literature that provides a viable solution to this problem [[1](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref1)]. Lay use of slings of various types in attempts to lift and suspend geriatric or injured horses have been sporadic in their success [[b,c](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1" \l "refb)] and may be extremely complicated. A rope figure-eight sling was promoted for many years by several rescue and humane groups; however, our live demonstration testing of this method using horses ([Fig. 1](javascript:fileName='fig1.asp';displayFig2())) found it unreliable, complicated, and uncomfortable to the animals.

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[Figure 1](javascript:fileName='fig1.asp';displayFig2()). Although promoted for many years, the figure-eight rope or Web Sling is unreliable and uncomfortable, and it does not provide sufficient surface area contact with the skin in live testing on demonstration horses. (Photo courtesy of Officer Sandy Mayberry, Winston-Salem Rescue Squad, Winston-Salem, NC). To view click on figure

Use of the Simple Vertical Lift Web Sling ([Fig. 2](javascript:fileName='fig2.asp';displayFig2())) has been successful in lifting animals in both clinical and rescue situations. However, it is not recommended for lifts >10 min in duration [[2](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref2)]. If an animal must be suspended for clinical reasons for greater periods of time (hours, days, weeks, or months) or requires technical rescue with a helicopter lift, the practitioner should choose the Anderson Sling [[c](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refc)].

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[Figure 2](javascript:fileName='fig2.asp';displayFig2()). The Simple Vertical Lift Web Sling in place during a practice lift of a horse out of mud. Overhead crane-lift equipment is connected to the spread bar by prusik loops that prevent the webs from slipping together. (Photo courtesy of Dr. Nathan Slovis, Hagyard-Davidson-McGee, Lexington, KY). To view click on figure

The Simple Vertical Lift Sling consists of webbing straps with sewn loops, prusik connectors, and steel attachment points for use with a vertical lift system ([Fig. 3](javascript:fileName='fig3.asp';displayFig2())). Custom-made National Fire Protection Association (NFPA) Instron-tested webbing straps are available [[d](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refd)] and should be used in these situations, if possible). A horse should be fully sedated during vertical lift to prevent further injury to itself or attending personnel.

[](javascript:fileName='fig3.asp';displayFig2())

[Figure 3](javascript:fileName='fig3.asp';displayFig2()). The Simple Vertical Lift Sling includes (1) chest restraint, (2) web straps with sewn loops (either commercial custom-made straps or fire-hose webbing), (3) steel large-gate carbiners, (4) 3-ft spread bar with steel shackles, and (5) 6-ft prusik loops of rescue-grade rope. (Photo courtesy of Dr. Janice Baker, CPT, U. S. Army Veterinary Corps., Fayetteville, NC). To view click on figure

Use of the Simple Vertical Lift Web Sling in both medical emergencies and technical rescues of entrapped animals has been extremely successful for recumbent or geriatric horses and for extracting horses from septic tanks, ravines, swimming pools, and mud holes [[3](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref3)].

**Recumbent Transport**

Horses are difficult to move or transport when sternally or laterally recumbent. Additionally, their tendency is to thrash in an attempt to get up, which can lead to further injury. There is little information in the literature providing viable solutions to this problem. Early attempts to use low-wheeled tables, tarps, or simple plywood for this purpose were impractical in the field, at shows, and on racetracks.  
The Rescue Glide [[e](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refe)] modified from the Massachusetts SPCA Rescue Glide [[f](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#reff)] and the CDA Products Rescue Glide [[g](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refg)], provides a practical means of moving a recumbent, non-ambulatory horse. It is a sked that has been modified by increasing the length to 8 ft and by using a recycled polypropylene polymer plastic that does not crack or break under heavy use. Horses with serious injuries or those displaying severe malnutrition or neurological symptoms can be easily relocated from a stall, removed from public view at an event/race/show, or even drawn along a wilderness trail to a horse ambulance for transport to a veterinary facility. The sked is a sheet of 8 x 4-ft recycled polypropylene with specialty access points, rachet tie-down anchor straps, and steel attachment points ([Fig. 4](javascript:fileName='fig4.asp';displayFig2())) for winch loading into an equine ambulance. A horse must be fully sedated during transport on the Rescue Glide to prevent further injury to itself or personnel.  
Use of the Rescue Glide in both medical emergencies and technical rescues of trapped animals has been extremely successful for transport of horses with severe tendon lacerations, neurologic injuries or diseases, broken pelvises and extremities, or shock to veterinary facilities.

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[Figure 4](javascript:fileName='fig4.asp';displayFig2()). Accessories for the rescue guide: (1) 3-in ratchet strap with fleece pads (two total), (2) 6-ft-long piece of 2-in webbing with double-sided velcro for securing head to glide, (3) 15-ft-long hobble rope, simple pulley, and carabiner for gathering hobbles, (4) fleece-lined leg hobbles (four total) with prusik loops and carabiners, (5) fleece pad (five total) for skin protection under ropes, (6) head protection (or towel, shirt, saddle pad, or life vest), and (7) 4-in webbing, 10-ft or longer (not shown). To view click on figure

