

STANISLAUS CONSOLIDATED FIRE PROTECTION DISTRICT POLICIES & PROCEDURES

ARTICLE: C-75
SECTION: Operations Division
DATE: 10/10/2011
SUPERSEDES: New
TITLE: Aerial Fire Ground and High Angle Rescue Operations

PURPOSE

To provide basic guidelines and procedures to members of the SCFPD for using an Aerial Ladder Apparatus on Fire Ground and High Angle Rescue Operations.

OVERVIEW

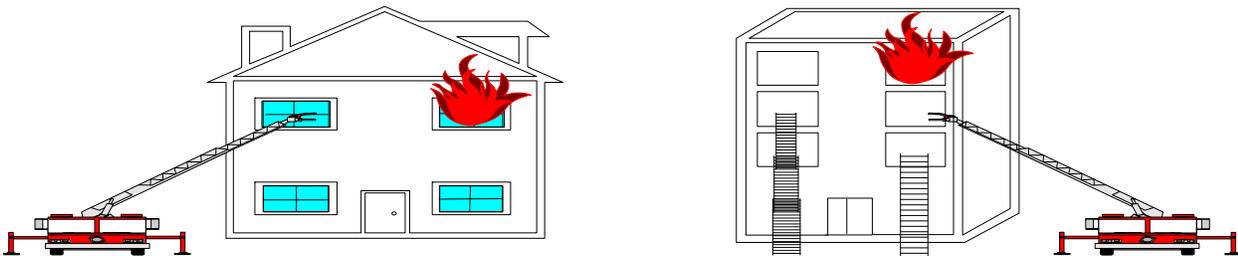
AERIAL (TRUCK/QUINT) COMPANY FUNCTIONS

Aerial Ladder tasks may include: forcible entry, rescue, ventilation, access & egress with possible ground aerial ladders, aerial standpipe, elevated streams or aerial ladder pipe, pulling ceilings, walls, or floors, securing utilities, loss control operations, overhaul, or any combination of these tasks. Aerial ladders carry extrication equipment, air bags, metal cutting, and other specialized equipment.

Aerial Apparatus crews think not only of life hazard, fire location and spread; but also access & egress, window type and positions, forcible entry, building height, building construction, roof type and load, ground ladder use, apparatus placement for rescue, egress, defensive operations, collapse, ventilation profile, and the type and location of utilities.

The aerial ladder and its operation is just one of the many tools used in the functions of an Aerial (Truck/Quint) Company. Aerial ladder personnel need to be familiar with all of the tools, their use, limitations, and maintenance.

Due to the versatility of an Aerial Apparatus (Truck or Quint), first arriving engine companies should always leave room for the Aerial for all fires on Single Family Homes as well as Commercial Occupancies.



PROCEDURE

SETTING UP THE AERIAL LADDER

The most stable position is in line with the chassis of the truck. The least stable position is to the side of the truck. Always follow the manufacturer's recommendations for the limits, angles, and loads for your truck. Become familiar with charts and graphs on the truck and in the manufacturer's manual.

Keep the truck as level as possible. Limits drop rapidly as the turn table is moved from level. Each aerial ladder has rated loads:

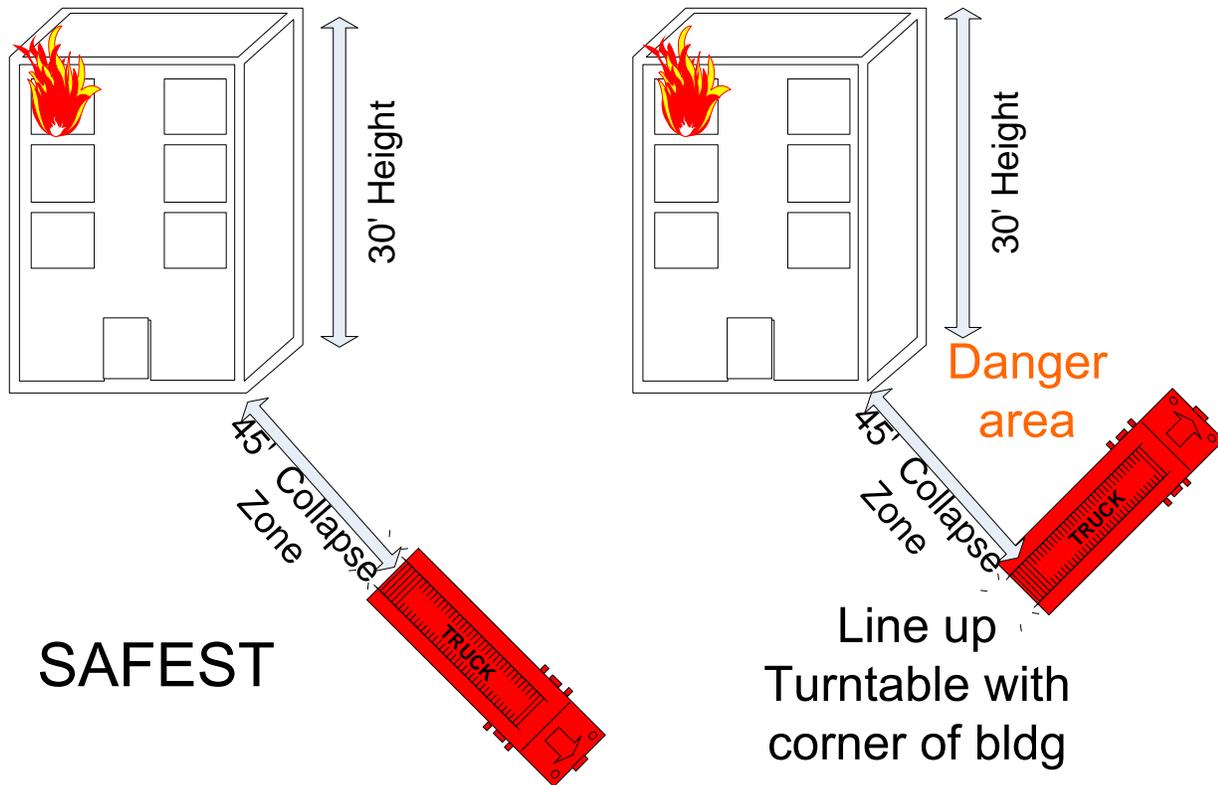
- Distributed load or the weight for each section of the aerial ladder will vary with the angle of the aerial ladder.
- Tip load or the load that takes in account personnel and equipment at the end of the fly section.
- Total load limit varies with the extension and angle of the aerial ladder.

Know your aerial ladder's limitations. You can be under the total load and still exceed the distributed or tip loads and cause damage or failure of the aerial ladder. Load graphs and charts are on the pump panel, turntable, and in the in the operator's manual.

Positioning the Aerial Apparatus

- Stop the truck on as level of an area as possible. Take into account:
 - building stability, height, construction, collapse possibilities, fire involvement, overhead wires, obstacles, and your mission
 - for fire calls think possible defensive position and rescue
- If on an incline, pull into the incline so that the rear end is lower than the front end, when the outriggers are deployed, the truck will become level
- Set brakes
- Engage PTO and Fire Pump (when necessary)
- Chock the FRONT Wheels. Chocking the front wheels will drive the chocks into the ground to keep vehicle from lurching forward when outriggers are deployed.
- Set outriggers and plates
- If parked parallel on a slope, extend the outrigger on the uphill side first, then extend the outrigger on the downhill side until the truck is level
- Pin Waterway to Appropriate position (rescue or fire attack)
 - Ladder is always stowed in Rescue Position
- Position Aerial Apparatus at corners of buildings so that two sides of the building are accessible and to safeguard from building collapse
- Keep long axis of the truck inline with corner of building with cab placed distal to corner
- Keep Apparatus out of Collapse Zone

