COMMACK FIRE DEPARTMENT TRAINING DIVISION

Commack Fire Department

CFD Probationary Firefighter Basic Lesson Plan

Topic: Handlines Class - 1

- **Level of Instruction**
  - Probationary FF
- **Location**
  - Station 2 Training Facility
- **Equipment Needed**
  - 1 Engine
  - 2 - 150'1&3/4" lines
  - Straight Bore Nozzle
  - Fog Tip Nozzle
  - 10 Road Cones
- **Instructors needed**
  - 3 instructors
  - 1 pump operator
- **Resources Needed**
  - CFD Probationary Firefighter Lesson Book
- **Terminal Objective**
  - Probationary firefighters given both lecture and hands on training will be able to advance a charged handline in a structure fire.
- **Enabling Objectives**
  - Probationary firefighters will know the difference between the various size hose and what it's used for
  - Probationary firefighters will learn the differences and uses for various nozzle types

- **Lesson Outline:**
    - Set up engine on the hydrant closest to sta.2
    - Set up 3 lanes with cones 20 feet apart from engine towards sump
    - Discuss the different nozzles and their primary functions on the fire ground
    - Discuss and go over the difference in attack lines: booster, forestry, 1 ¾", and 2 ½" lines.
    - Discuss the importance of being able to advance with a handline through a fire building
    - Discuss the engine companies' responsibility.
    - Perform the "Knee Slide" without narration at regular speed
    - Perform the "Knee Slide" at slow speed explaining each step
    - Have students perform the "knee slide" until they get it right
    - Perform the "Hip Grip" without narration at regular speed
    - Perform the "Hip Grip" at slow speed explaining each step
    - Have students perform the "Hip Grip" until they get it right
    - Perform the "Two FF Advance" without narration at regular speed
    - Perform the "Two FF Advance" at slow speed explaining each step
    - Have students perform the "Two FF Advance", switching positions until they get it right
    - Break students into three groups have them practice all three techniques in a rotation in the lanes made with the cones until they can perform each technique without instruction
    - Recap all aspects of the class
- **Summary**
    - The ultimate goal for the class is to get students comfortable with handlines and advancing them. Stress the importance of teamwork at all levels and the importance of each position working together to move the line through a structure.

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Handlines

- **Introduction**
  - The first handline is, without question, the most important lifesaving tool at a structure fire. Controlling fire spread and stopping smoke production save an untold number of lives every year. While smoke has its greatest impact on civilians, it is the fire itself that most threatens firefighter safety. Stopping the generation of smoke and toxic gases especially asphyxiating carbon monoxide is the best means of safeguarding civilian lives. Firefighters, equipped with SCBA and able to operate in smoke, are more concerned with rollover and flashover. Controlling fire growth to reduce the potential for burn injuries is how the first line best protects firefighters. - LT Andy Fredericks FDNY, LODD 9/11/2001.
    The handline is considered a fire attack line. It is comprised of the hose itself and the nozzle. It ranges in diameter from 2&1/2" to 1". The two sized lines we and most departments across the country that are used for interior structural fire attack are the 2&1/2 and the 1&3/4 lines. Anything smaller is usually used for smaller fires like rubbish and brush and is referred to as forestry hose or booster line. The bigger the diameter the hose, the more gallonage of water you are going to get from it. There are many ways to stretch a line. There are many ways to pack the line on the rig and there are many different line and nozzle combinations out there. For the purpose of this lesson, we will be discussing only what we do and have here in Commack. We will also be talking about the 4 different positions in the engine company. Handlines can be packed on engines many different ways but in Commack we try to standardize the way they get packed on all the rigs. Unfortunately, we don't have the same exact engines in all the stations so there may be some variations, but the way it gets packed is the same, it just may be configured differently on the truck. This means you will have to learn a few different loads (how it gets packed) on the truck. This lesson will cover all of the aspects of handlines and engine company operations

- **The Hose and Nozzles**
  The following section will contain descriptions and information about the hoses and nozzles we carry. There are a few different hoses and a few different nozzles that we use. The reason for different size hose is for different type fires. The smaller the inside diameter of a hose, the less gallons of water you will get out of it. Which makes the next point fairly obvious, the bigger the fire, the bigger the hose you are going to need. So, you need to familiarize yourself with all of them, their purpose, and their differences.
    - Nozzles
      Not all nozzles are created equally. There are a few different types of nozzles that we use in Commack. No matter which type of nozzle we talk about, the components are all basically the same. Each nozzle or knob has a tip, a main body and the bail (handle). The main nozzle we use for attack lines at structure fires is the Chief XD made by Elkhart Brass with a 7/8" straight bore tip. This nozzle is the most versatile in the business these days. In structure fires we always want to use a straight or sometimes known as a solid bore tip. The reason for this is with a solid bore tip, you get much bigger droplets of water which doesn't convert to steam as readily as smaller droplets of water. These large droplets cool the environment much faster than smaller droplets. When heat converts to steam it changes the fire dynamics and thermal layering of the fire and the room with the steam now mixing into the entire environment. When this happens, all the heat that was above a certain level in the room, now drops to the floor. This causes you to get burned sometimes even with gear on, but it also seals the deal for any victim that may be laying in the general vicinity, they don't have gear on and don't stand a chance. The main difference between a straight bore nozzle and an adjustable pattern or fog nozzle is that the straight bore is a solid stream, or bore, of water and the adjustable nozzle when used on a straight stream pattern is mixed with air and therefore gives you those smaller droplets. Another problem with the adjustable nozzle is, because the stream gets mixed with air, it has a tendency to draw more fresh air into the room behind you, air entrainment, so if you are not at or extremely close to the seat of the fire, this extra air entrainment could give the fire more oxygen that it needs to not only survive but grow as well.
      The following is a list of them and their applications:
      - John Bean Nozzle (Fig.1)
        This nozzle is primarily used as a brush nozzle on booster line (see hose section). It can also be used for small rubbish fires as well. It is only carried on the brush truck, 2-11-10.

- The TFT (Task Force Tips) Multipurpose Fog Nozzle (Fig.2) This nozzle has been mostly phased out in larger diameter such as 1&3/4 and 2&1/2 lines however there are still a few on trash lines on some of the engines. You will mainly find this nozzle on booster lines and forestry hose. This is an adjustable pattern nozzle that can either be used on a straight stream or as fog pattern by rotating the tip of the knob left or right. Left for fog, right for straight stream. This type of nozzle should only be used on exterior operations such as car fires, brush, and rubbish fires. There are two distinct disadvantages to using this nozzle in a structure fire.

    1. Small droplets of water = large volumes of steam. Smaller droplets of water convert to steam more readily and do not cool the fire environment as quickly as large droplets of water that come from a straight bore tip.
    2. If you come up short, you cannot add a length at the tip without shutting the line down completely at the pump panel.
    3. The fog tip is sensitive and as you are crawling you could accidently rub/bounce the nozzle on the floor causing it to spin and making I a wide fog pattern, Should this happen and you open the nozzle up on a wide fog, you are going to steam burn every person in the area including yourself, your crew and any victim that may be laying nearby.
    4. Less knockdown power meaning both of the fire and the sheetrock walls and ceilings
    5. Higher pump pressures. The TFT nozzle must be pumped at a higher pump pressure, to get the gallonage needed which makes it harder to handle, gives you more nozzle reaction, which makes it harder to handle as well and you can run the risk of the pump operator over/under pumping the nozzle because he's unaware that its on there

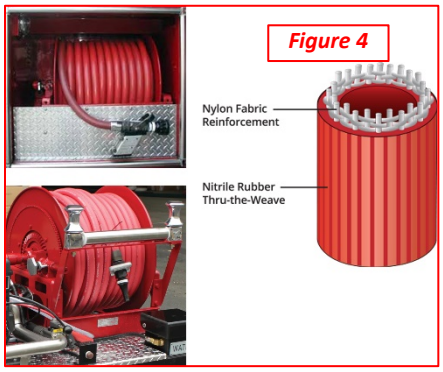
- The TFT and or any adjustable fog nozzle has its place in the fire service. But its best used on car fires and rubbish fires. It *can* be used inside a structure fire in a pinch, but it is definitely not the weapon of choice.

- The Chief XD Straight Bore or Fog Tip (Fig.3) You can put either a solid bore tip on it, or you can unscrew that and put a fog tip on it should you need it. Another advantage to it is the pump pressures do not change when you change the tip, which is one less thing for the pump operator/chauffeur has t think about. You also have the ability with this nozzle to shut down the nozzle and add a length of hose to it with another nozzle to extend a line without having to shut the water off at the pump.

- This nozzle *IS* the weapon of choice for structure fires, no question. It gets pumped at a lower pressure making it easier to handle without sacrificing gallons per minute delivered. The 1&3/4' nozzle gets a 7/8" tip screwed onto it and gives roughly 168 gallons per minute. The 2&/14 gets a 1&1/8 tip on it and gives you roughly 250 gallons per minute. It's a no brainer. The knockdown power of a 2&1/4 with a solid bore of water emanating form its orifice is something see. Fires go out very quickly with both of these size lines.

o Hose

- Booster Line – (Fig.4) Is a single jacketed rubber house with an inside diameter of 1 inch. The couplings use a special spanner to loosen and tighten. It is found on some booster reels carried by some engines. It is also carried on 2-11-10, the brush rig. Its primary purpose is for use on brush fires and small rubbish fires where a large volume of water is not needed. Booster line does not have to be disconnected from the reel in order to charge it with water. It is connected to the reel and water comes from the pump right to the reel. It is a stiff rubber hose that cannot be packed folded and packed, so that is why it gets rolled up on a reel. The sections of this hose come in anywhere from 25',50' and 100' lengths. Note: Booster line and 5' supply lines are the only lines we have that are single jacket. The nozzles that can be used on a booster line can be a John Bean nozzle, which is also used for chemical tree spraying (Fig.1), a standard fog nozzle or straight bore nozzle with a ¾" or ½" tip.



- Forestry Hose – (Fig.5) We have two types, a cloth covered double jacket and a rubber reinforced single jacket hose. Both types have a 1” inside diameter. The couplings are like any of the normal couplings on the bigger attack lines. It comes in 25’,50’ and 100’ sections like the booster line but mainly we have 100’ sections on the rigs. Like the booster line, although you can fold it, gets rolled up on a reel on the rigs that carry it as well. The reason for this is you can fit more of it on a reel than you could if it was packed conventionally like other attack/supply lines. Its primary use is on brush fires and small rubbish fires. The essential difference between booster hose and forestry hose is, forest hose has to be broken down and connected to a discharge on the engine. The nozzles that go on it can be a 1’ fog tip nozzle or a 1” straight bore nozzle with a ¾” tip. The main advantage of forestry over booster is its lighter, more flexible and when un-charged, lays flat on the reel allowing you get a large number of lengths on the reel.

- The Inch and Three Quarter – (Fig.5) is the bread and butter, standard attack line for a residential structure fire. The *only* time you would pull a 2&1/2 would be if there was a large volume of fire present on arrival. As of the time of the writing of this lesson, the manufacturer of hose we use is Key Hose and the models of 1&3/4 hose we use are Tru-ID and ECO-10. The reason we use two models is because we are phasing out the eco 10 model as they go bad during hose testing, for the TRU-ID. It is a stiffer, tougher hose that has a tendency to kink less lowering your chances of water loss due to kinks. Also, the inside diameters are different, TRU-ID has a true 1.75” inside diameter whereas the ECO-10 actually has a 1.88” inside diameter. So, at least the lead length of every interior attack line is the TRU-ID 1.75 and works best with our straight bore nozzle with a 7/8” tip. There could be more lengths of TRU-ID depending on how many lengths of ECO-10 went bad in previous hose tests. Both of these models are a double jacketed hose. The nozzle that

gets used on this hose is the above-mentioned Elkhart Chief XD. For structure fires we want to use this nozzle with the straight bore tip, for car fires and anything else, you want to use the fog tip on it. All the first attack lines on all the rigs have straight bore tips on them. The only line on the engines with a fog tip on it would be the trash lines in the front bumper on some engines and in the lower side compartments on the older engines and booster/forestry reels.
This combination delivers 168 gallons of water per minute.
The inch and three quarter is the most often used and most versatile line for the fire service making it an absolute workhorse

- The Two and a Half – (Fig.7) We call it the 2&1/2 but like the 1&3/4, the lead length is made up of TRU-ID hose which actually has an inside diameter of 2.25". Some people now call it the 2&1/4 but old habits die hard, so if you hear it referred to either way, they mean the same thing. The rest of the lengths are ECO-10 and will be phased out as they fail hose testing. Big fire, big water. The 2&1/2" attack line puts out a massive amount of water, 250 gallons a minute. We use 2&1/2 as the primary attack line for commercial structure fires. But when we have a large volume of fire in a residential dwelling, it can be pulled also. It is a beast of a line and can be difficult to handle but the more you train with it, the easier it will be as you will learn some tricks to handling it. This line also gets a chief XD Straight Bore nozzle.

Figure 7

- Engine Company Responsibilities
  - "If you put the fire out in the first place, you won't have to jump out a window." – Andrew Fredericks, FDNY LODD 9-11-01. Andy Fredericks wrote a ton of articles for Fire Engineering and Firehouse Magazine along with many other publications, he also taught engine company classes at the fire academy upstate and at just about every firefighting convention across the country be fore he perished. Every article he ever wrote has been compiled in a PDF by Gary Lane, it's called "The Book of Andy". This *book* is on our website and some key articles have been put together in the back of this lesson (APPENDIX A) that are a must read when it comes to the engine company. He was one of the brightest minds in Engine company operations the fire service has ever had and in his death, we lost more than that books worth of knowledge for sure.
    The engine company can take good a job and make quick work of it, making everyone look great but, it can also take a small job and make a conflagration out of it making everyone look horrible.

The engine company is responsible for putting the fire out. Is it that simple? Yes, it is. However, when you look at what the engine has to do to accomplish this goal, its not a simple task.
Each arriving engine company has a different task. The following is a list tasks that need to be accomplished by the first and second due engines in order:

- 1st due Engine
    1. Pick up a hydrant (whenever possible) on the way in to the scene
    2. Hook that positive water source up to the truck
    3. Stretch an attack line
    4. Advance the line into the fire
    5. Put the fire out
- 2nd due Engine
    1. Ensure that the first due engine has a positive water source (a working hydrant), and it is connected to it
    2. Ensure that the first line is properly stretched and placed, meaning making sure it's connected to the engine and checking and chasing out all the kinks
    3. Essentially, ensure that the 1st line is in operation
    4. Stretch a back-up line

"A working nozzle on the end of a hoseline in the hands of an experienced nozzleman, could help save 2, 10 maybe a hundred lives, civilian and firefighter alike" Andy Fredericks again. What he's trying say is do your job, put the fire out, its important, arguably the most important job on the fire ground.
The engine company must work as a team. The nozzle doesn't get to the seat of the ire without the officer directing, the back-up man feeding line around turns, the control man getting that hydrant and feeding the attack line in the door. In engine company operations, the saying "you're only as good as the guy next to you" is never more appropriate.