**Helicopter Slingload**

Horses present a particularly difficult problem to remove from the rescue environment of a wide flooded area or difficult steep terrain far from access by vehicles or heavy equipment. Because of their fractious and fearful nature, horses may fight any effort to walk, climb, or swim them to safety, and these attempts are inherently very dangerous for the rescuer. Past use of barges to remove horses from flooded areas have been very successful; however, the boat must be large enough to handle the shifting weight of a horse, and sedation is recommended [[4](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref4)]. A Rescue Glide sked can be used to transport a recumbent animal for many miles across terrain if pulled by an all-terrain vehicle or snowmobile. An equine flotation device is in the research and development phase at Clemson University for floating individual horses out of floodwater scenarios where a boat may be used to access the animal [[5](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref5)]. There are simple vertical web-sling options available where a crane or other ground-based equipment is used for a short-term lift. Unfortunately, many disaster or emergency scenarios may occur in areas not conducive to the use of these options [[6,7](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref6)].  
The use of cargo nets, inappropriate homemade slings, and other inadequate equipment has contributed to disastrous efforts by well-intentioned rescuers. Many homemade slings put most of the animal’s weight onto a "belly band", thereby inhibiting respiration and putting much pressure on the abdominal organs for a long lift. Other slings do not have a method to prevent the movement of the head and neck - if the animal panics and starts to throw its head, it can flip forward and out of the sling. Some slings do not support the rear quarters of the horse and have allowed animals to slip out of the sling backwards. Most slings do not distribute the weight of the animal very well, pulling the front end, back end, or middle part of the horse up too far. The Simple Vertical Lift Web Sling, extremely useful for short lifts using a crane, is not recommended for helicopter lifts [[8](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref8)]. There have even been desperate attempts at slingloading of cattle by roping the horns or one leg and transporting them into a waiting truck for removal from public lands. No veterinary evaluation of the animals was reported after these efforts.  
The Anderson Sling ([Fig. 5](javascript:fileName='fig5.asp';displayFig2())) has been successfully used for helicopter operations in multiple emergencies [[9](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref9)] and training demonstration flights, and it is the only Equine Sling recommended for this purpose. Although it was originally intended for clinical use in long-term recovery cases [[10](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref10)], it has become the industry standard for helicopter operations with equines because of its proven safety margin, design, and strength.

[](javascript:fileName='fig5.asp';displayFig2())

[Figure 5](javascript:fileName='fig5.asp';displayFig2()). The Anderson Sling includes the yellow/black abdominal, chest, and buttock supports that attach to an overhead steel frame by 18 attachment points. Red boat floats were added to allow the frame to rest comfortably on the animal’s back. This is a crane demonstration without a blindfold. To view click on figure

The U.S. Army, Coast Guard, Marines, and Veterinary Emergency Rescue Teams (VERT) [[11](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref11)] have used this sling to assist with emergency rescues and to bring in mules for desert military operations and training. The Anderson Sling is designed to transfer much of the weight of the horse to leg straps under the pelvis and sternum. In clinical use, the leg straps are attached to further distribute the weight to the bones of the legs but are not necessary in rescue lifts. The animal is attached to the soft part of the sling by use of straps around the barrel so that it cannot throw itself out of the sling. A steel overhead frame with 18 attachment points allows the horse’s weight to be distributed evenly. The load cable is equipped with a 15- to 20-ft nylon web strap at the load end to prevent static discharge from contact with the live load or rescuers, and it eliminates the need for grounding the load before handling. In some states, there are Large Animal Rescue Teams associated with the Veterinary School, the State Emergency Management Association, or local private Equine Ambulance Services that may have equipment and personnel trained in helicopter sling loading. This is a specialty interest that requires prior coordination, significant planning, and training of all personnel involved. Helicopter use can be very expensive (thousands of dollars per hour).

**2. Materials and Methods**

**Vertical Lift**

1. 3.5-in or wider Fire Hose webbing 6 ft long with sewn loops (two total);
2. Chest restraint (3-ft section of 4-in Fire Hose webbing or Western-type cinch with ropes attached);
3. spread bar (2-in square aluminum tubing 36 in long with four steel anchor shackles placed 4 in apart at each end);
4. Prusik loops of 0.5-in kernmantle rescue rope (two total);
5. Steel large gate carabiners (two total);
6. Head protection (this could be a towel or shirt);
7. Overhead rope system, crane, wrecker, rough terrain forklift, winch system, or A-frame rescue system with a minimum 3-m boom clearance.

**Protocol for Securing a Horse in the Simple Vertical Lift Web Sling**

This procedure takes 5 min with four trained personnel.  
Please note that all people must stay clear of the horse’s legs at all times (even when sedated). The person(s) securing the horse in the Vertical Lift equipment must always have a safety buddy. All animals should be fully sedated or anesthetized for this procedure with 10 μg/kg [detomidine](javascript:fileName='/products/product.asp?PN=detomidine_hydrochloride';displayProd()) [[h](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refh)] to reduce the chance of injury to personnel.