Collapse Zone: 1 ½ times the height of building



Laddering Buildings

From the turntable or pump panel

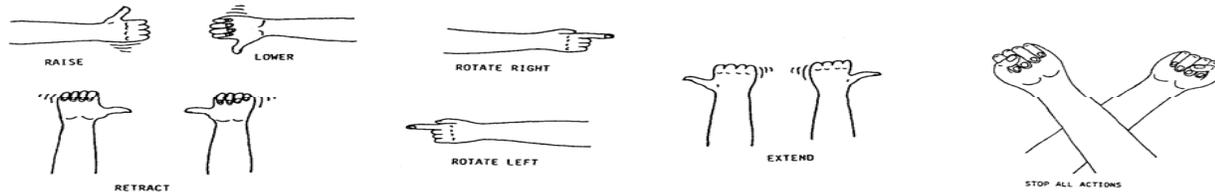
- Pick the target for the aerial ladder, plan the path, and consider obstacles.
- Switch on the fast idle for faster operation.
- Elevate the aerial ladder to just above the target angle.
- Rotate aerial ladder to target.
- Extend aerial ladder to desired length.
 - 3-5 rungs past a parapet
 - 1 rung past a window sill
- Lower aerial ladder to target.

Aerial ladder is designed to operate in a cantilever position (unsupported). When lowering into a parapet, window sill, etc., keep 8"-10" distance so the aerial ladder and/or waterway will not touch the building when loaded. As the aerial ladder is loaded it may accidentally touch the building, keep the beams as perpendicular to the target as possible to prevent twisting of the aerial ladder. **Never let the Waterway come in contact with any structure.** The Ladder Operator shall ensure that appropriate distances are maintained to protect the waterway.

Dual controls can be used with experience and skill, however, this should not be the normal procedure but used in special circumstances.

When approaching the target, it may be necessary to switch the fast idle off for a smooth, controlled approach. A spotter or lookout person should be used to watch the clearance of the waterway, nozzle, cables, etc. from a different perspective than the turntable operator. **Always use proper hand signals.**

Hand Signals



Stowing the Aerial Ladder

- Raise the aerial ladder clear from the building.
- If water has been flowed through waterway, **FULLY** raise ladder to 76 degrees and drain waterway before lowering or retracting the ladder. **NEVER LOWER OR RETRACT LADDER BEFORE DRAINING WATERWAY.**
- Retract the aerial ladder.
- Rotate the aerial ladder over bed position.
- Lower the aerial ladder to the bed. (Fast idle off on approach)
- After bedding, Fast Idle on and apply pressure to the top of the cylinders with the "down" control to lock the aerial ladder down so it doesn't bounce while driving, 1000 psi is adequate.

The fast idle switch will make the aerial ladder move faster and controls more sensitive. Depending on the operator's skill, it is advisable to have the fast idle off when raising the aerial away from the building and when bedding it. When the fast idle is off, the aerial ladder moves slower and the controls are less sensitive, making fine adjustments easier.

Critical points to Avoid:

- Low angles when loaded, especially rotation. Stay within the safety margins posted at pump and turntable.
- Lateral force.
- Twisting force (loading one side).

Safety Factors:

- Avoid moving the aerial ladder with personnel on it in normal operations.
 - It is permissible to make small movements with ladder during ventilation operations, making fine ladder adjustments, or when performing a rescue.

- Ensure that all feet are clear of rungs when extending/retracting (Stay to the end of the Red Zone on the ladder)
- FULL PPE with SCBA and Radio is required at all times while working on ladder for Fire Suppression. Helmet and Gloves are minimum for Non-Suppression activities.
- Ladder Operator shall ensure that personnel are secured to the ladder with a ladder belt and webbing (webbing is optional).
- Fall Arrestor should be considered for novice ladder climbers or when climbing in slippery conditions. Fall Arrestor can also be used for victim removal.
- ALWAYS use Proper Hand Signals in conjunction with Verbal Commands through the Voice Activated Microphone on the Ladder, or with Fire Department radio.
- Ladder Operator shall repeat command over intercom system or radio immediately prior to making any adjustment to aerial ladder.
- Except for stokes basket operation, never use the aerial ladder as a crane.
- Load the aerial ladder according to the charts.
- Do not use the tip as a ram of any kind.
- Keep at least 10' distance from any wires.
- Do not use when wind is 35 mph or more.
- Always keep an operator near the ladder controls.