- Each engine company is ideally comprised of a chauffeur, officer, nozzle, back up and control fire fighters. In a perfect world these positions would always be filled. But were not the FDNY nor are most of the fire departments around the nation. Most paid departments only run 3 ff engine companies because they can't afford to pay for this kind of staffing, and in the volunteer fire service, you never know what you're going to get. For the purposes of this lesson, we will talk about the positions in the ideal situation. Just understand that you may be tasked with doing multiple jobs in multiple positions at any given time, so no matter what, you need to know every position and its responsibility like you know the pledge of allegiance. The following is a list of positions on the engine and their responsibilities:

    - <u>The Officer</u> – The officer of the engine is responsible of making sure everything is getting done. But on top of that, he's responsible for some tasks of his own.

1. The engine boss needs to do a 360-degree size up catching at least 3 sides of the building as they pull up so that he can get a look at the conditions all around the building. When he gets off the rig, he needs to get a look at any sides he may have not seen
2. Estimate the stretch. Estimate how many lengths of hose the nozzle and back-up FF's should pull to get to the seat of the fire and add 1 length, and let them know
3. If possible, find the fire before the line enters the building, either by going in a little or using the TIC or both
4. Use the TIC to help lead the team to the fire
5. Monitor conditions heat/snoke and tell the nozzle firefighter when to open up the line and when to shut it down.
6. Once water is applied to the fire, let command know and call for ventilation

- The Chauffeur - Drives the rig to the scene but that's only half the battle
    1. Know where he/she is going
    2. Spot the hydrant on the way in
    3. Stop and pick up the hydrant should it so be ordered by the officer
    4. Put water in the attack line. This is the number one priority! Hook the supply line up to the engine while the nozzle and back up ff are stretching the line is great if there is time but getting water to the nozzle is most important.
    5. Hook up your supply line

- The Nozzle Firefighter – bring the nozzle to the fire
    1. Estimate the stretch. Everyone on the crew should estimate the lengths of hose needed to get to the seat of the fire. If the officer tells you a different number of lengths you had in your head, do what they tell you, they likely have seen something you have not
    2. Grab the nozzle and appropriate folds off the rig, take 4 steps back away from the rig, step to the side and allow the back-up ff to take his loops and they both proceed to the entry point. *Note: if your company uses a flat load with no service loop, you will flip the load onto your shoulder as you take your folds off.*
    3. Places the folds and the service loop (whichever type your company uses) on the ground. Depending on the service loop length your company uses depends on where you place your folds, either closer to the entry leaving the nozzle and first coupling where you dropped it, or away from the entry bringing the nozzle and first coupling towards the door. (You will be shown in hands on portion) Having the nozzle and 1st coupling gives you 50' of hose at the door ready to go which is the desired amount of hose minimum at the door

4. Under the direction of the officer open and close the nozzle as need to extinguish the fire (arguably the best job in the fire service)
5. Once you have everything in place you call for water from the chauffer (tell the chauffer to charge the line) and mask up
6. Ensure that you have adequate flow coming from the nozzle by bleeding the nozzle out before entry for a few seconds
7. Keep other firefighters in the crew informed if you need more line as you are advancing
8. Put the fire out!

- The Back -Up Firefighter – is a key player in stretching and advancing a handline. Without the back up FF, the nozzle FF is going to have a very tough time doing both
    1. Estimate the stretch
    2. Let the nozzle FF get his folds and nozzle and step away from the rig
    3. Grab your folds (how many depends on how long the stretch is) and pull yours off, flipping the entire bundle onto your shoulder as you step straight back off the rig.
    4. Follow the nozzle FF to the entry point peeling off the folds on your shoulder as you go
    5. When you are out of hose, make sure you have enough Lid out, if not go back and get more and repeat the steps
    6. Chase all the kinks out of line before it is charged, after it is charged, make sure there aren't any kinks that occurred after it got charged.
    7. Advance into the structure behind the nozzle FF and officer, pulling line as you go making sure it doesn't get caught up on any corners or turns. *Note: if you don't have a control FF or for some reason the control does not make it to the door before you go in, you may have to go back and forth from the door to the 1st turn or to the nozzle FF to get more line into the building.*
    8. Make your way up to the nozzle FF and back him up by taking the back pressure out of the line by pulling towards the nozzle FF. (will be demonstrated in hands-on)

- The Control Firefighter – runs their butts off. Between hitting the hydrant, hooking it up to the truck and feeding line into the building, they arguably work the hardest out of the crew
    1. Hit the hydrant if officers decides to stop
    2. Wait at hydrant until chauffeur calls for water. *Note: the 2nd due engine may say they will charge it for you. If so, leave the hydrant and go to the rig to help the chauffeur hook up*
    3. If you charged the hydrant, go up to the scene now
    4. Make sure there are no kinks in the attack line

5. Feed the attack line in the entry point as needed
6. Bump up to the inside as needed and also when the 2nd due engine comes to the door. *Note: you may be forced to go in and out pulling hose and making a loop of hose inside as needed if there are a lot of turns and the back up man is working a couple of them.*

- So, the bottom line is the engine puts the fire out. It is indeed the most important thing we can do to save lives and property. If you put the fire out everything gets better for everyone inside the building. And Fredericks once said, "More lives are saved at fires by a properly positioned hoseline, than by any other life saving techniques available to firefighting." He was right. Being the best damn nozzle firefighter you can be, able to take a beating in the heat and steam is such a tremendous asset on the fireground, that it is impossible to measure their worth, it is impossible to quantify. Everyone wants to in the truck or the rescue, some want their pictures taken climbing a ladder or cutting a roof or even carrying a victim out, but the truth is, without that nozzle firefighter in the depths of the fire doing their job, those rescues may not have ever even been possible. One thing is for certain however, you'll probably never see the nozzle firefighters' picture in the paper…

- **Hose Loads - Flat Load With a Horsehoe**
  - In Commack we use one type of load for our attack lines it's called a flat load. It doesn't make a difference whether its 2&1/4" or 1&3/4" line or whether it's a crosslay or off the rear of the truck, it all gets packed the same. On any engine with crosslay, the attack lines are 200', or 4 lengths. On the rear hose beds, there can be two 1&3/4's and a 2&1/4 or, one load with 200' of 1&3/4 and 400' of 2&1/4 under it with a reducer connecting the two sizes together. Below are some illustrations of how it gets packed:
    - On the bottom of the hose bed, you start with two rows side by side that are even with the edges of the hose bed. (Fig. H1) This length will be the last length to be deployed but the first length to get packed on the rig.
    - The next row we use what's called bunny ears, (Fig. H2) they are two loops that hang over the edge of the hose bed about 16" in length. These are for the back up FF, making it easier to pull the hose off.

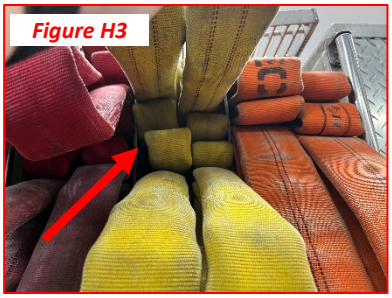
Figure H1

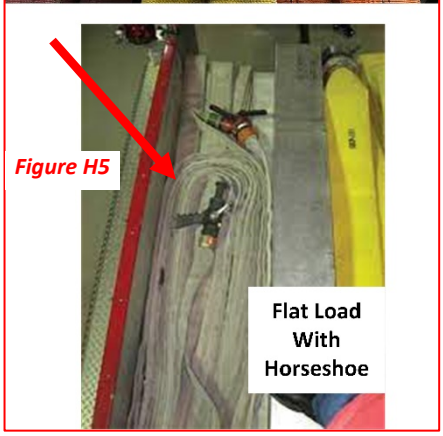

Figure H2

- The next two rows are once again even with the edges of the hose bed, so you'll have 4 folds (Fig. H3)

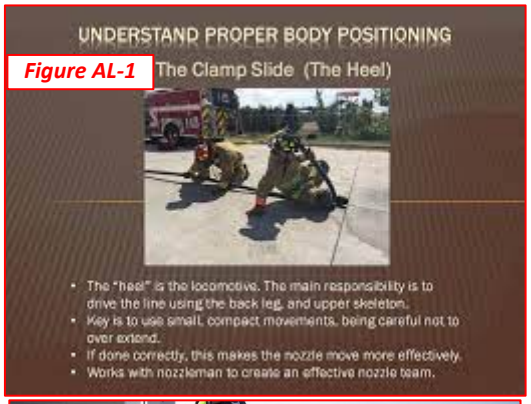
- At this point this is where the engines start to differ. You have now packed 3 lengths of hose in the bed. For the flat load you will just make two rows equal with the edges of the bed and place the nozzle on top of the load. (Fig. H4) If your company uses a horseshoe for the last length, this is where it will go (Fig. H5)

o So, no matter which company you're in and whether they use a horseshoe or not only makes a difference it the attack length when packing and deploying. Its either a straight up flat load or a flat load with a horseshoe. Both of these attack lengths get stretched very differently and you'll need to know how to deploy and stretch both, so practice often.





- **Advancing The Line**
  - In Commack we use some techniques take from Arron Fields. The combination of techniques is from a program he created called "The Nozzle Forward". It is impossible to show how these techniques are used in text and with just pictures. The hands-on portion of the class will teach to you the following:
    - The Clamp Slide – (Fig. AL-1) involves advancing the line through a building with your off knee on the hose, sliding it forward with your leg as you advance
    - The Hip Grip – (Fig. AL-2) technique to hold the line with your right hand pinned against your back hip and left hand on the knob while operating



    - The Flow and Go – is used to advance down a hallway toward a fire room with the nozzle open, combining both the Hip Grip to secure the hose to you and Clamp Slide to advance down the hall (Fig. AL-3)

  - These are just *some* of the techniques you will learn during the hands-on class. When you see these techniques shown to you and then when you do them all, it'll put it all together for you and you will definitely have a better understanding of what were trying to explain here.

- **Conclusion**
  - There is a lot to engine company operations, more than is written in this lesson. In this lesson you were told the very basics of how an engine operates, what each position on the engine is responsible for and how it all comes together. In Appendix A of this lesson, you will find some of the main article excerpts from The Book of Andy, these articles are well written, and you will have a much better understanding of engine company ops when you are done. We as a division encourage you very strongly to read the entire Book of Andy posted on our website in the Member files section. In Appendix B you will find some the Commack Fire Department's short articles written by the training division here in Commack, they contain plenty of tricks and tips and will be a great quick reference guide for you to look at when you are uncertain of, or you can't remember something.
    Engine company work. Specifically, handlines all start with knowing your job. You must know the job of each position, then learn the job of each position by doing it. The better your crew works as a team, the smoother your stretches will go. The smoother the stretch, the easier the advance, the easier the advance, the faster the fire goes out, the faster the fire goes out, the faster everything on the fireground gets safer for everyone.
    One more quote from Lieutenant Fredericks, "*The fire goes as the first line goes. All efforts should be concentrated on stretching, charging and operating the first line. Don't be consumed stretching the back-up line until the first line is stretched and operating unless you have the manpower to perform both functions."*
    Your job is to put water on the fire, so never stop practicing, the more you train the better you'll be. It is as simple as that.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"GET INVOLVED"

APENDIX A
The Book of Andy


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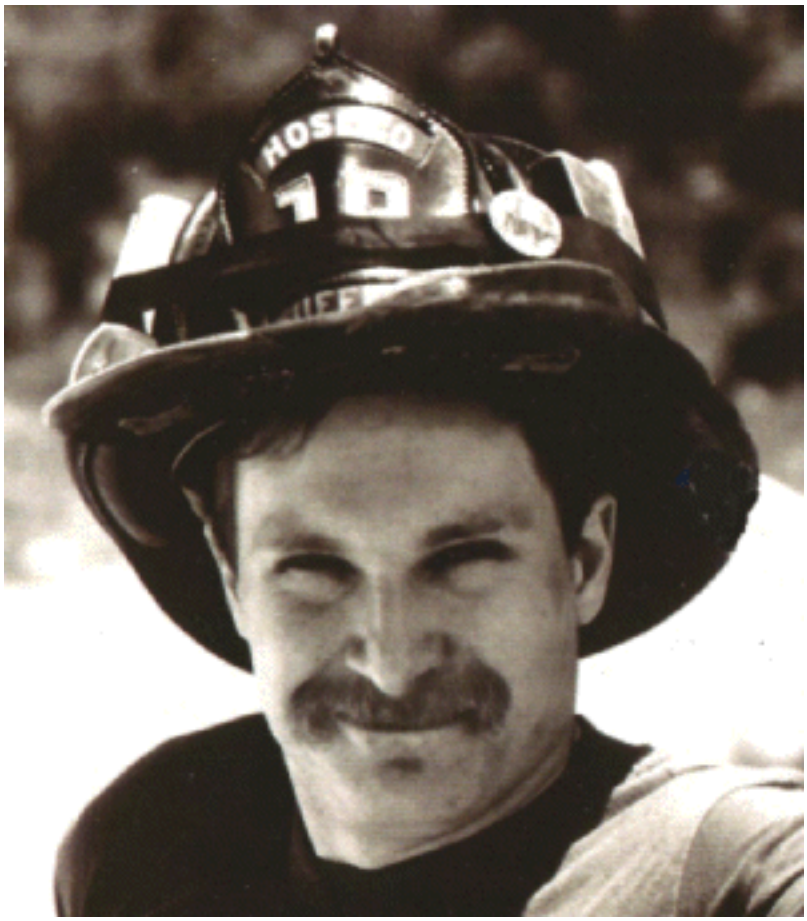
D
"GET INVOLVED"

A TRIBUTE TO THE WORK OF ANDY FREDERICKS

(COMPILED BY: GARY LANE)



"FIGHTING FIRE WITH WATER"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F
D
"GET INVOLVED"

"If you put the fire out right in the first place,
you won't have to jump out the window."


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F
D
"GET INVOLVED"

Quotes to remember by Andy Fredericks

Engine Company Basics

- More lives are saved at fires by a properly positioned hoseline, than by any other life saving techniques available to firefighting.
- The fire "goes as the first line "goes". All efforts should be concentrated on stretching, charging and operating the first line. Don't be consumed stretching the back-up line until the first line is stretched and operating unless you have the manpower to perform both functions.
- Do not become overly reliant on pre-connected lines. You must prepare and train for the fire that can't be reached by a pre-connected line. You must be capable of extending a line that will not reach the objective.
- Select the proper size line for the job at hand. "Little fire, little hose". "Big fire, big hose". Don't be afraid of the 2 ½" line. With the proper nozzle (smooth bore) and proper pump pressure this line can be managed even in understaffed departments.
- Do not "pull and pile" the hose – stretch the line correctly.
- Do not enter the fire area with an uncharged line. In private dwellings (1 and 2 story homes) the line should be stretched and flaked out in front of the building, than charged before entering.
- Bleed the air from the line prior to advance.
- All members should be on the same side of the line
- Back-up must lend physical support to resist nozzle reaction and allow nozzle firefighter to operate freely.
- Do not crowd the nozzle
- "Wait until you see fire and don't open up on smoke" does not apply in the fire environment today. Plastics and energy efficient windows have changed the fire environment. If you are wear you gear properly, full bunkers with hood, you cannot use heat as the indicator to open the nozzle. Once you feel heat through the gear it is too late. The next thing you might see in your facepiece is orange because the room just flashed! If the smoke is dark and angry (swirling around in front of your facepiece) open the line to cool off the ceiling.
- Stream should be directed "out in front and overhead". Water should be deflected off the ceiling and upper walls. The deflected water will:

- cover a greater area - cool superheated combustible gases at the ceiling level - prevent rollover of fire overhead - prevent the development of flashover

- Sweep the floor as you advance to prevent knee burns. NYC has seen an increase in burns from scalding water which enters the leg opening in the pants which forms when you kneel.
- Once the line is advancing, keep moving toward the seat of the fire, but don't push the nozzleman faster than he wants to go.
- Let the reach and penetrating power of the stream do the work, especially in large area buildings or when several rooms are involved.
- Ensure adequate ventilation to assist with extinguishment

9/11/01 NEVER FORGET!!!!!