1. Place some type of halter on the animal for guidance and restraint as well as head protection and/or a blindfold. Attach the spread bar and shackles to the lifting equipment.
2. Slide a 6-ft section of webbing under the horse and behind the front legs.
3. Gather the loops in the webbing with a doubled prusik loop connected to a carabiner ([Fig. 6A](javascript:fileName='fig6.asp';displayFig2())).
4. Repeat procedures 2 and 3 under the horse in front of the hind legs. Many horses will resist pressure in the flank and groin area, and therefore, care must be used to keep the webbing anterior of the sheath of male horses.
5. Attach the chest restraint ([Fig. 6B](javascript:fileName='fig6.asp';displayFig2())) to the front webbing at approximately the point of the shoulder. Ensure that the webbing does not ride up too high and put pressure on the trachea, nor should it go so low that it is under the pectoral muscles.
6. Bring the lift equipment to a spot above the animal. Connect the carabiners to the spread bar shackles quickly, slide rear web to a point in front of the rear legs ([Fig. 7](javascript:fileName='fig7.asp';displayFig2())), and prepare to make the lift in coordination with the Incident Commander.
7. Make the lift in one smooth motion ([Fig. 8](javascript:fileName='fig8.asp';displayFig2())). Jerking or snatching the load may contribute to component failure or injury to the animal. Most horses struggle for a short period when the feet leave the ground and pressure is applied, but then sulk quietly until their feet touch the ground again.
8. Disconnect the carabiners and allow lift equipment to move out of the area away from the animal. Some horses will lie all the way down when set down, but they may jump up when they realize they are back on the ground. Use of a blindfold should be considered on an individual basis.

[](javascript:fileName='fig6.asp';displayFig2())

[Figure 6](javascript:fileName='fig6.asp';displayFig2()). The front and rear straps should be placed behind the shoulders and collected with (A) carabiners. Then, (B) the breast collar is attached to the front web strap. To view click on figure

[](javascript:fileName='fig7.asp';displayFig2())

[Figure 7](javascript:fileName='fig7.asp';displayFig2()). The prusik loops should be connected to the carbiners on the overhead spread bar’s shackles through the sewn web loops Note that the bar is connected to the hook of the crane by more prusik loops. The rear strap is attached to the spread bar and placed in position. Then, the signal to lift is given to the crane operator. (Photo courtesy of Mark Cole, U. S. Rider, Inc., Lexington, KY). To view click on figure

[](javascript:fileName='fig8.asp';displayFig2())

[Figure 8](javascript:fileName='fig8.asp';displayFig2()). Make the lift in a smooth, coordinated manner. Because 65% of the horse’s weight is in front of the withers, it is crucial that there be a chest restraint or the animal will slip out of the sling. A rear strap is unnecessary for this short-term lift but may be necessary for lifting cattle. (Photo courtesy of James McKasson, University of California at Davis Veterinary School, Davis, CA). To view click on figure

**Recumbent Transport**

1. 3-in ratchet straps (2 total; [Fig. 9](javascript:fileName='fig9.asp';displayFig2()));
2. 2-in webbing with industrial strength velcro that is 6 ft long;
3. Hobble rope, 15 ft long, with simple pulley and carabiner;
4. Fleece-lined leg hobbles (four total) with prusik loops and carabiners;
5. Fleece pads (five total) as protection from pressure injuries to skin;
6. Head protection (this could also be a towel, shirt, or saddle pad);
7. 4-in webbing, 10 ft long.

[](javascript:fileName='fig9.asp';displayFig2())

[Figure 9](javascript:fileName='fig9.asp';displayFig2()). One person must maintain control of the head until packaging is complete. The first ratchet strap must be placed behind the shoulder and over the ribcage, secured at both ends, and tensioned. Fleece pads should be used to protect the skin of the animal. To view click on figure

**Protocol for Securing a Horse to the Rescue Glide**

The procedure takes 10 min with three trained personnel.  
Please note that all people must stay clear of the horse’s legs at all times (even when sedated). The person(s) securing the horse to the Glide must always have a safety buddy. All animals should be fully sedated or anesthetized for this procedure to reduce the chance of injury to personnel.

1. Place some type of head protection (towel, shirt, PFD Floatation vest) on and under the horse’s head. Special attention should be paid to the eyes and prevention of facial nerve paralysis.
2. Slide a 20-ft section of nylon webbing under the horse and behind the front legs to help shift the horse onto the Glide ([Fig. 10](javascript:fileName='fig10.asp';displayFig2())).
3. Pull the horse onto the Glide using the nylon web, the tail, and the mane. Someone must support and move the head. Alternatively, the horse can be rolled onto the Glide with control of any injured extremities and the head. Make sure that the front legs do not obstruct the anchor openings on the Glide.
4. One person must keep control of the horse’s head at all times even when sedated. A knee over the neck and tipping of the nose upwards decreases the chance of the horse getting up during the procedure. This person can watch the eye and reflexes, observe breathing rate, report capillary refill times, etc.
5. Place one of the ratchet straps over the ribcage at the point of the withers and behind the shoulder of the front legs. Secure both ends of the strap to the Glide ([Fig. 11](javascript:fileName='fig11.asp';displayFig2())). The anchor must curl around the Glide and fit into the opening underneath to prevent loss of the anchor. Put tension on the strap until the edges of the Glide start to lift. Use fleece pads to protect the skin from the strap and ratchet.
6. Place another ratchet strap over the abdomen (flank) in front of the hind legs in the same manner. Tension the strap until the plastic of the Glide lifts slightly. Tension should be assessed again several times during packaging and transport to ensure that it is tight enough to hold the animal down but not so tight to prevent movement of the ribs and diaphragm.
7. Attach the four hobbles to the pastern area of the legs. It is safest to attach hobbles by keeping your body near the back of the horse and reaching over the body to work on the legs.
8. Using the carabiner, connect the front leg and back leg hobbles from the same side to each other. Then connect the other side together, unless there is an injured extremity, where the third leg should be attached to the hobbled pair. Do not connect hobbles to an injured extremity - a rope may be tied to the prusik loop on the hobble for control of the extremity by a person during movement.
9. Tie one end of the hobble rope (the one with the pulley and carabiner) to the same opening where the front ratchet is attached to the glide.
10. Connect the carabiner to the prusik loops on the hobbles.
11. Slide the free end of the rope through the same anchor opening where the other end is tied to the glide. Place a fleece pad under the rope over the horse’s chest.
12. Pull the free end of the rope through the pulley, and flex all four legs as close as possible to the body. Make sure the check ligament does not prevent flexion of the hind legs.
13. Tie the free end of the rope to the Glide to maintain the legs in the proximal position.
14. Pull the head strap from underneath the Glide through the front slit openings. Secure the head to the glide with the velcro strap.
15. The horse is ready to be moved. Straps should be checked for tension regularly and after movement across terrain or into an equine ambulance. Any splinted extremity should be individually monitored to prevent it from getting caught on obstructions ([Fig. 12](javascript:fileName='fig12.asp';displayFig2())).
16. At this time, ECG, blood pressure cuff, pulse oximetry [[i](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1" \l "refi)], thermometer, and/or other patient monitoring equipment may be attached to the animal. It is possible for IV fluid catheterization to be maintained during transport.