Reach

Practice with positioning will quickly teach you your aerial ladder's reach. The height of the aerial is measured from the top rung to the ground at full extension with a 76 degree angle.

Calculate the reach of the aerial ladder for different buildings. You need to know the height of the building and how far away the turntable is positioned from the building. The Pythagorean Theorem is a good rule to follow: $A^2 + B^2 = C^2$. By substituting B as the building height and A as the distance from the building to the turntable, then C will have to be the length of the aerial ladder to make the reach.

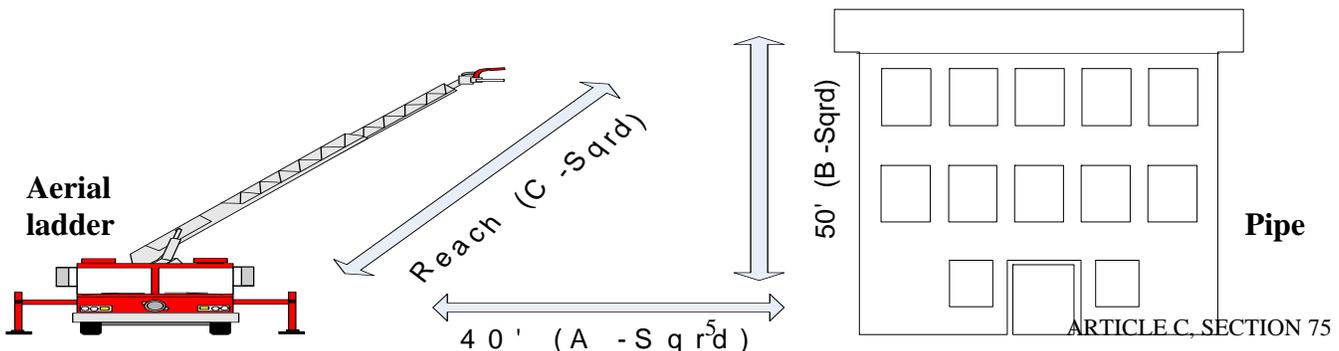
Example: If the building target is 50 feet high and the turntable is 40 feet away from the building, then:

$A^2 + B^2 = C^2$

$40^2 (40 \times 40 = 1600) + 50^2 (50 \times 50 = 2500) = C^2$

Or

$1600 + 2500 = 4100$ (so, find the square root of 4100 which is approx. **64 feet**)



The Aerial Waterway on the 2000 E-One HP 75 can be pumped directly from the onboard pump at its rated capacity. In the event that the pump is out of service or is supplying other handlines, the aerial ladder can be pumped independently by another engine company through the rear inlet-outlet. Always ensure that the wheel is turned to Waterway Open when flowing water to the ladder pipe. The rear inlet-outlet shall only be in the closed position when operating in intake mode.

The aerial ladder's pre-plumbed waterway has a mounted automatic fog nozzle that can be operated at the pump panel, turntable, or from the ladder. The fog nozzle can be removed and exchanged with a stream straightener and smoothbore tips. For aerial ladder pipe operations the waterway pin must be moved from Rescue mode so that the nozzle is attached to the end of the last fly section.

Extend to the height needed for the aerial ladder pipe. Stay within the manufacturer's recommendations. Once water is flowing do not extend or retract the aerial ladder. This may damage the waterway and could lead to failure of the waterway.