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Fire Engineering
March 2002

DEPUTY CHIEF RAY DOWNEY AND LIEUTENANT ANDY FREDERICKS... AS WE REMEMBER THEM

You may be wondering why we're publishing this tribute almost six months after 9-11. Mostly, it's because this was and is so hard for us to write-we just couldn't bring ourselves to do it until now. It's still raw. We're still numb.

Ray and Andy-two of our very close advisors-were very important to us professionally. They spent a lot of time with the Fire Engineering staff, advising, reviewing article submissions, writing articles and scripts, shooting and editing videos, attending and instructing at conferences, and so on. They both were remarkably talented and knowledgeable firefighters-geniuses, actually: Ray, the cool-headed, seasoned commander with 30 years on the job and an awesome, hard-earned national profile; Andy, the intense and firematically passionate younger man who had recently gained national prominence for his brilliant work in fire attack methodologies and who was headed up the FDNY ladder of success.

But it's personally that we're hit the hardest from losing them in the World Trade Center attack. It's hard to accept that Andy won't be walking through our office door to talk tactics with us, to brandish his dry, sarcastic wit-return fire for the good-natured swipes we took at him (after he made Squad 18 we started calling him "Squandy"). We talked for hours about the history of nozzles and fire attack, wrote and rewrote video scripts and 30-page articles that were as demanding as Andy was meticulous. His passion was evident in everything he did, and he did it all for the right reasons. If I had ever mentioned then that Andy was making fire service history, he would have just laughed at me and then resumed the conversation about why smooth-bore nozzles were the only choice for interior fire attack. He was driven to teach (for the Rockland County Fire Training Center; for the New York State Academy of Fire Science; and on the national level, including FDIC) and lay the groundwork for a better fire service. But that drive did not exceed his devotion to his family-Michelle, his wife, and his children, Andrew and Haley.

It's equally as impossible to make ourselves believe that we can't call up Special Operations Command (SOC) for Ray anymore. It was remarkable to us that even as important and busy as Ray was, he always had time for us. We swapped stories about grandchildren and children, we laughed and joked about fire service characters we knew, and we teased him about his "computer under the helmet." He brought us to FDNY SOC, he filled us in on the latest with FEMA or the lessons from last night's big job in New York or about who the real fire service experts were and who was just blowing smoke. He was our mentor, our rescue guru, our friend. On the road, Ray always requested small, intimate dinners with "just the FE gang"-and what special times those were! He could have been out with "the hot shots," but that wasn't Ray-when he

wasn't commanding a major rescue operation, he preferred the background. His modesty was as genuine as his God-given ability to lead in crises.

Ray and Andy were part of our family. It's very difficult to get rid of the feeling that each of them had so much more to give, but that's because they both gave so much and there's such a big hole now. They were change agents in the truest sense and made this world immeasurably better because they were who and what they were. This tribute can't fully convey what lies in our hearts for Ray and Andy, but we hope it shows the enduring faith we have that they live on. We hope this gives you a moment to reflect on the greatness in this business. That torch has been passed on to you, to us.

It is only a farewell on the physical level. My friends, they are always with us.

-Bill Manning

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When "God" was on the phone, you made sure to get rid of your other call. They called Ray that-"Rescue God," or just "God," for short. He commanded that level of respect from his Fire Department of New York personnel, from his seminar audiences, from his Fire Engineering readers and staff, and even from his family.

His son Joe, also a firefighter, tells of how members called Joe "Jesus" when he first came on the job as an FDNY firefighter. When he asked why everyone was calling him Jesus, one firefighter replied, "You're the son of God, aren't you?"

To us in his fire service family, Ray's relationship with his beloved wife Rosalie was a match made in heaven (they celebrated their 40th wedding anniversary in 2001 and have five children and nine grandchildren). Of course, when he was captain of FDNY Rescue Company 2, someone at Fire Engineering asked Ray if his wife called him "captain" at home. He replied, "Yeah, she tells me, 'Hey, Cap, take out the garbage." In fact, Ray was so humble that he didn't widely publicize his recent promotion to deputy chief. Jim Ellson, a retired FDNY captain and Downey's right-hand man in SOC, relates that one day he walked into SOC to visit Downey and Downey was grinning from ear to ear. Ellson had to pry it out of him that Downey had been promoted.

In 1994, Ray was promoted to battalion chief and joined Special Operations Command (SOC) a year later. He became the head of SOC in 1997. In 1998, he pushed for the creation of special FDNY squad units with extra training in terrorism response, especially in preparation for the new millennium. He was promoted to deputy chief this past August. Due in part to Ray's diligence, FDNY is one of the best equipped and most prepared fire departments in terrorism response in the world.

When asked how he was able to command complex operations so well, Ray jokingly said it was because he had stored a lot of information in his "computer under the helmet." He was a true, mild-mannered gentleman, but on the job he commanded the utmost respect from firefighters and officers alike. On the scene, Ray was in control. He

had what's known as "command presence." In his eulogy at Ray's memorial service, a close fire department friend said he would never forget the image of Ray commanding operations from a tower ladder bucket extended over the water at the crash of TWA Flight 800.

Ray was a former Marine and the most decorated firefighter in FDNY history. He joined the department in 1962, serving with ladder and engine companies and Rescue 2 before forming Squad 1 in 1977. In 1980, he returned to Rescue 2 as captain, where he remained for 14 years. In 1988, he launched the popular column The Rescue Company in Fire Engineering, which not only coincided with his rise to national prominence in technical rescue operations (and which would become the basis for his book of the same name) but helped generate a wave of interest in the area of technical rescue that has continued to this day.

Some of the major incidents on the national and international level for which Ray served as rescue operations commander include the Philippines earthquake (1990), Hurricane Andrew (1992), the World Trade Center Bombing (1993), Hurricane Opal (1995), the Oklahoma City Bombing (1995), the Atlanta Olympics (1996), Hurricane Fran (1996), the Puerto Rico Humberto Vidal Explosion (1997), and the New York ice storms (1998). On the local level, incidents include the US Airways Flight 405 crash (1992), St. George Hotel fire (1995), TWA Flight 800 crash (1996), the 31st Street building collapse (1998), the Times Square scaffolding collapse (1998), the Bronx garage collapse (2000), the Father's Day fire (2001), and the State Street Gas Explosion (2002).

Ray was the USAR task force leaders representative to FEMA for all 28 USAR teams and served on the FEMA Incident Support Team (IST), the advance team that manages federal emergency responses. He spent a great amount of time-including a lot of personal time-making the USAR teams better prepared, trained, and equipped. He was known worldwide as the leading authority on responses to both manmade and natural catastrophic events. For years, Ray had been warning the fire service community and the federal government that, with respect to a major terrorism incident on U.S. soil, "It's not a question of if, but when." In fact, Ray served on the Gilmore Commission, a congressional advisory panel that issued a report last year entitled "Toward a National Strategy for Combating Terrorism."

Downey would have been 64 on September 19, 2001. He was due to retire this year but wanted to stay on in hopes that his son Joe would be made chief. They would have been FDNY's first father-son chiefs.

Ray's dedication to training was evident: In between responding to disasters worldwide, training FEMA teams, testifying before Congress, and spending time with his family, he always found time to teach at FDIC and FDIC West.

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Andy said his late father was the one who sparked his interest in firefighting. But his passion for fire attack methodologies in particular was triggered after he received steam burns while making an interior "combination" fire attack with a fog nozzle, as was typical procedure for the Virginia fire department Andy worked for at the time, prior to his getting on the job in New York. He turned his serious intellectual skills (evidenced in part by his two bachelor's degrees and master's degree in fire protection management) to the application of water on interior fires and soon would develop the nickname "Andy Nozzles."

Andy's initiation to the national firefighting stage was an auspicious start. His first work for Fire Engineering, "Return of the Solid Stream," was published in 1995 as part of a three-article package called "Fighting Fire with Water." The other two articles in the package were written by none other than William E. Clark and Keith Royer, two giants in fire service history and firefighting methods. For Andy, this was a harbinger of greatness to come. Though Andy's life was cut short as he was nearing the height of his career, in six short years he established himself as an industry giant in his own right.

In 2000, Andy delivered a riveting keynote speech, "Don't Worry 'bout that Nozzle, Kid, 'cause We Don't Do Fires Anymore," at the Fire Department Instructors Conference Opening Ceremony. "Firefighting today still remains largely a gritty, up-close, personal affair using tactics and techniques that date back decades," he said. "Even in the high-tech battlefield of today, it is the soldier with the rifle who still makes the difference in wartime. So until we make greater strides in the fire prevention and fixed suppression arenas, the firefighter and his nozzle will continue to be the difference between life and death for literally thousands of Americans threatened by fire every year."

The three videos Andy developed for Fire Engineering, Advancing the Initial Attack Handline (1997), Stretching the Initial Attack Handline (1998), and Methods of Structure Fire Attack (1999), inarguably are the finest and most comprehensive works ever developed on engine work in the video training genre. But Andy's brilliance showed through in all types of training venues, be it at the podium, on the training ground, in print, or on video. He was working on a book on engine company operations, which he saw as the culmination of his life's work to date, at the time of his untimely death at the World Trade Center.

His opinions truly were deep-rooted-and he was not shy about expressing them. "To me, the fire service is still dirty hose and brass nozzle tips, seasoned firefighters who know what it means to pull a ceiling and know what to do when they're told to trim a window ellipse and it's about chiefs who trust their instincts and exude that command presence," he said.

"I view the two-in/two-out rule as a copout standard," he opined to a broad national audience, with searing logic that was a Fredericks trademark. "When the two who are in are in trouble, what are the two who are out going to be able to do? My experience is that it may take a half dozen or more firefighters ellipse to rescue just one firefighter in distress ellipse. To me, the safest way to operate if there are only four personnel

available for interior firefighting, I think, is all four in. And the reason is that the search for victims will be completed much more quickly, but most important, water will be applied to the seat of the fire in a shorter time frame, which eliminates all the hazards the two-in/two-out rule was created to address in the first place."

Andy had a reputation for being a devoted family man. There was one time when a deadline for writing one of his video scripts was fast approaching. When he was called and reminded to get his video script finished, his wife picked up the other phone extension and chimed in, "As soon as he paints our kitchen cabinets he can finish the script!" He painted those cabinets.

An indication of the respect the fire department and the City of New York had for Ray Downey: In July 2001, Mayor Rudolph Giuliani held a dinner at Gracie Mansion in Downey's honor.

Speaking at a firefighter's funeral a few weeks before the September 11 tragedy, Ray said, "We have to accept this as part of the job. Sometimes in this job, goodbye really is goodbye."

"People ask me, am I old school?" Andy said, though he entered the fire service as a volunteer in 1979 and was only 40 years old at the time of his death. "I guess in many ways I am, because I truly believe that tradition is important to the long-term survival of the fire service."

Andy was a nozzleman, heart and soul. He had made the decision to get back to his roots and was seeking a detail back to the engine company.


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Fire Engineering
September 1995

RETURN OF THE SOLID STREAM

BY ANDREW A. FREDERICKS

A growing number of fire departments large and small are returning to the use of solid-stream nozzles (also called "smooth-bore" or "solid-bore" nozzles) for interior structure firefighting. They are realizing success in directly attacking interior fires using the long reach afforded by the compact solid stream and fire-quenching power of its high-volume flow. This article is intended to describe some of the many benefits provided by solid streams and to contrast the safety and efficiency of the direct method of fire attack with both the indirect method and the so-called "combination" attack. When I first entered the fire service in the late 1970s, many of my instructors taught both the indirect and combination methods of fire attack with little or no mention of the direct method. Training films of the period demonstrated the supposed efficiency of using 30- and 60-degree fog patterns for interior fire attack, and live fire drills often involved tolerating extremely debilitating heat conditions brought about by inappropriate use of fog streams. As recently as 1987, while engaged in a training exercise as a member of a career fire department in Virginia, I received a second-degree steam burn on my face due to improper use of fog within the training building--even while wearing a protective hood.

Although my instructors preached the gospel of fog, the most experienced nozzlemen I fought fires with consistently used straight streams and the direct method of extinguishment. I, too, adopted this method of aggressive, interior fire attack; and, in my 16 years as a career and volunteer firefighter, I have never used anything but a straight stream or solid stream inside the fire building.

Whereas the indirect method of attack, if employed properly at fires involving unoccupied enclosed spaces such as attics and cocklofts, can be a valuable tactical tool, the same cannot be said about the combination method. In my opinion and that of a growing number of firefighters and fire officers, the combination attack should be permanently retired to the scrap heap of tried and failed firefighting techniques. In almost all cases, an aggressive, interior, direct attack will provide for rapid and efficient fire control while minimizing the potential of burn injury to civilians and firefighters.

PRINCIPLES OF DIRECT EXTINGUISHMENT

The direct method of attack involves applying water directly on the burning fuel to cool it below its ignition temperature and suppress production of volatile vapors. If the fire is small and localized, a fire stream, such as that from a pressurized water extinguisher, may be aimed directly at the base of the flames; in short order, the fire will be extinguished. Even in the case of a mattress burning in a bedroom or rubbish burning in a hallway, a stream from a handline can be applied directly on the burning materials. In the case of larger fires--those approaching flashover and those already in the fully developed phase--it may not be possible or safe to immediately apply a stream of water

directly on the burning fuel. Due to burning fire gases rolling across the ceiling, high heat conditions, and/or partitions and obstructions interfering with the direct application of water, the stream first must be deflected off the ceiling and upper walls until the nozzle team can get close enough to permit direct cooling of the fuel.

Some members of the fire service confuse the deflection of a straight stream or solid stream off the ceiling and walls with "indirect" extinguishment. The purpose of directing the stream upward at a 60- or 70-degree angle is not to cause rapid cooling of the effluent fire gases (which will create large amounts of steam, as in the indirect and combination methods of attack) but to allow droplets of water from the stream to rebound off the ceiling and walls, penetrate thermal currents produced by the fire, and start cooling the burning fuel--all while the nozzle team operates from a safe distance. Once the rolling flame front at the ceiling has been repulsed due to a reduction in fire gas development, the nozzle team can make a close approach to the seat of the fire and complete the extinguishment process.