[](javascript:fileName='fig10.asp';displayFig2())

[Figure 10](javascript:fileName='fig10.asp';displayFig2()). A 20-ft section of 4-in nylon webbing is slipped under the abdomen of the recumbent horse, and then used as an anchor point with the tail and mane to shift the animal onto the Glide. (Photo courtesy of the Boston Animal Rescue League, Boston, MA). To view click on figure

[A sedated horse is strapped to the Rescue Glide sked with the front...](javascript:fileName='fig11.asp';displayFig2())

[Figure 11](javascript:fileName='fig11.asp';displayFig2()). A sedated horse is strapped to the Rescue Glide sked with the front and rear ratchet straps. Then, the hobbled legs are pulled close to the body with a simple pulley. All work on the animal is completed from the back of the horse for safety. (Photo courtesy of Dr. Janice Baker, CPT, U. S. Army Veterinary Corps., Fayetteville, NC). To view click on figure

[](javascript:fileName='fig12.asp';displayFig2())

[Figure 12](javascript:fileName='fig12.asp';displayFig2()). A modified Robert Jones bandage and Kimsey splint are applied to the injured extremity, which should be on the high side to allow it to be protected by one person while moving the Glide. (Photo courtesy of Dr. Linda Molesworth, Huntington, MD). To view click on figure

Please note that personnel should not be allowed to stay in the ambulance trailer with horses, whether standing, recumbent, or strapped to the Rescue Glide. Injured, terrified, and sick horses can crush a human inside the confined space of a trailer. Use a wireless camera system to monitor the animal and stop transport if a problem develops.

**Helicopter Slingload**

1. Helicopter with appropriate slingload capacity and crew;
2. Anderson Sling with steel overhead frame and all ancillary equipment;
3. Cable assembly (10-in steel ring, 100-ft cable, 20-ft web, 10-in steel hook, 20-ft brightly colored web safety line) or 150-ft Kevlar cable.

**Protocol for Conducting Helicopter Vertical Lift of a Horse**

Performance of this procedure is not timed; the emphasis is always on safety. However, trained personnel can conduct entire protocol in <2 h.  
There will be two teams on the ground in addition to the aircrew in their helicopter. The lifting team will attach the sling and overhead frame to the horse in the rescue environment (floodwater, mud, precipice, deep snow, etc.). Another team (the landing team) will be at a pre-selected landing site initially to connect the cable and web strap with hooks to the helicopter, and later, to receive the horse and disconnect it from the helicopter. Personal Protective Equipment (PPE) for rescue teams will include at a least a helmet or hardhat with chin strap, hearing protection, full goggles, and long sleeves and pants. All jewelry must be removed.

Lifting Team - Personnel Needed

* One animal handler;
* One safety officer (may be the communications officer);
* One communications officer (preferably an air crew member with a radio);
* Two sling operators (one on each side of the horse);
* One incident commander (may be the animal handler).

Landing Team - Personnel Needed

* One animal handler;
* One safety officer (may be the communications officer);
* One communications officer (preferably an air crew member with a radio);
* Two sling operators (one on each side of the horse);
* One incident commander (may be the animal handler).

Initial Assessment

The use of a helicopter in an equine rescue operation should be the absolute last choice in any scenario [[12](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#ref12)]. Slingloading operations are extremely hazardous to personnel under the aircraft, and normally, they require intensive training and practice to achieve success. In any rescue scenario (including human rescue) where the flight crew becomes endangered for any reason or the helicopter experiences in-flight difficulty, the pilot will drop the slingload whether it is a bale of alfalfa or an animal. The life of the human rescuer will always have priority over that of an animal victim.  
The rescue crew must determine whether there is room for safe maneuvering of a helicopter in the area of the horse in the rescue environment (i.e., mud, floodwater, etc.) before this option is considered. The best use of helicopter and boat resources in a disaster may be to bring feedstuffs and fresh water to the animals stranded on dry land and wait until the water recedes.  
An appropriate rotary-wing aircraft must be used with a minimum slingloading capacity of 2000 lb for lifting an average 1000-lb horse (two times the weight to increase the safety margin). Helicopter access must be coordinated before it is needed, because every helicopter is rated with a different slingloading capacity that declines with the increasing age of the craft. Most news and similar crew helicopters are not rated sufficiently to attempt this procedure.  
Areas used for landing zones, preparation of equipment, and the rescue site should be secure; do not allow the general public and media photographers to get too close. Helicopter operations are dangerous and can endanger people on the ground.