- Nozzle pressures: 80 psi for the fog and smoothbore nozzles.
- Always refer to the Rated Load Charts at the Pump Panel or on the Ladder when personnel are working on the aerial.
- The weight of the water is a distributed load and part of the total load.
- The firefighter at the nozzle is part of the tip load and part of the total load.
- Rotation is done **s l o w l y** to avoid lateral force.
- Nozzle sweep is also done **s l o w l y** to avoid twisting force.
- Force of the nozzle reaction is approximately 1/2 of the GPM.
 - The exact formula is $1.57 \times D^2 \times NP$.
- Weight from water discharged can cause failure of upper floors if not drained. Keep track of the total amount of water (check the digital gauge that gives GPM and total gallons) or keep track of the time. Inform command if large amounts of water accumulate on upper floors or flat roofs.
- Handlines can also be used off of the aerial while flowing an aerial ladder pipe.
 - Be aware of the added weight and secure hoses to the aerial ladder.

Approximate Stream Reach:

- 1 3/8" Smoothbore 84' 500 GPM
- 1 1/2" Smoothbore 88' 600 GPM
- 2" Smoothbore 94' 1000 GPM
- Fog on Straight Stream 90' 1250 GPM (Fog Nozzle flows 350-1250 gpm)

Optimum saturation is getting 90 percent of the GPM inside a 15" circle at the seat of the fire. This may not always be possible. Attempting to extend the reach by over-increasing pressure will cause the stream to break up rapidly.

Due to the large water flow demands, each aerial ladder pipe should have its own hydrant and/or supply engine attached (if necessary) with one 5" line, or two 3" lines. If being supplied by another engine, the two Engineers shall communicate the appropriate pressure needed based on elevation, nozzle type and size, and supply line size and length.

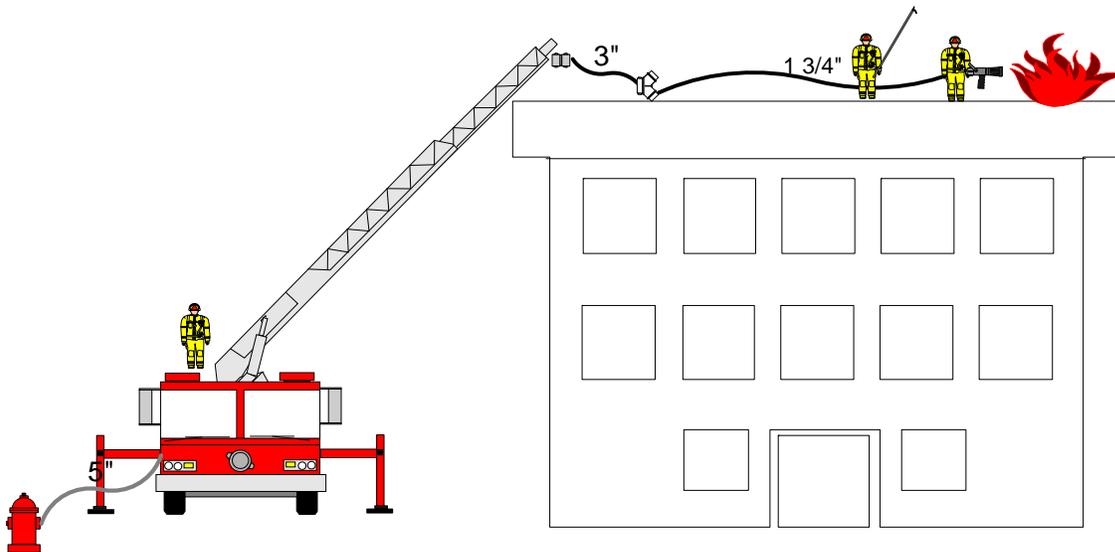
The Aerial Fog Nozzle can also be operated manually using the attached wrenches at the nozzle connection. This shall be available in the event of mechanical/electrical problems with the nozzle while on the scene of an incident.

Aerial Waterway as a Standpipe (Flying Standpipe)

The pre-plumbed waterway is a ready made standpipe that can be utilized by removing the fog nozzle at the tip. This procedure can be used to:

- Take handlines aloft through windows or the roof.
- Stretch a horizontal standpipe on an upper floor with a wye and bundles.
- Supply monitors on adjacent roofs for use on the fire building.