CRITICAL FACTORS

Four critical factors affect the safe and efficient extinguishment of fires using the direct method:

-Volume or flow sufficient to overcome the heat being produced by the fire. Many fire attack operations have been doomed to failure simply because the size of hose was too small to deliver the proper flow or the nozzle was designed with a flow range too limited for the job at hand.

-Form or shape of the water as it leaves the nozzle (commonly called the "pattern") and as it reaches the burning fuel. The goal is to get water on the fuel-flame interface without premature vaporization of the water and excess steam production.

-Reach and penetration of the stream, enabling the nozzle crew to initiate operations from a safe distance and allowing "the water to do the work." I am not saying to open the nozzle on smoke, but the nozzle team does not have to be so close as to risk severe burn injury. In addition, the hydraulic force of the stream should be sufficient to allow penetration of tightly packed or baled materials.

-Ventilation. This critical factor must be timely and adequate. Ventilation is essential to remove combustion gases, smoke, and unwanted steam and permit an unhindered advance to the seat of the fire. We learned in basic firefighter training that when water converts from liquid to vapor at 212°F, it expands some 1,700 times its volume. Most of us were never taught, however, that at 1,000°F, a ceiling temperature easily attained at interior fires, water expands some 4,000 times! Without a large channel or opening through which to remove this superheated steam safely to the outside, suppression crews will be enveloped in the expanding steam and subjected to extreme discomfort and often painful burns.

Regardless of the type of stream--fog, straight, or solid--whenever a nozzle is opened in the fire building, conditions for the nozzle team immediately worsen. Most visibility is lost, and it can become uncomfortably hot and humid even near the floor. There is no magic fire stream, but a direct attack with straight or solid streams coupled with proper

ventilation wins hands down over the combination method in maintaining more tolerable interior conditions.

SOLID STREAMS VS. STRAIGHT STREAMS

Although their use in direct attack is similar, straight and solid streams have distinct differences. A straight stream is, in essence, a very narrow fog stream. It is produced by a combination nozzle and is composed of millions of tiny water droplets separated by air entrained within the stream. One text identifies the narrow stream produced by a fog nozzle as a "solid" stream, but this is not correct. A solid stream is produced by a smooth-bore orifice and is a compact, solid cylinder of water as it leaves the nozzle. With proper tip pressure, a solid stream will remain compact for a considerable distance before friction with the air, gravity, and other factors degrade the quality of the stream.

One important reason solid streams are more effective than straight streams in interior fire attack concerns water droplets. When a solid stream is deflected off the ceiling and walls, it produces droplets of sufficient size and mass to reach the burning fuel without being carried away by thermal currents or vaporized prematurely by the heat of the fire. Straight streams--created by fog nozzles and therefore the result of changing the direction of water travel within the nozzle by striking the stream against a deflector (most fire service nozzles are of this type, called periphery jet)--consist of countless small droplets that are made even smaller in colliding with the ceiling and upper walls. These smaller droplets, with their low mass, are drawn into and propelled out of the thermal column of the fire, never reaching the burning fuel--producing excess steam and wasting water.

MISCONCEPTIONS ABOUT SOLID STREAMS

Misconceptions about solid streams abound within the fire service community. I will address some of the most common ones. The first and most commonly held misconception is that a solid stream, unlike a fog stream, does not offer the nozzle team protection when operating inside the fire building. I`m sure you`ve heard that the fog pattern will protect you should fire roll over your head or flashover occur or a gas pipe suddenly fail and create a jet of burning natural gas. It is simply not true! Using fog inside the fire building does not protect you; it burns you. The combination attack has been largely discredited because of its injury-causing potential, inefficiency, and the lack of evidence to prove otherwise.

I`ve encountered fire rolling over my head and failed gas piping, and the solid stream always offered ample protection. This misconception has it beginnings in "war stories" told to probies by "senior men" who remember the days when fog--especially high-pressure fog--was all the rage. In those days, the few self-contained breathing masks available were so bulky, heavy, and time-consuming to don that crews on the first attack line often opted not to use them. The "johnies" were amazed by stories of nozzlemen who had to "breath the air from the fog pattern" just to stay in the fire building--leaving yet another false impression that fog is a lifesaver. In reality, it is the volume and reach of the stream (in conjunction with your protective clothing and SCBA, of course) that protect you--nothing else.

The next most common misconception concerns water damage. You`ve heard it, and I`ve heard it: Solid streams cause more water damage than fog streams. Again, it is not true. William Clark in Firefighting Principles and Practices describes several tests conducted to determine the amount of water runoff from fires extinguished by solid streams and fog streams. In trial after trial, runoff from the fires extinguished by solid streams was consistently less than that from fires extinguished by fog streams at the same flow. I believe the reason is that a solid stream, used in a direct attack on the burning fuel, will knock down the fire much more quickly than a fog stream. If the nozzleman shuts down almost immediately after darkening down the main body of fire, water damage will be minimized and overall fire attack effectiveness and safety will be enhanced. These test results aside, firefighter safety and prompt control of a serious fire are absolutely more important than any concerns about water damage. If they are not, you should carefully reevaluate your tactical priorities.

A related misconception concerns water conservation. For years, many rural fire departments--and even some suburban ones--believed that, by using low-flow fog nozzles at structural fires, the water supplies carried on board their apparatus could be extended until the fire was extinguished. Problematically, unless the gpm flow being discharged was sufficient to overcome the heat produced by the fire, it continued to grow. Eventually the on-board water supplies were exhausted and by the time drafting operations, tanker shuttles, or relay operations were established, all that remained of the fire building was smoldering rubble. The key, as reflected in most modern rural fire attack operations, is to hit the fire hard and fast with ample volume to quickly knock down the fire and limit extension.

Another misconception concerns nozzle reaction. I`ve heard line officers at training sessions state that solid streams produce more nozzle reaction than straight streams. False! Solid-stream nozzles require lower operating pressures than standard fog nozzles, producing significantly less nozzle reaction and making hoselines less stiff and easier to move around corners and newel posts. In general, at equal flows, a 100-psi combination nozzle in straight-stream position will generate one-third more nozzle reaction force than a solid-stream nozzle operated at 50 psi. In an effort to control the straight stream and its higher reaction force, the nozzleman may change to a fog pattern (lessening nozzle reaction but also reducing reach) or the shutoff may be partially closed, breaking up the stream and/or reducing the flow. Any of these actions will compromise the safety of the nozzle team, and firefighting efficiency will be lost.

Misconceptions also exist about why lower pump discharge pressures resulting from the use of solid streams are better and safer than higher pressures needed to supply straight streams. Several recent articles decry those who call for lower operating pressures. One such article (purported to separate fire stream "facts" from "fantasies") points out that today`s fire hose is designed to resist pressures of at least 300 psi and that our modern pumping apparatus is designed to pump higher volume and higher pressure. This article states that since our equipment can handle the higher pressures, reducing the workload on our personnel is the key issue.

But, if this is such an important concern, why should fire departments employ fog nozzles that produce more nozzle reaction (in straight-stream position) than solid-stream tips at the same flow and make the hoseline steel hard and extremely difficult to bend and advance? In addition, higher pump pressure is a serious safety issue. Although present-day pumping apparatus is designed to operate efficiently over a wide range of discharge pressures, higher pressures are dangerous. In the real world, hose lengths burst and injure firefighters (pump operators most often) and damage apparatus and equipment. This danger is especially great when pressures greater than 250 psi are needed to supply standpipe systems in conjunction with the use of combination nozzles.

Another misconception is that solid streams degrade rapidly after leaving the nozzle whereas straight streams hold together better due to the design of the combination nozzle, which produces a more uniform "exit" velocity across the stream. In most cases, the reason some solid streams appear to break apart so rapidly is that they are over-pressurized. Most texts state that a solid-stream tip should be operated at 50 psi. In reality, lower tip pressures are better, and engine company chauffeurs in the City of New York (NY) Fire Department (FDNY) commonly supply 40 psi to the tip, producing a better, more compact fire stream. "Old timers" in the FDNY state that even lower tip pressures may be advantageous--especially when using 2 1/2-inch hose. Supplying only 30 to 35 psi to a 1 1/8-inch tip attached to 2 1/2-inch hose produces a fire stream with considerable reach, adequate volume (about 210 to 230 gpm), and reduced nozzle reaction.

STANDPIPE FIREFIGHTING OPERATIONS

One of the areas in which fire departments continually demonstrate tactical deficiency is standpipe firefighting operations. NFPA 14, Standard for the Installation of Standpipe and Hose Systems (1993 edition) states that Class I and III standpipe systems need only supply 100 psi at the most remote floor outlet. The 100 psi represents required tip pressure when using combination nozzles, but what about friction loss, which is at least 20 to 25 psi per 50-foot length of 1 3/4-inch hose at approximately 200 gpm? Older standpipe systems may only supply 65 psi at the most remote floor outlet, and a pressure this low can be safely used only in conjunction with three lengths (150 feet) of 2 1/2-inch hose and a 1 1/8-inch solid-stream tip. Critics will say that pressures can be increased sufficiently to properly supply combination nozzles once fire department pumpers begin augmenting the system. This is true in some cases; but as the Philadelphia Fire Department found out at the One Meridian Plaza high-rise fire in 1991, permanently affixed pressure-reducing hose outlet valves installed on standpipe outlets in very tall buildings will defeat any attempt to effectively augment pressures. Standpipes may also suffer from inadequate maintenance, vandalism, and clogging of the system`s piping by debris--all of which reduce outlet pressures and prevent effective augmentation. Even when higher pressures can be supplied to the floor outlets, there is a danger the system riser and/or fittings may fail due to improper design or the use of pump pressures that exceed the system`s rated pressure.

Another lesson learned from the One Meridian Plaza fire is that some types of automatic fog nozzles require a minimum pressure of 40 to 50 psi at the tip to actuate


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Fire Engineering
December 1996

THE 2 1/2 INCH HANDLINE

BY ANDREW A. FREDERICKS

For decades, 2 1/2-inch hose was the mainstay of fire departments across the nation. Despite the widespread availability of smaller, lighter 1 1/2-inch hose after World War II, many fire departments continued to use 2 1/2-inch hose exclusively for interior and exterior firefighting. Urban fire departments in particular--confronted with large factories, high-rise office buildings, and residential neighborhoods crowded with combustible housing stock--found the limited flow of 1 1/2-inch hose insufficient. In New York City, 2 1/2-inch hose was required for all structure firefighting up until the late 1960s.

During the early 1970s, a combination of factors caused a reevaluation of 2 1/2-inch hose as the handline of choice for many fire departments. One factor was the sudden, dramatic increase in fire activity throughout urban America. Increased fire activity required handlines that could be deployed swiftly and drained and repacked with a minimum of effort. Recently introduced 1 3/4-inch hose met these specifications. With the appearance of 2-inch hose during the late 1970s, still more fire departments abandoned their allegiance to the "deuce-and-a-half."

A second factor for the reevaluation of 2 1/2-inch hose was staffing. Firefighter layoffs, resulting from the near-bankruptcy of some cities, decimated the ranks of career fire departments. The membership rolls of many volunteer departments also began to dwindle. Bending, maneuvering, and advancing 2 1/2-inch hose are normally difficult, but the painful staffing reductions made them even more so.

A third factor was the introduction of various experimental technologies to the fire service, including friction-loss reduction agents, which were popular in the early to mid-1970s. These agents, which allowed flows of 250 gpm through 1 3/4-inch hose, convinced many chief officers that 2 1/2-inch hose no longer was needed. By the mid-1980s, the most potent offensive weapon at the disposal of the fire service had been relegated to second- and even third-class status among available handline options. Some fire departments retired it altogether.

With all these arguments against 2 1/2-inch hose, can a valid case be made for its continued survival as part of the municipal fire service arsenal? The answer is unequivocally yes, and the balance of this article makes such a case.

LIMITATIONS OF 1 3/4-INCH HOSE

As James J. Regan points out in his thought-provoking article, "1 3/4-Inch Hose: The Booster Line of the `90s?" (Fire Engineering, September 1993), the main reason for

developing 1 3/4-inch hose was its greater speed and maneuverability during fire attack operations within cramped tenements houses in New York City. This handline could be deployed and advanced much more quickly than 2 1/2-inch lines without suffering the 50 percent flow reduction resulting from the use of 1 1/2-inch hose. This history has apparently been lost on many fire service members; 1 3/4-inch hose is erroneously viewed as the answer to almost all firefighting problems. As Regan observes: "We have seen 1 3/4-inch hose used as a replacement for 2 1/2-inch hose in fireground situations that the original proponents and developers of the small-diameter hose did not contemplate and, in all likelihood, would not support."

Fireground flows from 1 3/4-inch hose should range from 150 to 190 gpm. The City of New York (NY) Fire Department (FDNY) considers 180 gpm the ideal flow from 1 3/4-inch lines in terms of fire extinguishment capability and handling characteristics. Some members of the fire service (myself included) suggest that actual fireground flows from 1 3/4-inch hose are somewhat less than the 150-gpm minimum given above. The main reason for this is widespread under-estimation of the friction loss in 1 3/4-inch hose at flows of 150 gpm or more.

How many pump operators have been taught that the pump discharge pressure (PDP) for a 150-foot preconnected line of 1 3/4-inch hose fitted with a 100-psi fog nozzle is only 120 to 130 psi? At a PDP of 120 psi, a flow of about 100 gpm is delivered--simply not enough water for interior fire attack operations. I contend that handline flows of less than 150 gpm are insufficient and potentially dangerous. A target flow of 175 gpm is much safer. To flow 175 gpm through 1 3/4-inch hose, a friction loss of at least 20 psi per 50-foot length must be overcome. In the example above (150-foot preconnected line with 100-psi fog nozzle), the PDP must be at least 160 psi.

THE TWO-FIVE SYNDROME

There is a movement afoot to promote the notion that only two sizes of hose are needed: 2-inch for handlines and 5-inch for supply lines. Some departments never adopted 1 3/4-inch hose and instead converted directly from 1 1/2-inch to 2-inch when it became widely available. Two-inch hose offers a higher practical flow limit than 1 3/4-inch (about 220 gpm vs. 190 gpm) while maintaining the handling and maneuverability characteristics that have made 1 3/4-inch hose so popular. Despite an increased flow over 1 3/4-inch hose, 2-inch hose is still no substitute for the 2 1/2-inch handline in many situations.

When comparing flows from 2-inch and 2 1/2-inch hose, 2 1/2-inch hose will deliver on average about 50 gpm more at the same PDP--and possibly as much as 100 gpm more--depending on the size of the nozzle tip used. This is a direct result of a much higher practical flow limit for 2 1/2-inch hose (around 330 gpm). Obviously, fireground situations will arise at which the reduced flow from 2-inch hose may make a critical difference in controlling the fire. And, like 1 3/4-inch hose, the friction loss per length of 2-inch hose is often underestimated. To flow 210 gpm through 2-inch hose, a friction

loss of between 15 and 18 psi per 50-foot length must be calculated. Just as with 1 3/4-inch hose, some pump operators believe that a PDP of 120 psi is sufficient for a 150-foot preconnected 2-inch line equipped with a 100-psi fog nozzle. A PDP this low will produce a flow of about 125 gpm. If only 125 gpm is desired, you might as well return to using 1 1/2-inch hose.