Landing Team at the Landing Zone

The landing team selects a landing zone based on safety for the helicopter and air crew, preferably a mowed pasture at least the size of a football field with no overhead obstructions such as telephone lines and poles, antennas, etc. There must be a clearance of at least 30 ft around any power poles, trees, or other obstructions. There must be at least 40 ft of clearance from a cliff or rock face. The landing zone should be cleared of all small objects such as cans, bottles, boards, tree limbs - anything that could be sucked into the air intakes of the helicopter engines and cause a fatal crash. Correct personal safety gear must be worn, because the rotor wash of the helicopter will force small objects and sand into the faces of any ground personnel.  
Do not give conventional landmarks - give the 911 address. The aircrew will need GPS coordinates in UTMs or latitude/longitude. Things look very different from the air. The crew may or may not be familiar with the area, and in some disasters, the old landmarks may no longer be there.  
Night rescue should never be considered. Although the air flight crew may be capable of doing such an operation, darkness multiplies the danger factors for the ground crews. The animal should be made as comfortable as possible, and the crew should wait until daylight to attempt rescue or euthanize the animal. The helicopter will land in the landing zone. Do not allow ground personnel to approach the helicopter without pilot permission. This standard operating procedure (SOP) should be given to the air crew. An operations meeting should be held, and all safety and planning considerations should be discussed before attempting the lift ([Fig. 13](javascript:fileName='fig13.asp';displayFig2())).

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[Figure 13](javascript:fileName='fig13.asp';displayFig2()). After the air crew lands, a planning session should include discussion of connection of the cable assembly to the helicopter, communication and safety issues, and the details of the operation. Speed is not critical, and safety is the priority. To view click on figure

Stretch the steel cable and webbing on the ground facing the helicopter with the steel ring nearest the helicopter. Have the air crew attach the steel cable with ring to the hook under the belly of the helicopter with the 20-ft web with hook for attachment to the Sling above the horse at the other end.  
It is preferred that one air crew member should be brought by vehicle or boat to the horse lifting team’s location site to act as the safety and communications officer. This person should have radio communication with the pilot. Hand and arm signals are not a safe alternative. If this is not possible, a fly-over should be performed before the rescue attempt, and good communications should be established with the lifting team before attempting the lift.  
In case of a malfunction, the air crew will attempt to move the helicopter left and forward of the current position. All personnel on the ground should be cognizant of the helicopter’s position in case of a crash.

Lifting Team at Horse’s Location

The lifting team should normally have the Anderson Sling and the overhead frame with them to place on the horse. In extreme terrain where these components cannot be transported with the lifting team, the helicopter can deliver them to the lift team site. However, the team should not attempt to place the sling while the helicopter hovers above - always minimize the amount of time that the lifting team is underneath the helicopter. The empty sling and frame are easily transportable under or inside the helicopter.  
Place the Anderson Sling on the horse ([Fig. 14](javascript:fileName='fig14.asp';displayFig2())). It is currently the only suitable and safe sling for use in helicopter sling loads of equines. All buckles and straps should be placed correctly before attempting the lift. The veterinarian should be consulted for sedation of the animal; in most cases, the animal should be heavily sedated with a combination of [detomidine HCL](javascript:fileName='/products/product.asp?PN=detomidine_hydrochloride';displayProd()) [[h](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refh)] (10 - 20 ìg/kg, IV) and[butorphanol tartrate](javascript:fileName='/products/product.asp?PN=butorphanol_tartrate';displayProd()) [[j](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refj)] (0.01 - 0.02 mg/kg, IV) to prevent movement of the slingload. For horses trapped in water or depressed, sedation may cause the horse to collapse. In these situations, sedation may be reduced, not used, or administered immediately before the helicopter lift is made when the weight of the horse is supported in the sling. The animal should be blindfolded, and the steel overhead frame with floats should be placed on top of the horse. The 18 attachment points of the soft portion of the sling should be connected, and last minute adjustments should be made to balance the load.

[](javascript:fileName='fig14.asp';displayFig2())

[Figure 14](javascript:fileName='fig14.asp';displayFig2()). During a training lift, the lifting team readies a horse for helicopter slingloading. This includes sedation, blindfolding, and adjusting the sling. Minimal personnel will remain under the helicopter to connect the load hook to the frame. (Photo courtesy of Rancho Cucamonga Fire Rescue Department, Rancho Cucamonga, CA). To view click on figure

It is preferable that the communications officer be a flight crew member with radio that stays on the ground to better direct the pilot. The pilot cannot see the ground team or the slingloaded horse underneath the helicopter and has to rely on directions from the communications officer, who gives all signals and communications to the pilot from the incident command (IC).  
The safety officer monitors the position of the cable and uses a rod, if necessary, to prevent the slack in the cable from getting caught on the sling or wrapping around personnel during descent, attachment, and ascent ([Fig. 15](javascript:fileName='fig15.asp';displayFig2())). The safety officer should have a full view of all personnel and should have a hand and whistle signal for stopping the operation at any time. It is extremely loud underneath a helicopter, and vocal communications will not work.