Prior to raising ladder to building, connect 3" hose bundle with attached 2 1/2" – 1 1/2" gated wye to waterway and secure all necessary equipment on ladder that may be needed for firefighting activities. This includes at a minimum, but not limited to: high-rise hose bundles (1 or 2) and saws. Personnel must be in Full PPE with SCBA and Radio prior to engaging in any firefighting operations. Fire attack crews must coordinate efforts with Engineer for adequate pressure to maintain 100 psi at fog nozzle.



Ventilation

Saws, axes, pike poles, and rubbish hooks may be secured to ladder before climbing for safety purposes. Refer to Ventilation Policy and Procedure for effective ventilation techniques.

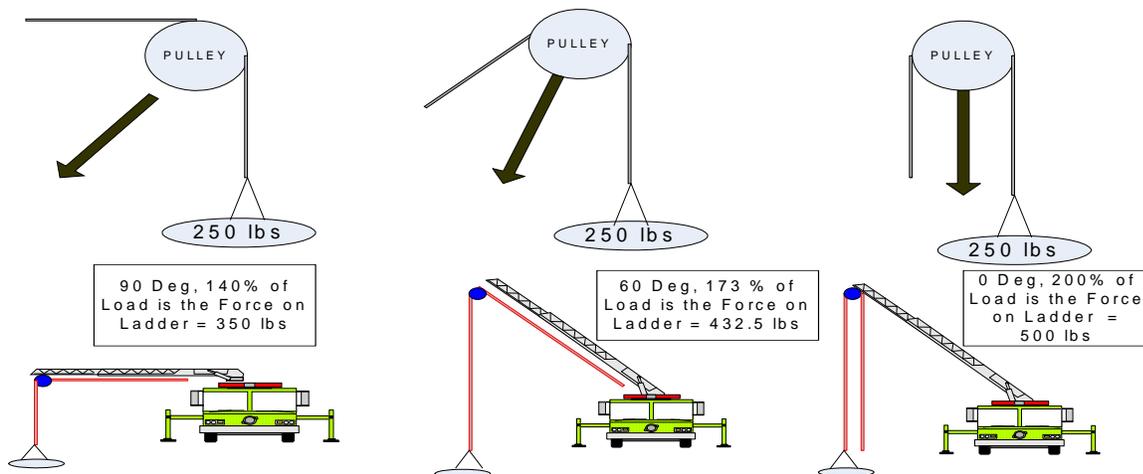
RESCUE LITTER (STOKES BASKET) OPERATIONS

This is an operation to get a person from an elevated position to the ground by using the aerial ladder to move them in a Rescue Litter suspended beneath the aerial or using the aerial as a slide.

Points to remember in this operation:

- Using the Ladder as an Elevated Anchor for a Raising/Lowering System should be considered as a last-resort option due to stresses that are exerted on the ladder's fly sections. Always try to use structurally sound existing anchor points first.
- Weight of the Rescue Litter, hardware/software, and the patient become total tip load.
- Use the ladder extension and angle according to the manufacturer's limits.
- Never SHOCK LOAD the ladder.
- To stay within a safe range, use the following as Rules of Thumb:

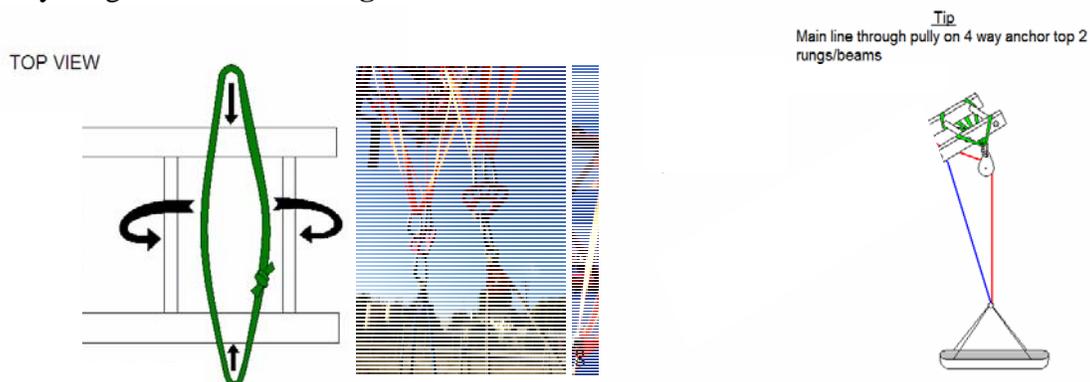
90 Degree angle – 1 ½: 1 ratio **60 Degree Angle- 1 ¾: 1 ratio** **0 Degree – 2:1 Ratio**