If a pump operator attempts to deliver the 250 to 260 gpm normally expected from 2 1/2-inch hose through a 2-inch line, friction loss quickly becomes excessive and the required PDP goes through the roof (especially when 100-psi fog nozzles are used). This increases the chances of a burst length, makes the hoseline extremely rigid and difficult to bend, and increases the nozzle reaction burden. Consequently, the advantages of better handling and maneuverability offered by 2-inch hose are lost, and both fireground safety and efficiency are compromised.

IMPACT OF REDUCED STAFFING

The staffing that existed in fire departments across the country before the reductions that occurred during the early to mid-1970s has never been fully restored. Today, the typical career engine company is staffed with an officer and only two firefighters, including the chauffeur/pump operator. This leaves only two personnel, the officer and a firefighter, available to get the first handline into service. If the officer must break away from the line to complete a search, the firefighter is left alone to struggle with the line and try to keep it moving until help arrives. And in some suburban and rural areas, help may be five, 10, or even more minutes away.

Many volunteer departments, especially on weekdays, also suffer from staffing shortages, causing the burden of stretching and operating the first handline, in many cases, to fall on the shoulders of one or two firefighters. Mutual aid can be summoned, but it will take time for it to arrive. In these situations, the tendency to always stretch a 1 3/4- or 2-inch handline is quite understandable. Fire departments also get away with it because most fires occur in residential buildings with small rooms ideally suited for the use of 1 3/4- and 2-inch lines. This is called the "residential room fire mindset." Unfortunately, problems arise when a fire is beyond the flow capabilities of the smaller-diameter handlines. Even when 2 1/2-inch hose is carried by engine companies, often no one thinks to stretch it or no one has been trained in its effective use.

"SLIPPERY WATER"

Forward-thinking fire chiefs greeted the advent of friction-loss reduction agents in the early 1970s with great optimism. For a variety of technical and political reasons, these agents fell into disfavor and quickly disappeared from the scene. Recently, attention has been focused on various types of Class A foams, and they represent first and second cousins to the "slippery water" agents of 25 years ago. A discussion of Class A foams, however, is beyond the scope of this article.

ADVANTAGES OF 2 1/2-INCH HOSE

I will not dispute that 2 1/2-inch hose is difficult to use. Many a big, burly firefighter has been humbled by its sheer size and weight. The water alone contained in a 50-foot length of 2 1/2-inch hose weighs some 106 pounds (compared with 52 pounds for 1 3/4-inch hose). But no combination of smaller handlines can duplicate the volume, reach, and pure knockdown power of a single, well-placed 2 1/2-inch line. In addition to its high volume flows (between 250 and 320 gpm) and long stream reach, 2 1/2-inch hose provides the following benefits when used with a 1 1/8-inch solid stream tip: low friction loss per 50-foot length (only about six to eight psi at 262 gpm), exceptional penetrating power due to hydraulic force of stream, little premature water vaporization in highly heated fire areas, easy reduction to smaller-diameter hand-line(s) after knockdown, and much better maneuverability than 3-inch hose (sometimes used as a handline) or portable master stream devices.

To realize each of these advantages, personnel must be thoroughly trained in the use of 2 1/2-inch hose as a mobile, highly effective handline. In addition, to avoid the problems caused when each of several engine companies stretches its own smaller-diameter handline at large fires, an incident commander should not hesitate to team up two, even three, engine companies to place a 2 1/2-inch line into service and ensure its mobility. In previous articles, I have questioned the practice of using 3-inch hose as a handline, especially by chronically understaffed departments. I`ve heard chiefs argue for the use of 3-inch hose as a "blitz" attack line, but its weight, its size, and the extreme difficulty it poses in handling should cause a rethinking of this approach. In practical terms, 2 1/2-inch hose provides just as much water but is less fatiguing to use and more maneuverable, increasing its tactical flexibility.

Some departments that use 2 1/2-inch hose equip their handlines with high-volume fog nozzles (250 to 300 gpm). This practice decreases the effectiveness of the 2 1/2-inch handline because the nozzle reaction (in straight-stream position) may be as much as 125 pounds or more at a flow of 250 gpm. A nozzle reaction this high rapidly fatigues the nozzle team and requires a large commitment of resources to keep the line moving. If the nozzle is changed to a fog pattern, the reaction force is reduced, but the reach of the stream is lost, and a long reaching, high-volume stream is the reason 2 1/2-inch hose is employed in the first place. Fog streams also turn readily to steam and never reach the burning solid fuels. Even very compact fog streams (commonly called "straight streams") will suffer more premature water vaporization than solid streams when directed into highly heated fire areas.

Some suggest that when 1 3/4- or 2-inch hose is "outgunned," the solution is to employ lightweight, portable master stream devices, bypassing the 2 1/2-inch hose altogether. Fireground flows now have jumped from 150 to 200 gpm all the way up to between 400 and 800 gpm. Is there not room for some middle ground here? In addition, just how advantageous can a portable master stream device be when it must be secured in

position for safe operation and does not provide the mobility offered by a handline? Portable master streams have their place, but not at the expense of 2 1/2-inch hose.

TACTICAL CONSIDERATIONS

FDNY standard operating procedures call for the use of 2 1/2-inch hose at fires involving retail stores, factories, warehouses, and industrial occupancies. Below-grade fires in commercial buildings also require that 2 1/2-inch hose be used. FDNY requires that 2 1/2-inch hose be stretched as the first handline during all standpipe system operations. It can also be stretched on order of the engine company officer any time fire conditions appear to indicate its use.

When should a 2 1/2-inch handline be used instead of smaller hose? One way to remember those situations that call for 2 1/2-inch line is to use the mnemonic device "ADULTS," created by an FDNY firefighter while studying for the lieutenant promotional exam:

-Advanced fire on arrival

-Defensive operations

-Unable to determine extent (size) of fire area

-Large, uncompartmented areas

-Tons of water

-Standpipe system operations

Advanced Fire on Arrival

Any time you encounter an advanced fire condition on arrival, consider deployment of a 2 1/2-inch handline. An advanced fire condition often precludes immediate entry into the fire building. Even private dwellings may warrant an attack with 2 1/2-inch hose, especially when a large volume of fire involves the front porch or first floor, or if combustible siding is burning and threatening nearby exposures. While the use of master stream devices at fires in occupied residential buildings is not recommended, the same cannot be said about 2 1/2-inch hose. After all, it is a handline and can be advanced into the building to complete extinguishment once the fire has been given a quick dash from the outside.

If the 2 1/2-inch line itself proves too difficult to bend and maneuver within the confines of a residential building (which is almost always the case), two potential solutions exist. In the first solution, the 2 1/2-inch line can be shut down and abandoned and a smaller-diameter handline can be stretched for interior operations. The second solution is to shut down the 2 1/2-inch line, remove the nozzle tip, and extend the line with smaller hose. One caution with this second method: If the shutoff handle becomes submerged in water or is buried by a fallen plaster ceiling, it may inadvertently be bumped and closed by a passing firefighter. To ensure the safety of the nozzle team, station a firefighter at the shutoff. If this is not practicable, secure it open with a short length of rope or a hose strap. (This practice should also be followed when 2 1/2- or 3-inch hose is used with a gated wye or manifold to extend the length of preconnected handlines.)

If an engine company opts to use a master stream attack when encountering an advanced fire condition, two issues need to be addressed. The first is the speed with which a portable master stream device can be set up for an attack on the fire. Even new, lightweight portable deluge guns require that a supply line be preconnected and that their deployment be well-rehearsed at drills for effective use. The second issue involves use of an engine-mounted deck pipe. Depending on circumstances, heavy fire venting from a storefront might suggest a quick shot from the deck pipe, but will the height of the deck pipe above the ground allow for penetration of the stream into the fire building? The stream will not be effective if most of the water is directed at the floor 25 feet inside the entrance door. In both of these cases, stretching a 2 1/2-inch handline fitted with a large tip (1 1/4-inch) might well be the fastest means of getting water where it is needed to quickly darken down the fire.

Defensive Operations

When an offensive fire attack fails or the fire building is a "loser" right from the start (unoccupied vacant, with a history of previous fires), use of 2 1/2-inch handlines from outside positions is an effective tactic. A 2 1/2-inch line is far more mobile than any master stream device and can be placed in service rapidly. It can be stretched and operated from windows and rooftops of adjoining buildings, alleyways, and rear yards--areas often inaccessible to master stream placement. If a harder-hitting stream proves necessary, two 2 1/2-inch lines that already have been stretched can be combined to supply a portable deluge set, providing flows of 500 gpm and more. Firefighters operating from outside positions must constantly be aware of the danger of collapse. The size of the "collapse zone" is dictated by the height and construction of the fire building. Using the long reach of the 2 1/2-inch stream is essential to keep firefighters out of the danger area. Avoid the temptation to creep into the collapse zone for a better shot at the fire. Line and sector officers must exercise close supervision in these cases due to the inherent aggressiveness displayed by most firefighters. If the stream isn`t reaching the desired objective, reposition to another safe location or consider the use of a master stream device, as discussed above.

Unable to Determine Extent of Fire Area

If the size of the potential fire area cannot be determined initially or if the size (volume) of fire within a particular occupancy is unknown, use the 2 1/2-inch line. The 2 1/2-inch handline is needed for its high-volume flow and because it can deliver its high flow a distance of some 70 feet or more. With a solid-stream tip, the water can be directed into highly heated fire areas without significant loss of volume due to premature water vaporization. If a size-up of the fire area or the amount of fire reveals that the fire can be handled with smaller hose, the 2 1/2-inch line can be put aside or reduced to 1 3/4- or 2-inch hose, as previously described.

Large, Uncompartmented Areas

Large, undivided areas require the volume, reach, and penetration offered by the 2 1/2-inch line. The wide-open floor spaces found in supermarkets, bowling alleys, and warehouses are common examples. Most of these occupancies also feature high ceilings. High-ceiling areas allow large amounts of heated fire gases to collect while giving little indication of their presence at floor level. These gases can ignite suddenly, and the streams produced by smaller handlines may not be sufficient to push back the flames, cool the ceiling (which may be combustible itself), and penetrate to the burning solid fuel. The reach provided by a properly pressurized 2 1/2-inch line often allows it to be operated from the safety of a doorway until the ceiling gases have been dealt with and advance is possible.

Tons of Water

A 2 1/2-inch handline with a 1 1/8-inch solid-stream tip will deliver approximately 260 gpm at a nozzle pressure of 50 psi. With a weight of about 8.33 pounds per gallon of fresh water, that`s more than one ton of water per minute. Lobbing more than a ton of water per minute on smoldering rubble or large piles of rubbish from a safe distance is another use of the 2 1/2-inch line. Although many times a master stream device can accomplish the same objective with less physical effort on the part of the firefighters operating it, sometimes the flexibility afforded by a high-volume handline is required. At many fire operations, master stream devices and high-volume handlines are used simultaneously, and this often is the soundest approach in terms of its tactical benefit to the incident commander.

Standpipe System Operations

As I discussed in my article "Standpipe System Operations: Engine Company Basics" (Fire Engineering, February 1996), the many variables involved in using standpipe systems require that 2 1/2-inch hose be used. A 2 1/2-inch handline fitted with a 1 1/8- or 1 1/4-inch solid-stream nozzle tip can deliver a significant quantity of water at

very low pressure. Pressure problems are common at standpipe operations, and the pressure available at upper-floor hose outlets may not be sufficient to overcome the high friction loss produced by smaller handlines at desired flows. The chapter "Standpipe Work at Fires" in The Fire Chief`s Handbook, Second Edition (The Reuben H. Donnelley Corporation, 1960) indicates that even with less than 50 psi pressure available at the hose outlet, a flow of about 220 gpm can be provided through three lengths (150 feet) of 2 1/2-inch hose equipped with a 1 1/8-inch solid-stream tip. The Handbook states on page 360 that "about 30 to 35 pounds nozzle pressure is enough for men to handle when working into a smoke-filled floor and will furnish a stream of sufficient strength and reach if properly applied." The fact that even at very low pressures 2 1/2-inch hose can easily deliver more than 200 gpm makes it the best choice for firefighting safety and effectiveness during standpipe system operations.

Regardless of when and where a 2 1/2-inch handline is used, reducing the tip pressure will produce a more manageable nozzle reaction force and facilitate better line movement and handling. At a flow of 260 gpm, the nozzle reaction produced by a 1 1/8-inch tip at 50 psi is about 95 pounds. By lowering the tip pressure to 40 psi, the nozzle reaction drops to about 76 pounds at a not-too-modest 236 gpm. Although by lowering tip pressures the upper end flows will not be delivered, streams significantly higher in volume than those produced by smaller-diameter lines are readily attained.

HANDLING 2 1/2-INCH HOSE

Many otherwise excellent texts and training guides on firefighting procedures depict 2 1/2-inch hose as an immobile handline reserved for use at lumberyard fires or other defensive operations. It is usually illustrated in a fixed position, with the hose formed into a loop and the nozzleman sitting atop the line at the point where the hose crosses over itself. Sometimes it is shown being held by three or four firefighters, often on opposite sides of the line, grasping the handles of the nozzle playpipe or supporting the hose on their shoulders using hose ropes or straps. In either case, movement of the 2 1/2-inch line is handicapped, and it can hardly be considered an effective handline for interior fire attack. With the right hose and nozzle and regular training, however, 2 1/2-inch hose can be developed into a highly mobile handline, well-suited to offensive and defensive firefighting.

Modern fire hose is exceptionally lightweight. Most outer jackets are made of a synthetic fiber weave, and couplings are constructed of aluminum alloy. Modern nozzles are also very lightweight and of aluminum-alloy construction. Some new solid- stream nozzle tips are made of highly durable plastic. Nozzles used with 2 1/2-inch hose are not limited to stacked-tip configurations and large playpipes with handles. FDNY has used "direct-connect" 2 1/2-inch nozzles for decades, never having adopted playpipes. Direct-connect nozzles feature a compact shutoff and a detachable nozzle tip. FDNY currently uses a 1 1/8-inch nozzle tip, but the 1 1/4-inch tip was used for many years and still is the standard tip size in Chicago and several other cities. Recently, FDNY has started a pilot program to evaluate pistol-grip shutoffs for 2 1/2-inch hose. While there are pros

and cons to using pistol grips (which I have discussed in previous articles), I am in favor of pistol grips on 2 1/2-inch handlines to aid in resisting the high nozzle reaction force generated by a ton-per-minute fire stream. Even if your department prefers 2 1/2-inch nozzles with playpipes, modern playpipe assemblies are available in lightweight construction.

Effective use of the 2 1/2-inch handline requires thorough training so firefighters become familiar with its size, weight, and handling. A nozzle team assigned to operate a 2 1/2-inch line should stretch the line dry as far as safely practical. It is much easier to move an uncharged line than a charged one. Once the line is charged, it must be bled of air. While all handlines must be bled prior to advancing, 2 1/2-inch hose entrains more air than smaller lines. Thoroughly bleeding the line is of particular importance at operations involving automatic and nonautomatic dry standpipe systems. In addition to air being trapped within the 2 1/2-inch hose itself, large amounts of air from an improperly flushed standpipe riser will enter the line and must be bled off at the nozzle. A story was related to me about a nozzleman who failed to bleed the line properly at a fire involving a couch in a standpipe-equipped building. The air that was discharged through the nozzle quickly increased the size and intensity of the fire, which grew to involve the entire living room.