[](javascript:fileName='fig15.asp';displayFig2())

[Figure 15](javascript:fileName='fig15.asp';displayFig2()). The lifting team catches the load hook (with orange safety web) and attaches it to the steel sling frame’s ring. The safety officer minds the web and cable. The IC gives the command to lift to the communications officer. (Photo courtesy of Alta Loma Riding Club’s Disaster Committee, Rancho Cucamonga, CA). To view click on figure

The helicopter should hover at ~100 ft over the horse, allowing the load hook to be attached to the steel overhead frame of the Anderson Sling. The horse handler and one sling operator on each side stay with the horse until the load hook is connected.  
IC gives the command to lift to the communications officer. The communications officer then relays the command to the pilot. All personnel leave the site under the helicopter as soon as the horse’s feet leave the ground. The lead rope should be left attached to the halter, and the safety officer will stabilize the load with a hanging 20-ft web until the slingload is lifted out of reach ([Fig. 16](javascript:fileName='fig16.asp';displayFig2())).

[](javascript:fileName='fig16.asp';displayFig2())

[Figure 16](javascript:fileName='fig16.asp';displayFig2()). The safety officer holds a web to stabilize (prevent swinging or twisting) the load as it ascends. Note that the lead rope is attached to give the landing team control at descent. The head and neck is prevented from excessive movement by straps connected above, on the sides, and below the horse. To view click on figure

Landing Team at Horse Landing Zone

The communications officer under the direction of the IC signals the helicopter to descend and set the horse on the ground; then, the helicopter should hover at ~100 ft. The safety officer may pick up the lead rope and web to stabilize the load as it descends.  
When the horse is set down on the ground, give the animal a chance to stabilize itself (some will lay down and some attempt to stand). Although the nylon web strap should eliminate the need to ground the load and should dissipate static electricity, care must be taken by rescue personnel not to accidentally handle the steel cable if it is lowered to a reachable height. The aircraft may lower its position to allow the metal portion of the cable assembly to rest on the ground away from the horse and rescuers to prevent a buildup of charge. The animal handler should take hold of the lead rope from the safety officer.  
One person should release the hook from the frame of the sling by disconnecting the yellow hook from the sling frame. This person then holds on to the hook by the orange safety web hanging from it until the hook clears everyone’s head. Do not allow the hook to swing freely after disconnecting it from the sling. The communications officer on order of the IC signals the helicopter to move away from the horse landing site and land at a safe distance to disconnect the cable assembly.  
The Anderson Sling frame and sling are removed from the horse.

**3. Results**

Actual emergency rescues of large animals using these techniques have been used by the authors or students of the authors on multiple occasions to much success. Technical advice relayed over the phone has contributed to six more successful emergency rescues and assists with geriatric or severely debilitated animals.  
Since 1995, the authors have performed over 100 training scenarios using live demonstration animals (horses or llamas) in the Simple Vertical Lift Web Sling or the Rescue Glide and simulated or live practice helicopter slingloads with the Anderson Sling for emergency responders and veterinary personnel. In each scenario, a trained demonstration animal is secured in the equipment by students (if sedation is needed, 10 μg/kg [detomidine](javascript:fileName='/products/product.asp?PN=detomidine_hydrochloride';displayProd()) [[h](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refh)] is used). The horse (load) can then be moved with the use of a technical rope system with Airshore A-Frame [[k](http://www.ivis.org/proceedings/AAEP/2004/Gimenez/chapter.asp?LA=1#refk)] ([Fig. 17](javascript:fileName='fig17.asp';displayFig2())), or helicopter out of the scenario’s rescue environment (i.e., swamp, ravine, hillside, snow, or other significant terrain feature). Each of these training scenarios has been successful and has resulted in no injuries to demonstration animals or personnel.

[](javascript:fileName='fig17.asp';displayFig2())

[Figure 17](javascript:fileName='fig17.asp';displayFig2()). Fleece-lined webbing may be purchased for use. A horse is prepared for lift with the Airshore A-Frame System in a live demonstration. Rescue personnel should wear helmets when working around overhead heavy equipment. (Photo courtesy of Rancho Cucamonga Fire Rescue Department, Rancho Cucamonga, CA). To view click on figure

Helicopter slingloading operations are dangerous. Evaluations after the helicopter lift of five horses during the Hurricane Floyd (1999) disaster in North Carolina showed that the protocols in use at that time were not sufficiently attending to the safety of the rescuers on the ground and that changes needed to be made to increase the safety of these dangerous rescue attempts. Viewing videotapes of well-intentioned rescue attempts from all over the world showed that many critical safety mistakes were made by emergency responders, volunteer rescuers, pilots, and the general public at the scene.  
These authors have responded to 12 individual stranded equine scenarios (mud, steep terrain, snow, flood water), and coordinated demonstration helicopter lifts of six horses for hands-on training courses. Telephonic coordination has contributed to three successful rescues of stranded horses. There were no iatrogenic injuries to horses nor were there any injuries to rescuers that were reported after the completion of operations.

**4. Discussion**

Animals in these scenarios may have special medical concerns such as severe injuries, hypothermia, dehydration, shock, and exhaustion. Coordination between the veterinarian and the rescue team is extremely important to increase the efficiency of the extrication and allow medical attention to be administered. The use of sedation should be carefully evaluated when scenarios occur in water environments, because the heavily sedated horse could drown.