Rigging the Ladder

HAUL LINE: 4-way load sharing anchor on the 2 end fly rungs and beams. **Rungs-alone are not to be used as a sole anchor.**

BELAY LINE (SAFETY) 1 Rung-set down from Haul Line Anchor. 4-way load sharing anchor on the 2 end fly rungs and beams. **Rungs-alone are not to be used as a sole anchor.**



Apparatus Anchor Points: Outriggers, Tow Hooks, and Tires

Hardware Weight Considerations

Red Pulley: 2 Lbs

Gold Pulley: 1 lb

Blue Pulley: 1 lb

Stokes Basket (metal): 31 lbs

Carabineer: 1 lb

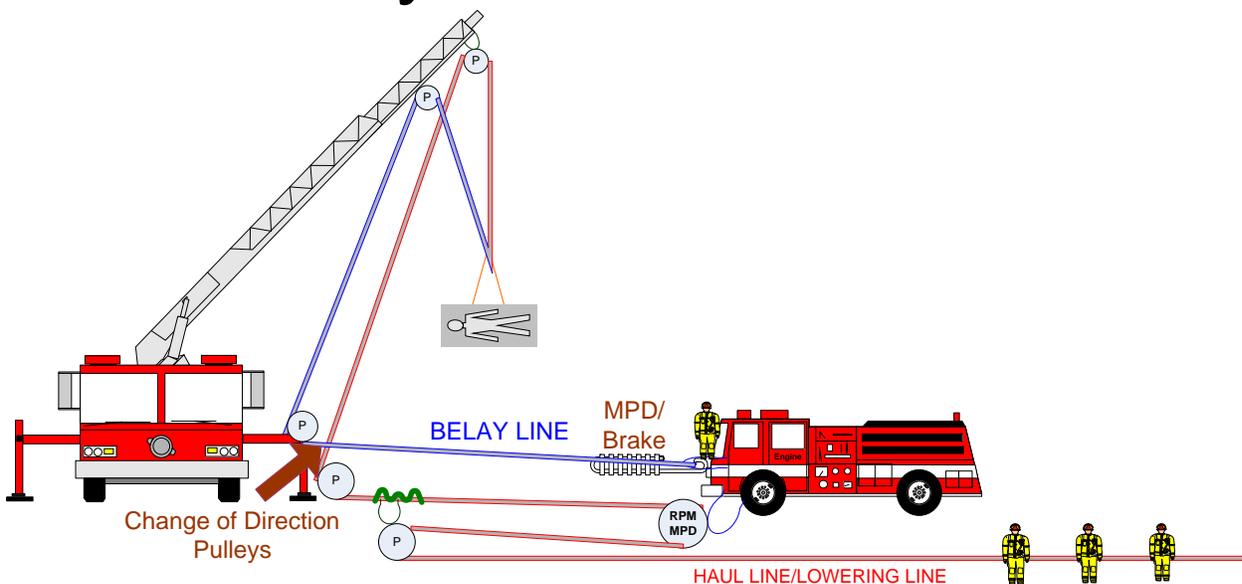
Rule of Thumb: Total weight for Hardware/Software, Stokes on Haul and Safety Line: **50 lbs**

The Rescue Litter can be maneuvered by raising and lowering the aerial and rotating the ladder. Extension/retraction can be used also to maneuver the litter. When the ladder is in stationery position, the Litter can be lowered using the Rappel Rack or Multi-Purpose Device (MPD) with a firefighter tending the tandem prussic belay. A (tag) line may be attached to Litter basket and controlled by a firefighter on the ground (or roof) to control the rescue litter suspended beneath the aerial ladder.