-Controlling and operating a 2 1/2-inch hand-line, while far from easy, can be facilitated by following these basic rules:

-The nozzleman must keep sufficient hose out in front to permit unhindered nozzle movement.

-The backup man should lean into the nozzleman to provide physical support in resisting the nozzle reaction.

-The backup man must keep the line low behind the nozzleman and as straight as possible.

-The backup man should "pin" the hose to the ground using his hands or knees, thus easing the task of resisting the reaction force without adversely affecting nozzle movement.

-When moving the line, shut down or gate down the nozzle to reduce the reaction-burden. Make sure the fire area ahead of the line has been cooled sufficiently before advancing.

-Attempting to stand while operating a 2 1/2-inch line is difficult at best. If a doorway, wall, or tree is nearby, lean against it and use it to help resist the nozzle reaction.

-It may be necessary to assign additional personnel to "lighten up" on the line and keep it moving. This is especially important during standpipe operations or when the line must make several bends and turns.

-If a 2 1/2-inch line is being used in a purely defensive mode and staffing levels are light, forming the line into a loop, as described earlier, is an acceptable technique.

It should be noted that many of these rules apply to any size handlines. In addition, due to the long stream reach produced by a solid-stream tip and 2 1/2-inch hose, geometry tells us that a small movement of the nozzle will result in the distribution of water over a rather wide arc some 60 or 70 feet away. This is important because rapid nozzle movements are not easily performed when 250 gpm or more is flowing.

BIG FIRE, BIG WATER

Most structure fires (probably around 90 percent or so) are quickly controlled by a single 1 1/2, 1 3/4, or 2-inch handline. It`s the other 10 percent, however, that necessitate fire departments` maintaining 2 1/2-inch handlines on their apparatus. Minimal staffing does not alter the fact that some fires require 2 1/2-inch handlines for expeditious control. When big fires occur, big water is needed; 2 1/2-inch hose is a time-tested fire attack tool for delivering high-volume flows with long reach and exceptional knockdown power. It remains a vital part of the municipal fire service arsenal.

FDNY standard operating procedures require the use of 2 1/2-inch hose for fires involving stores, factories, and other commercial occupancies. Nozzle teams should use the long reach and high volume of the 2 1/2-inch stream to best advantage when attacking fires in these and similar occupancies. Be cautious when advancing the line at commercial building fires. It is possible that what appears to be a first-floor fire actually originated in the cellar or subcellar. (Photo by Bob Pressler.)

When an advanced fire is encountered, a 2 1/2-inch handline is needed for

rapid control. Unlike most portable master stream devices, 2 1/2-inch hose can be deployed quickly and is highly mobile, allowing its operation from positions that are inaccessible to master stream devices. This is particularly important when life safety is a factor or when the potential for autoexposure or fire extension to nearby buildings exists. Large, uncompartmented areas (supermarkets, department stores, manufacturing occupancies, service garages, and so on) require the use of 2 1/2-inch hose to best ensure firefighter safety. High-heat conditions and a large volume of fire demand the 250 to 320 gpm flow possible from a 2 1/2-inch handline. A solid-stream tip (1 1/8 or 1 1/4-inch) will provide exceptional reach while minimizing premature water vaporization. A 2 1/2-inch handline is ideal for defensive firefighting operations. Its long-reaching, high-volume stream permits firefighters to operate outside the collapse zone, but it is more flexible than a portable master stream device. Oftentimes, 2 1/2-inch handlines and master stream devices are used together to control large fires and keep exposure buildings cool. Standpipe system operations require 2 1/2-inch hose and solid-stream nozzles because they can deliver flows of more than 200 gpm at very low pressures. The friction loss per 50-foot length of 2 1/2-inch hose while flowing 260 gpm is only about six to eight psi.

A 2 1/2-inch handline often proves too difficult to bend and maneuver within the confines of residential buildings and other small occupancies. After a quick knockdown from the outside, the 2 1/2-inch line can be reduced to a 1 3/4- or 2-inch hose by simply unscrewing the nozzle tip and connecting the smaller hose to the nozzle shutoff. It is important to prevent the shutoff from being inadvertently closed, which could result in burn injuries to the nozzle team. It is easily secured in the open position using a short length of rope. (Photo by author.)

Note how the backup man is "pinning" the 2 1/2-inch hose to the ground using his hands and knees. This allows him to resist the nozzle reaction without undue stress and permits the nozzleman to freely move the nozzle. The nozzleman must strive to keep the nozzle in front of and away from his body to permit effective movement of the stream. (Photo by Matt Daly.)

Modern 2 1/2-inch nozzles are lightweight and very compact. These so-called "direct-connect" nozzles often feature pistol grips. Attaching this type of nozzle to lightweight 2 1/2-inch hose makes a highly effective hose/nozzle combination that is well-suited to offensive firefighting. If your department prefers 2 1/2-inch nozzles with playpipes and handles, modern types are made of lightweight aluminum alloy and are much easier to carry and manipulate than heavy, brass ones. This 2 1/2-inch handline is fitted with a lightweight nozzle that features three stacked tips to provide a range of high-volume flows. (Photos by author.)


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STRETCHING AND ADVANCING HANDLINES, PART 1

BY ANDREW A. FREDERICKS

Quickly stretching and advancing a handline is the most fundamental and important firefighting function an engine company performs. This series of two articles will discuss the proper stretching and advancing of handlines to control and extinguish structure fires-fires where lives are most often at stake. Part 1 will examine various considerations in stretching handlines, and Part 2 will cover techniques to ensure a safe and efficient advance to the seat of the fire.

INDISPUTABLE TRUTHS

Although tactical considerations governing the selection and placement of handlines based on needed fire flow and fire control objectives will not be addressed here, three indisputable firefighting truths concerning handlines bear mentioning. First, it should be the rare situation indeed that a second handline is stretched before the first line has been stretched, charged, and started its advance on the seat of the fire. The fire control efforts of the first handline save more lives at structure fires than any other firefighting action. Placing the first handline in service must be the primary objective of first alarm engine companies.

Second, in almost every case, the first handline should be stretched through the front entrance to best ensure prompt fire control and the saving of lives. The front entrance is usually the most accessible and easiest to reach; it leads directly to the main hall and stairs--usually the primary means of egress for building occupants--and permits the first handline to be placed in service quickly to protect firefighters performing search operations on the fire floor and the floor(s) above.

Third, as near as possible, the ideal amount of hose necessary to reach the fire should be stretched. When an insufficient amount of hose is stretched (a so-called "short" stretch), rapid fire control will not be achieved, and a lot of screaming will take place on the fire floor. If too much hose is stretched, excessive kinks and high friction loss become problems. The fear (bordering on paranoia) of not stretching enough hose has resulted in stretches with up to six or seven extra lengths. Stretching the correct amount of hose for a given fire situation requires knowledge of various building types and an accurate estimate of the distance between the engine apparatus and the seat of the fire.

BASIC RULES OF STRETCHING HOSE

The following basic rules apply anytime a handline is stretched:

1. You must know the exact location of the fire before you can correctly estimate a handline stretch. The importance of this rule cannot be overstated. A reported fire on the third floor does not necessarily mean that the fire is on that floor. The fire may turn out

to be on the fifth floor, and removing only enough hose to reach the third floor would cause a significant delay in applying water on the fire. In addition to facilitating a more accurate estimate of the hose required, waiting until the location of the fire has been confirmed will help to avoid stretching the line to the wrong place. Handlines have been stretched to the wrong floor, into the wrong wing of a building, and even into the wrong building altogether.

2. Estimating the amount of hose required to reach a fire is a two-step process. The first step is to determine the amount of hose needed within the fire building. This amount of hose is usually consistent for a given family or group of buildings, simplifying the hose estimate. The second step is to determine how much hose is required between the engine apparatus and the entrance door to the fire building. This will vary according to how far the building is set back from the street; the position of the engine apparatus in relation to the building entrance (often a factor of the type of water supply procedure employed); and landscaping, fencing, or other obstructions that might increase the amount of hose required. The use of preconnected handlines has somewhat eroded firefighters` abilities to estimate how much hose will be needed. But even when preconnected lines are employed, some hose estimation is required, especially when preconnected handlines of various lengths are carried on the same apparatus.

3. Pre-incident planning is essential. For large-area buildings and garden-apartment complexes, stretching dry lines during training exercises or pre-incident planning activities will help eliminate problems when a fire does occur. Long handlines may be required, and engine apparatus should be equipped with hose loads that allow for a rapid and efficient stretch even when the fire area is beyond the reach of the longest preconnected line.

ESTIMATING THE STRETCH

As mentioned in Rule #2 above, many types of buildings (particularly residential buildings) allow for fairly accurate estimates of the amount of hose required. Most rules for estimating hose are based on a building`s size and its stair configuration. Each City of New York (NY) Fire Depart-ment (FDNY) engine company assigns an experienced firefighter to "control" the handline stretch. The "control firefighter" is responsible for estimating the amount of hose needed to reach the fire and ensuring that it is properly removed from the hosebed. When I am assigned this position, I use several basic formulas to assist in determining the amount of hose required. FDNY does not use preconnected handlines, due to the tremendous variation in hose stretches faced by firefighters in New York City. Handline stretches in my area of the Bronx can vary from about three lengths (150 feet) up to 14 lengths (700 feet) or more, making accurate hose estimation vital.

The first formula concerns private dwellings. Most private dwellings (up to three stories) can be covered with between one and three lengths of hose, depending on the dwelling`s size. It is a good idea to stretch enough hose to cover the entire dwelling, since the line may have to be repositioned to cut off a rapidly extending fire. The amount of hose required to reach the entrance door from the street may be two or three lengths

in suburban areas, but often a single length will suffice. Fires in two-story garden apartment buildings are effectively reached by two lengths; three-story garden apartments require a third length. It may require a significant amount of hose to reach the entrance of the garden apartment building itself. This issue is addressed later.

Another formula can be used for small multiple dwellings (buildings with a front-age of 35 feet or less and a depth of between 50 and 75 feet). For these small buildings, simply use the floor number of the fire floor to determine the amount of hose required. For example, a fire on the fourth floor would require four lengths of hose within the building to reach a rear room in the fire apartment. This accounts for one length of hose between the first and second floors, a second length between the second and third floors, a third length between the third and fourth floors, and a length for the fire floor. (Maintaining at least one length on the fire floor is another good practice. Larger buildings may require up to two lengths or more.) Since the distance between the front entrance and stairs is short and the stairs are usually of a small, U-return type, this formula works very effectively. Lengths of hose are added based on how far the engine is from the building entrance.

In the case of larger multiple dwellings (buildings with frontages from about 36 feet up to 100 feet and depths up to 100 feet or so), start with the floor number of the fire apartment and immediately add one length. More lengths may be required as follows: The distance between the entrance door and stairs may require at least one full length; a very large building will warrant a second length on the fire floor. For a fire on the sixth floor of a large multiple dwelling, my initial hose estimate is six lengths, plus one, for a total of seven lengths. If it turns out that the distance between the entrance door and stairs is about one length, I will add this to the estimate, for a total of eight lengths. Many of these buildings have large apartments, straight-run stairs, long hallways, and large lobbies. These features demand a hose estimate formula more generous than the one used for smaller multiple dwellings. In the example above, five lengths are needed to reach from the base of the stairs to the sixth floor; one length is needed between the entrance door and the stairway itself; and two lengths are available on the fire floor due to the long hallways and large apartments. Additional lengths will be needed between the fire building entrance and the engine apparatus.

HOSE STRETCH VARIATIONS

Occasionally, a stair configuration may require adjustments to the basic hose estimation formulas. One such configuration is that in which the stairs wrap around an elevator shaft. Although not a common arrangement, it dramatically increases the difficulty of the stretch and requires that additional lengths be figured into the hose estimate. On the other hand, sometimes fewer lengths of hose are needed to reach a given fire area. Some stairways contain a well-hole, a vertical opening within the center of the stairway that often permits a single 50-foot length of hose to reach from the first to the fifth floor. The presence of a well-hole must be made known as soon as possible so the hose estimate can be adjusted accordingly. Effective use of a well-hole can reduce substantially the number of lengths required. This in turn increases the speed with which a handline can be placed in service and significantly decreases friction loss.

Although many commercial buildings require thorough pre-incident planning to determine the amount of hose necessary to reach specific areas, typical "main street" businesses--those located on the first floor of multiple dwellings or in one- and two-story taxpayer buildings--can usually be covered by one or two lengths of hose. Most of these buildings are between 50 and 100 feet deep, and entrances are readily accessible on the sidewalk. An additional length should be added for a cellar fire, since many bends and turns may have to be made, or should an alternate entrance have to be used for the line advance.

When stretching a second handline at a structure fire, it is good practice to make the second line longer than the first by one length. Although the primary purpose of the second handline is to ensure the safety of the nozzle team assigned to the first line, in multistory buildings the second line is often directed to cover areas above the main body of fire. Operations on the floor above the fire may be ordered to protect searching firefighters or to control fire extension. Even in one-story structures, the second line may be directed into adjoining areas, and additional hose may be required. Im-mediately adding another length in anticipation of operating above or adjacent to the main body of fire will save time and provide for a smoother, more professional operation.

FDNY standard operating procedures require that anytime a third line is needed, it be stretched via the outside of the building. This is done to reduce the difficulties created when three lines are stretched via the interior stairs. Three charged lines on a narrow staircase can make moving up and down extremely hazardous and advancing the lines difficult, since they often become entangled. A quick and easy way to stretch a line on the outside of a building is to use a utility rope. The rope can be deployed from a stairway window, an apartment window, a fire escape balcony, or the building`s roof. FDNY uses a 75-foot-long 3/8-inch nylon rope, which is stored in a 1 1/2-gallon empty plastic bleach bottle with a hole cut near the top. Many companies attach snap hooks to each end of the rope. The nozzle firefighter and officer ascend to the point at which the rope will be deployed while the balance of the engine company stretches the handline to the "drop point." Once the rope is dropped, it is attached to the hose using either a clove hitch and binder, a simple hitch, or the snap hook, which is wrapped around the hose behind the nozzle and then hooked onto the rope. Utility rope stretches also come in handy at fires in large buildings with complex layouts and when the stairs wrap around an elevator shaft, as discussed above.

One more point: While it may be necessary to use an aerial ladder to stretch a handline, do not allow a charged line to lie on the ladder. Instead, let the line run vertically up the side of the building and properly secure it with a hose strap. This will reduce the amount of hose needed in the stretch and free the aerial ladder for other critical duties. Aerial ladders are purchased by fire departments for the following reasons (listed in ascending order of importance): (4) to provide elevated master streams, (3) to provide access to the fire building for topside ventilation and VES (vent-enter-search) operations, (2) to rescue or remove civilian victims, and (1) to rescue firefighters trapped on the upper floors. If the aerial is tied up with a handline, this defeats its primary purpose, and

firefighters lives may be jeopardized. Tom Brennan has made this point more than once in his Random Thoughts column, and I feel it is important enough to mention again.