**Vertical Lift**

Septic tank drainage and other hazardous materials concerns on scene should be handled by trained, certified hazmat personnel ([Fig. 18](javascript:fileName='fig18.asp';displayFig2())). All personnel should use extreme caution when attempting to assist an animal in water environments (swift or flood waters require certified training). Emergency personnel should not attempt to assist animals in concrete flumes until public works has been notified to redirect floodwaters.

[](javascript:fileName='fig18.asp';displayFig2())

[Figure 18](javascript:fileName='fig4-.asp';displayFig2()). A pony lifted out of a broken septic tank by firefighters and a hazmat crew using a modified Simple Vertical Lift System. The spread bar is not in view here, but it is necessary to prevent the straps from slipping together, which may cause the load to be lost. (Photo courtesy of Seminole County Fire Rescue Department, Sanford, FL). To view click on figure

Mud provides another aspect to consider in rescue. Often, it is difficult to thread a web strap around the abdomen of a trapped animal unless using a Nikopolous Needle (6-ft piece of 1.5-in conduit bent into a C shape). The vacuum effect of mud on the body and long extremities of a horse can exert more force than even the gravitational forces (weight) of the horse in the mud. The joints may be separated if too much force is used to lift the animal without canceling this vacuum effect. Injecting air or water around the legs and under the animal’s abdomen simultaneously with the lift effort has shown great efficacy ([Fig. 19](javascript:fileName='fig19.asp';displayFig2())).

[](javascript:fileName='fig19.asp';displayFig2())

[Figure 19](javascript:fileName='fig19.asp';displayFig2()). A mud rescue training scenario with the animal in 5 ft of man-made mud. The Simple Vertical Lift Sling System is placed around the animal using a Nikopolous Needle, and an air injection technique breaks the vacuum’s suction on the animal’s body during the lift. (Photo courtesy of Dr. Becker, DVM, Hast, Jeffersontown, KY). To view click on figure

Benefits of the Simple Vertical Lift Web Sling include equipment that is simple to employ, cheap to acquire, and very effective in use. The technique makes the animal feel completely trapped. Usually, this causes the horse to sulk or hang quietly during the lifting procedure, minimizing risk to itself and others. The practical use of the Simple Vertical Lift system has been shown in numerous situations and with other large animals ([Fig. 20](javascript:fileName='fig20.asp';displayFig2())). A problem with implementing the Vertical Lift Sling is that personnel must be trained in its use to maximize safety when working around a trapped or recumbent frightened animal. Initial sedation or light anesthesia of the animal is essential to allow the animal to be strapped in the sling and to prevent it from struggling and injuring itself or the rescuers.

[](javascript:fileName='fig20.asp';displayFig2())

[Figure 20](javascript:fileName='fig20.asp';displayFig2()). The Simple Vertical Lift Web Sling is effective for lifting other large animals such as llamas and cattle. This practice scenario used a trained demonstration llama that is not sedated. (Photo courtesy of Dr. Ginger Bross, DVM, Archer, FL). To view click on figure

There are other specialty issues of which practitioners should be cognizant. First, there is a possible increased chance of shock when combining sedation with rescues, because the veterinarian may not be able to treat the animal until several hours after the incident occurred. Second, this vertical lift system seems to place significant pressure on the abdominal area of the animal; however, abdominal, thoracic, and pulmonary perfusions have not been observed to be significantly impaired in rescued or demonstration animals lifted in this manner for 2 - 12 min (>90 lifts in training scenarios). Pregnant mares have been successfully lifted using this equipment and technique. Contact pressure is minimized when using wider straps for the lift, because they increase the surface area of the contact points on the animal. The Simple Vertical Lift Sling, in conjunction with appropriate lifting equipment, provides a safe and suitable means of short-term vertical lift of large animals.

**Recumbent Transport**

In certain situations, a horse may be unable to support itself on an extremity to walk or to stand in a trailer for transport to veterinary facilities. Alternatively, it may have a neurological disease, viremia, shock, neglect, or other injuries that prevent normal transport of the animal. A safe way to prevent struggling and iatrogenic injury is to anesthetize the horse and transport it recumbent in a trailer ([Fig. 21](javascript:fileName='fig21.asp';displayFig2())). Moving a recumbent horse several hundred feet or even miles to the closest access point of an ambulance trailer is difficult because of the weight of the animal, which can often cause damage to the legs, neck, head, and eyes, and safety concerns for the rescuers (possible injuries from a horse struggling and kicking). It can take 8 - 10 people to move a recumbent horse 20 ft without proper equipment, especially up a hill and in loose soil or sand.