***Haul Line and Belay Line change of direction pulleys must always be kept inline with the ladder to prevent twisting of the aerial ladder.**

Example of a Raising-Lowering System. This drawing is not considered to be standard practice, only to serve as a possible option.

3:1 Raising-Lowering System



LADDER SLIDE

The Aerial Ladder may be used as a ladder slide when there is a need to move a patient from the roof or any elevated area to the ground. This procedure may be used with the Plastic (orange) Rescue Litter or a SKED. The following is needed to perform this operation:

- Minimum of six trained personnel to facilitate the rescue
- Life Safety rope for maintaining control when lowering patient down ladder
- Tag Line (utility rope) to assist in pulling the litter (if needed due to low angle/friction)
- Carabineers, webbing, and braking devices to safely move patient to ground

LADDER SLIDE

Hardware/Software at Tip

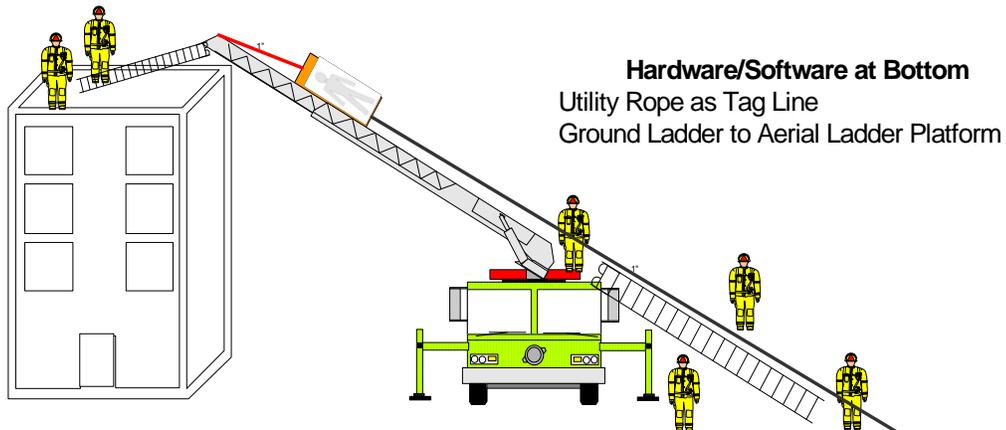
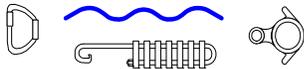
Life Safety Rope

Carabineer

Braking Device: Rack, 8 plate, or prussics

Webbing

Roof Ladder from roof to Aerial



FALL ARRESTOR

The ASAP® Mobile fall arrest device is available as an optional safety device for trained fire personnel to use when working in slippery conditions on the aerial ladder. The device is also an effective tool to use in conjunction with a victim harness for assisting rescued victims that are able to climb down a ladder. The fall arrestor shall always be used when non-trained aerial ladder climbers ascend/descend the aerial ladder during training exercises.

- Stops a fall, a slide or uncontrolled descent
- Works on vertical or angled rope
- Moves up and down along the rope without manual intervention
- Easy to install and remove at any point on the rope



1. Attach rope to Right Side (Captain's side) end of Ladder Beam prior to raising and extending ladder



2. Raise and Extend ladder to desired length

3. Attach rope to the beam on the base of the ladder with a double-wrapped prussic cord as rope-tensioner



4. Attach Fall Arrestor to rope and attach ladder belt, or victim harness to carabineer



5. Climb up and down ladder freely.

6. In the event of a fall, arrestor will lock into place, reset arrestor by moving it up on the rope.

SUMMARY

All personnel working on or around the Aerial Apparatus shall be familiar with all aspects of its operations and capabilities. Always utilize safe practices and regularly review the various functions associated with the aerial ladder apparatus in order to ensure effective and efficient mitigation of emergencies.

Written by: Captain Jeff Frye

Approved by: _____

Date: January 6, 2012