In the absence of a utility rope, a six- or eight-foot hook can be used to stretch a handline to the upper floors via a fire escape. Place the bale or handle of the nozzle shutoff on the hook, which is held in an inverted position and passed hand-over-hand to firefighters stationed on each fire escape balcony between the ground and the point at which the line enters the building (most often the floor below the fire). For extra security, the nozzle can be lashed to the hook with a hose strap or a short length of rope. This technique is a modification of a hose-stretching method used many years ago that used a special "fire escape hook."

WHEN PRECONNECTED LINES FALL SHORT

How do fire departments successfully handle structure fires that cannot be reached by preconnected lines? Several methods are available to quickly ensure placement of the first handline (as well as a backup line), even when fire areas are a considerable distance from the engine apparatus. One method is to use a "bulk," "dead load," or "static" hosebed--containing hose that is not preconnected. Carrying hose in this fashion permits the effective use of a "reverse lay" or "backstretch" and allows rapid deployment of a long handline.

Static hosebeds may contain up to 16 lengths of line and are used very successfully by many fire departments, including FDNY and Los Angeles City, California. In FDNY, each engine is equipped with two 1 3/4-inch and one 2 1/2-inch hosebeds. The 1 3/4-inch beds contain no more than six lengths of 1 3/4-inch hose "filled out" with 2 1/2-inch hose, to reduce friction loss when a long stretch is required. Los Angeles City engines are equipped with three transverse hosebeds (sometimes called "crosslays"), each containing a handline loaded in bulk fashion. After the necessary amount of hose is removed, the line is broken and attached to one of three discharge outlets located below the transverse hose compartments.

Another method of overcoming the limitations posed by preconnected lines is to combine the features of a static hosebed with a preconnected hose load. Part of the hose loaded in a hose compartment is preconnected. Additional hose is carried in bulk fashion below the preconnected line or in an adjacent compartment. If more line is needed, it is added to the preconnected line near the engine apparatus. A problem posed by this method is that most crosslay hosebeds feature a discharge outlet on a chicksan swivel. The swivel is often difficult to reach due to the height or width of the crosslay hose compartment. A simple solution is to connect a five- to 10-foot length of hose to the swivel outlet. This makes breaking the line to add more hose an easy process and eliminates any delays in getting water on the fire. The same solution can be used for preconnected lines loaded at the rear of the apparatus. Many older engines are fitted with discharge outlets at the front of the hosebed, not readily accessible from the rear step. By using a 10- or 15-foot length of hose, the handline can be quickly broken and additional lengths inserted as needed.

Still another method is to use a static hose load consisting of 2 1/2-inch or three-inch hose with a manifold (usually a gated wye or "water thief" appliance) attached. Anywhere from two to four lengths of 1 3/4- or two-inch leader line are preconnected to the manifold and bundled as a "skid load" for efficient transport. The bundled hose may be held together by old seat belts, nylon webbing, or sections of inner tube. Once the manifold is in position, the leader line is unbundled, charged, and advanced into the fire area. In the case of multistory buildings, the manifold may be deployed in the lobby or on the floor below the fire, depending on the location of the fire in the building. At fires involving garden apartments or private dwellings set well back from the street, the manifold is usually brought to a point just outside the entrance door. The leader line is then flaked out and charged. A second line can be quickly attached to the manifold--and perhaps even a third and fourth line--depending on the size of hose supplying the manifold and the type of manifold in use. Large manifolds with up to six 2 1/2-inch outlets are available for use with four- and five-inch hose.

Once a manifold has been placed in service and the first line is charged and advancing on the fire, where is the hose that is to be used for subsequent handlines obtained? Some departments merely disconnect preconnected lines from the apparatus and drag or carry them as a shoulder load to the manifold. Other departments use additional bundled hose loads. Still others carry the hose in a soft-sided bag or case. As I mentioned in "The 2 1/2-Inch Handline" (Fire Engineering, December 1996, pp. 36-49), whenever a leader line is attached to a nozzle shutoff or manifold, the shutoff or manifold should be secured in the open position to ensure the safety of the nozzle team.

STRETCHING THE HANDLINE

Once the correct amount of hose has been removed from the apparatus, it must be brought to the point of operation. I will not begin to describe the many different hose loads in use, but I must mention some key considerations in loading hose that will facilitate a rapid and efficient stretch. One is to load the hose such that the firefighter assigned to the nozzle can easily remove the nozzle and at least one length of hose. The nozzle firefighter is responsible for the length of hose that is advanced into the fire area--the so-called "working length." It is very poor practice to simply grab the nozzle and run, trailing hose behind. This hose inevitably gets caught on car tires, tailpipes, shrubbery, fences, door jambs, and so on. If the nozzle firefighter does not stretch sufficient hose to cover the anticipated fire area, he has failed in his mission. Likewise, avoid "pulling and piling." Pulling hose off and creating a pile near the apparatus causes knots in the line and greatly increases the potential for kinks once it is charged. In addition, load each preconnected handline so that the entire amount of hose is easily removed or "cleared" from the apparatus, thereby reducing the possibility of charging the line with hose still remaining in the bed.

Another important consideration is to stretch the line uncharged or dry as far as safely practicable. It is much easier and more efficient to stretch a dry line than to advance a line that has been charged prematurely. The point at which the line gets charged varies with the size and type of building involved. Normally, at private dwellings, the line is charged in the front yard or driveway or on the floor below the fire, if cramped quarters

do not make this impracticable. If the line is flaked out in the yard or driveway, it is desirable to form a series of "S"-shaped curves to reduce the potential for kinks. For a second- or third-floor fire, the first 20 to 30 feet of line should be kept straight to permit a quick advance up the stairs.

At multiple dwellings, the line is usually stretched to the public hallway and charged just outside the entrance to the fire apartment. The safety of this tactic hinges on control of the fire apartment door. That is why it is so important to preserve a door`s integrity (minimize distortion so it can still be closed) when forcing it open and to maintain control of it by placing a piece of rope or a hose strap over the doorknob. If fire conditions deteriorate severely before the handline is ready or if a loss of water occurs, you can pull the door shut quickly by grabbing hold of the rope or hose strap. If a size-up of the door indicates the fire is immediately behind the door (blistering or melting paint, door or knob hot to the touch, door or knob glowing red), do not under any circumstances force it open until the line has been charged and bled. Many times the fire apartment door is left open by a fleeing occupant, allowing fire to extend into the public hall. Sometimes the fire has burned through a wooden door or transom, making the public hallway untenable. While ladder company personnel should attempt to close an open apartment door or seal the opening with a door forcibly obtained from an apartment elsewhere in the building, the handline will have to be charged on the floor below the fire and advanced up the stairs. This will require more effort, but it is the only safe course of action. It may also be more efficient to charge the line on the floor below or on the stairs leading up to the fire floor in multiple dwellings with narrow hallways and small landings.

If the fire apartment door is controlled and there is no immediate danger of extension into the public hall, the line should be flaked out on the fire floor. Make every effort to reduce the potential for kinks and to ensure an unhindered advance to the seat of the fire. This may require flaking some of the line out on the stairs leading to the floor above the fire (or the roof bulkhead in the case of a top-floor fire). Two benefits provided by this tactic include less line on the landing, which may be small and crowded, and the assistance gained from gravity feeding the line down the stairs and into the fire apartment. This tactic can also be very dangerous if control of the fire apartment door is lost while the firefighter flaking out the line is still on the stairs above. The firefighter assigned to flake out the line on the stairs (most often the backup firefighter) should ascend only as far as necessary while staying low and against the wall, not the balustrade. His SCBA face piece must be in place, and communication with the forcible entry team is essential. Another tactic is to force the door to an adjoining apartment or, preferably, an apartment opposite the fire apartment and flake the line out inside. Although this may be safer than exposing a firefighter on the stairs above the fire, will the forcible entry tools necessary to force open one or more other doors be available? Will opening the door to another apartment cause the fire to extend or endanger occupant lives due to contamination by heat and smoke? In all cases, these various factors must be carefully (albeit quickly) weighed and a course of action chosen.

MODERN APPARATUS DESIGN

Apparatus design also affects the task of stretching handlines. Engine apparatus continue to get longer, wider, and higher. Many hosebeds are well above the head height of the average firefighter--even when standing on the rear step. Crosslay hosebeds are also very high and are often a chore to reach. This has impacted fireground safety and efficiency by increasing the difficulty in removing hose and stretching handlines. It has also increased the potential for muscle-strain injuries to personnel and the time required to get water on the fire. The height of modern hosebeds can be attributed to both an increased demand for compartment space and today`s average booster tank capacity. Even in urban and suburban areas with adequate water supply systems and engines equipped with large-diameter hose, 750- and 1,000-gallon booster tanks are common. Why? The main reason is staffing. Criminally low staffing levels have forced fire departments to alter their tactics. Increasingly, fire attack operations are initiated with booster water because only two or three personnel arrive with the first engine. In anticipation of a delay in establishing a continuous water supply, larger booster tanks are specified to provide more operational time and a wider cushion against running out of water. Hose loads should be designed as best as possible to overcome the limitations posed by modern apparatus and to recognize the size, strength, and physical abilities of the average firefighter.

OTHER CONSIDERATIONS

Individual fire departments must evaluate their response areas, building types, staffing levels, and hosebed capacities to determine what hose loads will work best for them. The actual mechanics of stretching handlines must be practiced on a regular basis, especially the more difficult and uncommon stretches. For example, a department that routinely fights fires in small, private homes using preconnected handlines must practice stretching hose from a static bed to reach a fire on the upper floors of the few multiple dwellings it protects. Stretching handlines via a wellhole is another tactic that requires practice and discipline on the part of the firefighters involved. Deploying manifolds and leader lines is yet another important tactic requiring regular drills to ensure proficiency. Consult some of the many excellent firefighter training guides for specific information on various hose loads and methods of stretching lines. Ideas and suggestions can also be obtained by visiting neighboring fire departments to see firsthand the types of hose loads in use and how they address operational problems. The chapter "Handling Hose and Nozzles" in Fire Stream Management Handbook by David P. Fornell (Fire Engineering Books, 1991) is an excellent source of information on various hose loads and hosebed configurations used by fire departments around the country.

One more issue must be addressed when discussing handlines--accurate pump discharge pressure (PDP). Most departments label individual gauges or discharge valve handles with preset pressures for their preconnected handlines. This is an effective and widely used system. Complications may arise, however, when a static hose load or manifold and leader line are stretched. In the latter case, if the manifold itself is preconnected and the leader lines are all of the same diameter and length, preset pressures can still be used. If the manifold is not preconnected and its length varies depending on the distance between the engine apparatus and the point of operation,

the chauffeur or pump operator must be informed as to how much hose of each size has been stretched so he can calculate the correct PDP. The same is true if hose is stretched from a static bed. In the case of multistory buildings, the chauffeur must also be told what floor the fire is on, which may not be evident at night or if the fire is in the rear of the building or in a shaft. As handlines grow longer, it is also wise to increase the diameter of the hose to keep friction loss to a minimum. A rule of thumb is to use no more than four lengths of 1 1/2-inch hose, six lengths of 1 3/4-inch hose, or eight lengths of two-inch hose. Using fewer lengths, of course, is better, especially if 100-psi fog nozzles are used as opposed to low-pressure fog nozzles or smooth-bore tips. Using a larger-diameter hose (2 1/2-inch most often) to "fill out" a long stretch is another widely adopted solution. Reducing the PDP minimizes the potential for burst lengths of hose.

As a chauffeur, I must emphasize one more point when stretching hose from a static bed: Once sufficient hose has been removed and the line is broken, let the chauffeur decide to which discharge outlet it should be attached. I prefer to attach the first and second handlines to the pump panel where I can observe them and label them with a grease pencil. Face-to-face communication is essential, as illustrated by the following story: A veteran chauffeur in Brooklyn was suddenly contacted by an officer in charge of a handline desperately asking him to charge the line. The chauffeur assumed at first that the officer was mistaken and was actually trying to contact another chauffeur. Just to be on the safe side, however, he walked around to the opposite side of his rig to investigate. Sure enough, a dry handline was attached to a discharge outlet, and it proved to be the handline in question. The firefighter who had broken this line and connected it to the rig never informed the chauffeur he had done so. Not only didn`t the chauffeur know how much hose had been stretched, he didn`t even know he was responsible for supplying another handline. Communication on the fireground, particularly between the chauffeur and the nozzle team(s) he is supplying, is vital. Take a few seconds to talk, and you may save yourself a lot of heartache later.

PREPARING FOR THE ADVANCE

Even after a long and difficult hose stretch, the real work of the engine company has yet to begin. This is where experience and training really pay dividends. As the late senior member of Engine Company 48 in the Bronx used to say, "Never run to the rig when turning out for an alarm; if you run to the rig, you`ll run at the fire, and running leads to shouting and the job won`t get done." Experienced firefighters know how to pace themselves--both physically and mentally; this conserves energy, prevents needless injuries, and enables them to maintain a focus on the task at hand without losing sight of the big picture. Advancing a handline at a tough fire requires discipline, concentration, and some intangible factors--courage, mostly--to see the job through. The many considerations in advancing handlines will be covered in Part 2. Emphasis will be on the first line, since it is the most critical.


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STRETCHING AND ADVANCING HANDLINES, PART 2

BY ANDREW A. FREDERICKS

Part 1 (March 1997) covered stretching handlines, including estimating the amount of hose needed for specific types of buildings and hose loading techniques to effect prompt handline placement under a variety of operating conditions. Part 2 describes procedures to help ensure a safe and efficient advance to the seat of the fire, with specific attention given to the first line, as it is responsible for saving most lives at structure fires.

THE NOZZLE TEAM

In many cases, engine company staffing provides for only two firefighters (or one firefighter and an officer) to stretch and advance the first handline. Where most firefighting operations are performed in private dwellings using preconnected lines, two firefighters may be sufficient. In areas where longer, more difficult stretches are necessary, three or more firefighters will be needed. An incident commander should never hesitate to team together two, three, or even four engine companies to ensure prompt placement and operation of the first handline at a structure fire. In addition to the required number of firefighters, an officer should be assigned to direct the advance of the line. The benefits to be derived from having a supervising officer are described more fully below.

The first two firefighters on a handline (as well as the officer, if present) are commonly referred to as the "nozzle team." One firefighter is assigned to operate the nozzle and the other (called the "backup" firefighter) helps resist the nozzle reaction so the nozzle firefighter can freely manipulate the nozzle. If a third firefighter is available, he is assigned the "door" position. Once the handline begins its attack on the fire, the "door" firefighter facilitates a smooth and rapid advance by feeding hose to the nozzle team. In the City of New York (NY) Fire Department (FDNY), some engine companies have a fourth firefighter to assist in stretching and advancing the handline. This firefighter is assigned the "control" position, described in Part 1. In those engine companies without a separate and distinct "control" position, the door firefighter assumes responsibility for controlling the stretch. Once the line is charged, he moves into position at the door to the fire area and feeds hose to the nozzle team.

Let`s examine the specific responsibilities given to each firefighter during the handline advance, beginning with the engine company officer.