[A Quarter horse mare with a broken pelvis is safely transported out of a stall...](javascript:fileName='fig21.asp';displayFig2())

[Figure 21](javascript:fileName='fig21.asp';displayFig2()). A Quarter horse mare with a broken pelvis is safely transported out of a stall and across the gravel driveway on the Rescue Glide sked. A winch is used to pull the Glide into an equine ambulance for transport to veterinary facilities. (Photo courtesy of Gilder Cantrell, South Carolina Large Animal Rescue Team). To view click on figure

A benefit of the Rescue Glide is that the plastic reduces the friction of the weight of the animal on the ground surface, and therefore, fewer people are needed to move the animal. The tough resilient plastic is flexible, which allows it to move easily over obstacles such as logs and roots or through ditches. It curls up around the animal’s body so that it can be easily fit through a standard stall door or a tight space encountered on a trail. The Glide may be attached to a winch, or the ropes can be pulled by human rescuers or a vehicle (all-terrain vehicle, car, etc.). The use of the Glide prevents iatrogenic injury to the face, skin, and eyes because the animal’s entire body is on top of the plastic. The technique makes a smaller "package" of the animal. This usually makes the horse feel completely trapped, and it tends to sulk and lie still.  
A problem with implementing the Rescue Glide is that personnel must be trained in its use to maximize safety when working around a recumbent, frightened animal. Initial sedation or anesthesia of the animal when placed on the glide is essential to allow the animal to be strapped to the Glide and for the legs to be drawn up close to the animal’s body. In this way, the animal cannot struggle and further injure itself. On four occasions, animals were delivered to a veterinary hospital fully awake, and after one or two attempts, they did not fight the restraints until they were unstrapped. In this way, they seemed to have resigned themselves to being trapped and unable to move ([Fig. 22](javascript:fileName='fig22.asp';displayFig2())).

[](javascript:fileName='fig22.asp';displayFig2())

[Figure 22](javascript:fileName='fig22.asp';displayFig2()). A mare with severed extensor tendons is delivered into the exam room at the University of Georgia Veterinary School Large Animal Clinic. Note that a modified Robert Jones bandage was placed on the injured extremity, which is on the high side and not hobbled to the other legs. (Photo courtesy of Dr. Fred Caldwell, University of Georgia Veterinary School, Athens, GA). To view click on figure

A specialty "packaging issue" that practitioners should be cognizant of is the possible increased chance of shock and/or hyper/hypothermia, because the animal is less capable of thermo-regulating when combining sedation with lateral recumbency for several hours. Abdominal, thoracic, and pulmonary perfusion has not been observed to be significantly impaired in the five animals transported for >2 h each nor in the demonstration animals transported for 10 - 15 min (>90 times in training scenarios). Radial, facial, or other nerve paralysis has not been encountered, but extra padding should be considered for long transport times (excess of 2 h).  
The practical use of the Rescue Glide has been shown in numerous situations including severe limb injuries, neurological compromise, recumbent/unable to rise, severe neglect/malnutrition, and recovery/removal of dead large animals. The equipment has been used at race tracks and riding competition events for transport of animals into ambulances as well as by veterinary rescue response teams in trail-riding accidents, pasture accidents, and trailer injuries to improve their on-scene and pre-hospital care of horses.

**Helicopter Slingload**

Over the last 10 yr, much time and effort has been devoted to the dilemma of horse vertical lift for rescue by helicopter slingloading. Improved sling equipment, improved awareness of safety considerations, and use of the IC system for leadership on-scene have decreased accidents significantly. However, any consideration of helicopter operations is still a last resort technique. There are many simpler, cheaper, less risky, and less dangerous options available to assist with the rescue of a stranded horse in most situations.  
One concern to professional emergency responders is the ever present danger of helicopter operations, irrespective of technique. It is a common point of contention whether helicopter assets should be used for animal victims in general. In a disaster, helicopter assets should be prioritized to assist with saving human lives and may not be available even if prior planning and coordination has been made. Practitioners on disaster scenes should be aware of this fundamental decision in the disaster management arena, because it may influence their choice to treat, rescue, or euthanize.  
As horse owners in our society enter into increasingly close and emotional relationships with their animals, their expectations of the veterinary and emergency rescue professions include saving their horses in what would have been impossible scenarios in the past. Technological improvements in rotary-wing aircraft, equine slings, and SOP related to their use have allowed the consideration of these techniques today. Although most practitioners do not have the equipment discussed herein, familiarity with this SOP will make them capable of better assisting with a rescue attempt of a horse with assets provided by a veterinary school, their state’s Large Animal Rescue Team, or a local Equine Emergency Ambulance service.

**5. Conclusion**

The use of the SOPs presented here represent improved options for the successful extrication and transport of horses trapped during a disaster or emergency. Use of these equipment and procedures requires significant planning, coordination of resources, and personnel training.

**Footnotes**

1. Anderson Sling, CDA Products, Porter Valley, CA 95469, USA.
2. Liftex, Inc., 443 Ivyland Road, Warminster, PA 18974, USA.
3. Wiggins & Associates, Inc. 503 SW Victoria Court, Gresham, OR 97080-9265, USA.
4. Custom Web Slings, New Haven Moving Equipment, 2490 Verna Court, San Leandro, CA 94577, USA.
5. Rescue Glide (modified), Ben McCracken, B & M Plastics, Greenville, SC, 29607, USA.
6. Rescue Glide, J. Silva, Equine Ambulance Services, Methuen, MA, USA.
7. Rescue Glide, CDA Products, P.O. Box 53, Porter Valley, CA 95469, USA.
8. Dormosedan, Orion Corporation, Espoo, Finland.
9. NIBP Monitor V6004, SurgiVet, Inc, Waukesha, WI, 53186, USA.
10. Torbugesic, Fort Dodge Animal Health, Fort Dodge, IA 50501, USA.
11. Airshore International, Suite 3, 19695 92nd A Avenue Langley, British Columbia V1M3B3, Canada.

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