THE ENGINE COMPANY OFFICER

Many engine companies include an officer in their staffing levels, but all too often he is a "working" officer, forced to assist with both stretching and advancing the handline. In some fire departments, the engine company officer is actually the nozzleman or backup

man. This detracts from his ability to observe conditions, communicate with the IC, and monitor the safety of the nozzle team. In addition to these important functions, what other advantages does a supervising officer provide?

At private-dwelling fires, the officer can often make a quick perimeter survey as the handline is being stretched. This will assist in determining the location of the fire and provide information on fire extension and rescue problems. An interior survey also should be attempted, including conducting a quick primary search in the immediate fire area and closing any doors that will help retard fire spread. This is especially important when no ladder company is on the scene or it is understaffed. At multiple-dwelling fires, the officer can assist in the hose estimate and should immediately announce the presence of a wellhole and report on any unusual conditions that will affect the handline stretch.

When there is no ladder company present, the officer should confirm the floor and number of the fire apartment and attempt to gain entry to locate the fire and search for any trapped occupants. If heat and fire conditions preclude a search, a glance below the smoke may prove helpful.

If a ladder company arrives along with the engine, an effective technique for the engine company officer is to drop down to the apartment below the fire apartment and attempt to gain entry. This will provide the officer with important information concerning the layout of the fire apartment, which can then be relayed to the nozzle team. If the fire apartment is in the rear of the building, there may be no indication of the fire`s location from the street.

To help pinpoint the fire room(s), the officer should look out any rear and side windows of the apartment below for signs of smoke and flame issuing from the fire apartment. Once the fire`s location is determined--either visually or from radio reports given by ladder company personnel searching the fire apartment--the officer should count the number of doors, the required number of left- and right-hand turns, and the approximate distance between the entrance door and the seat of the fire. On his return to the fire floor, it may also prove valuable to look out the stairway window at the half landing to obtain one more view of the fire apartment from the exterior. The same techniques can be used for second- and third-floor fires in garden apartment buildings. Even for a first-floor fire, the adjacent apartment is usually a mirror image of the fire apartment, and much information can be obtained by taking a quick look. Of course, no matter what the fire situation, information gathered from occupants, neighbors, and early arriving police officers may prove extremely valuable.

THE NOZZLE FIREFIGHTER

When possible, the firefighter assigned to the nozzle should be both aggressive and experienced. In the absence of an officer, the nozzleman establishes the pace of the handline advance and makes many decisions on which the outcome of the entire firefighting operation hinges. He chooses when to open and close the nozzle and where to direct the stream to confine and extinguish the fire as quickly as possible. Without an

officer present, the nozzleman must be equipped with a portable radio to call for water, to report information on the progress of the fire attack operation, and to request help when necessary.

The nozzleman must maintain control of the nozzle at all times. While waiting for the line to be charged, he should kneel on the hose immediately behind the nozzle and ensure it does not get kicked by a passing firefighter. He is also responsible for bleeding trapped air from the line prior to the advance.

Some nozzlemen prefer to crack the nozzle open as they await water. This provides immediate indication that the line is being charged and allows the air to bleed off as the hose fills with water. Others simply wait until the line stiffens and then bleed off the trapped air. In addition to exhausting trapped air, cracking open the nozzle provides the nozzleman with assurance that the engine apparatus is in pump gear.

Occasionally, an inexperienced chauffeur may forget to place the rig in "pumps." Due to the "flow through" nature of centrifugal pumps, hydrant pressure will permit the handline to fill with water, but the pressure received at the nozzle may be inadequate to produce an effective fire stream. NEVER enter the fire area or suspected fire area with an uncharged handline.

Use straight or solid streams for the fire attack--as they are much less disruptive to the thermal balance than fog streams. As a result, they help maintain better visibility, produce less unwanted steam, and are less likely to "push" fire. They also have long reach, which is necessary when several rooms are involved or you encounter a long hallway.

If using a fog nozzle, the nozzleman must ensure that it is in straight-stream position. As the nozzleman holds the nozzle, straight-stream position requires that he rotate the pattern adjustment ring clockwise. It is a good idea to keep fog nozzles in straight-stream position at all times, but the nozzleman should still check while waiting for water.

As a general rule, do not open the nozzle on smoke. The nozzleman should wait until he encounters fire and direct the stream toward the ceiling while whipping the nozzle in a clockwise or side-to-side motion.

After the fire begins to "darken down," the nozzleman can lower the angle of the nozzle and soak the smoldering solid fuels with water. If the fire is relatively small to begin with, deflecting the stream is not necessary. Once a fire has started to roll across the underside of the ceiling, he should direct the stream at an upward angle to allow droplets of water to rebound off the ceiling and upper walls, penetrate the thermal column of the fire, and cool the solid fuel materials below their vaporization temperatures. This will cause the flame front at the ceiling to diminish and permit a closer approach to the seat of the fire. (For more information on proper direct fire attack techniques and the use of solid-stream nozzles, see my article "Return of the Solid Stream," Fire Engineering, September, 1995, pp. 44-56.)

It is also very important for the nozzleman to sweep the floor periodically with the stream as the team advances. This pushes aside and/or cools burning embers, scalding water, and molten plastics. Even while members are wearing bunker pants, knee burns are still possible. The protective layers of the bunker gear are stretched tight over the joint when kneeling, thus eliminating much of their insulating qualities. Sweeping the floor also "sounds" the floor to provide indication that a hole or other opening lies ahead. Still one more important reason for sweeping the floor is to push aside glass shards, nails, and hypodermic needles. Bunker pants will do little to prevent penetration by a needle positioned at just the right angle. Use extreme caution when advancing over carpeting, as "sharps" may be stuck in the pile at crazy angles and may not dislodge when you sweep the floor. It may be safest to "duck walk."

I stated above that in most cases you should not open the nozzle on smoke. Recently, many veteran firefighters and officers have indicated that it may be necessary to rethink this approach. The fire environment has grown more dangerous and less predictable from the use of energy-efficient windows (not to be confused with simple, double-glazed windows), membrane roofs, and fuel materials that produce increasingly large quantities of dark flammable smoke. High heat conditions that force the nozzle team down to floor level with no visible fire may necessitate that the nozzle be opened on smoke, at least momentarily, to avoid burns from imminent rollover and flashover. I recently had such an experience with my local volunteer fire company at a cellar fire in an old, wood-frame, converted dwelling.

We advanced a handline down one of two interior stairways leading to the cellar. Initially, heat conditions were very tolerable at the top of the stairs, so a mad dash to the bottom was not necessary. A tenant insisted that the fire was "to the left" once we reached the bottom of the stairs. So at the bottom of the stairs, we made a left turn and advanced a little bit, but no fire was readily visible. It turns out we were not in the fire room but in a large utility room connected to the fire room by a doorway. The doorway itself was in the far corner of the room located behind two oversize water heaters. Unfortunately, almost as soon as our advance began, so did our problems. Three firefighters, including the nozzleman and me, stumbled into sump pits located around the boiler. A water pipe burst, spraying us with hot water; wires and plastic conduit dropped from the ceiling, producing an entanglement hazard; and all the while, heat conditions continued to intensify without any sign of fire rolling across the ceiling. Stone foundation walls, which radiated the heat in all directions, and a lack of available ventilation openings exacerbated our problems. Not knowing if fire was wrapping around behind us made me a bit leery of moving forward. After a firefighter descending the stairs said the venting smoke was now very hot, a decision was made to open the nozzle, even though no fire was visible. The nozzle was opened briefly and heat conditions did improve slightly, but I was still fearful of the worst. With our handlights shut off, we could finally see a glimpse of fire at ceiling level and quickly knocked it down. A handline had been stretched down the other stairway, and we soon heard the sound of its stream from our position in the utility room. Shortly thereafter, the doorway was discovered behind the water heaters. Opposing streams were never an issue, and

fire venting up the other stairway made for a difficult push but also left no doubt as to the fire`s location.

THE BACKUP FIREFIGHTER

Although lacking the glamour associated with the nozzle position, the backup firefighter plays a key role in handline advance. He must absorb as much of the nozzle reaction burden as possible. The nozzleman and backup man must work in unison, giving the appearance of a well-oiled machine. During most fire attack operations, the nozzleman will be directing the stream toward the ceiling. In this case, the backup man must maintain the line low behind the nozzleman and as straight as possible. If the nozzleman lowers the nozzle to sweep the floor, to hit a burning mattress, or to direct the stream down a cellar stairway, the backup man must elevate the line behind the nozzleman. If the nozzleman directs the stream to the left, the backup man must move the line to the right. Conversely, if the nozzleman swings the nozzle to the right, the backup man must move his part of the line to the left. When no officer is present, the backup man should constantly observe conditions. He becomes the "eyes" of the nozzle team, alert to such dangers as fire rolling overhead, fire wrapping around from behind, or side rooms involved in fire.

The backup man should be in physical contact with the nozzleman. If the nozzle firefighter is relatively inexperienced, a senior backup man can help talk him through the fire, providing encouragement as well as physical support. When the advance must be made by only two people, the backup firefighter will have to move between his position immediately behind the nozzleman and a point several feet behind the operating nozzle to pull hose around corners and keep the line moving. If the officer is the second person on the line, he may be forced to break off on forays to vent and search, leaving the nozzleman to resist the nozzle reaction alone. This fact speaks for the value of low-pressure fog nozzles or solid-stream tips, which produce less reaction force than 100-psi fog nozzles.

THE DOOR FIREFIGHTER

The presence of a third firefighter during handline advance increases efficiency immeasurably. Due to smoke and physical barriers such as walls, the doorman will seldom be able to observe the nozzle team as it is advancing. To permit an unhindered advance without pushing the nozzle team, use the "bow" technique. This requires the doorman to feed sufficient hose toward the nozzle team until he creates a bow in the line. This bow represents slack that the nozzle team can pull trim without undue effort as they advance. As the bow straightens out, the doorman simply feeds more line until the bow is restored. If the team must make many bends and turns, the doorman might consider making a large bow behind him before he moves up to feed hose around the next corner.

When staffing levels are light, an alternative to the bow method is to create a loop in the line and roll the loop of hose into position behind the nozzle team. This provides hose to keep the advance moving when a door firefighter is not available. Obviously, a fourth

firefighter on the line will increase the speed and efficiency of the advance still further. He should be initially positioned on the half landing below the fire floor in multiple dwellings and outside on the front steps or porch in private dwellings.

FINAL PREPARATIONS

After a difficult stretch, the opportunity to quickly regroup and catch your breath while waiting for the line to be charged can go a long way in reducing stress. My brother, an exercise physiologist and fitness specialist, told me that when a rest period (or "refractory" period) between stressful anaerobic activities is short, the ability to quickly recover your heart and breathing rate is vital. This will help ensure that sufficient oxygen is reaching muscle tissues and that performance at a high level can continue. Of course, rapid recovery depends on proper physical conditioning; an adequate hydration level; and experience that teaches you how to work smarter, not harder.

When donning your face piece or pulling up your protective hood, your helmet should be wedged firmly between your legs or under a bent knee so it doesn`t get lost. It is a good idea for all nozzle team members to become proficient in donning their SCBA face pieces, pulling up their protective hoods, and activating their PASS devices with gloves ON. Too many times, I have seen firefighters remove gloves to adjust SCBA straps or coat buckles, only to lose a glove in smoke or darkness or to have trouble getting it back on quickly, delaying the advance. Another reason for learning how to manipulate all your straps and buckles while wearing gloves is that during an SCBA emergency in a hot, smoky environment, there may not be time to remove and then redon gloves saturated with perspiration and water. In addition, it is simply too dangerous to expose your fingers and hands to possible burns and other injuries.

If an officer is present, he will call for water via his portable radio; otherwise, the nozzleman will have to do it. Once the line is bled, the officer (or nozzleman) must contact the ladder company firefighter(s) responsible for ventilation of the fire area. Timing the handline advance with ventilation is very important, and communication is the key. If ventilation is performed before a charged handline is in place, rapid fire growth and early flashover are real possibilities. If the ventilation comes too late or is not adequate to release the heat and expanding steam, the nozzle team will have a difficult advance and may be subject to burn injuries. The most common method of "venting for fire" is to simply remove the windows in the fire area opposite the advancing nozzle team. An exception might be a fire in a one-story "taxpayer" or strip mall. Extensive security measures may make horizontal ventilation at the rear of the building almost impossible. If ventilation is effected, it will be significantly delayed. In these cases, a large hole cut in the roof may be the only way to provide relief for the engine company advancing the handline and to help slow lateral fire spread. A top-floor fire in a multiple dwelling also requires a large roof hole in addition to extensive horizontal ventilation.

During the advance, all members of the nozzle team must be positioned on the same side of the handline. It is also very important that the nozzle team remain low and to one side of the opening to the fire area, using the door and wall as a shield against escaping heat and fire. If an officer is present, he may have to move to the other side of the door

opening due to a narrow hallway or small landing. The officer must exercise extreme caution if this is required. Once the door is forced open, control of the door is vital to the success of the firefighting effort. (Some considerations in door control were discussed in Part 1.) Occasionally, by opening the entrance door to an apartment, the room or rooms involved in fire may be closed off by the open door--especially when you encounter "railroad flats." This makes for some difficult bends and turns and causes a delay in getting water on the fire.

A fire in one such apartment near FDNY Engine 48`s quarters required the forcible entry team from Ladder Company 56 to remove the entrance door. The safety of the firefighters on the handline was a key factor in this decision. Although they could advance the line around the door with some difficulty, evacuating the fire apartment in a hurry would have been impossible. Consider removing an apartment door as a last resort because it violates the principle of door integrity. In this case, the door was not removed until all tenants evacuating down the stairs had descended below the fire floor and the handline had started its advance on the fire with a continuous water supply behind it.

You MUST chock open any door through which the handline passes. Closing a door on an uncharged handline is like placing a hose clamp on the line. For more on the importance of chocking doors, see the sidebar "The Door Chock" by Michael N. Ciampo above. Remove storm doors and screen doors that will not stay open or do not open very wide. The nozzle team (and other firefighters) should also keep doorways clear and unobstructed. This permits an inrush of cool, fresh air to replace the heated products of combustion being displaced by the stream. It also maintains open the means of egress for any remaining occupants, firefighters performing rescue and/or removal operations, and firefighters in distress.

The sound of the stream can also provide clues as to the presence of a window or doorway. A doorway may lead to another room involved in fire. A window opening may allow the stream to be operated across an alley, shaft, or driveway to extinguish the burning sheathing or window frames of an exposure building. In addition, the nozzle pattern can be adjusted to ventilate the fire area. By changing a combination nozzle from straight stream to a fog pattern, effective negative-pressure ventilation is readily accomplished. In FDNY, some nozzlemen and engine officers carry a small, plastic, rotary fog tip (such as that found on standpipe "house line"), which can be quickly placed on the shutoff after removing the solid-stream tip. Even a solid stream, broken into coarse droplets by partially closing the nozzle shutoff, will move a substantial volume of air.

DANGERS OF KINKS

A recent series of tests conducted by FDNY Battalion Chief Peter Rice and involving engine companies 5, 14, and 33 sought to quantify the reduction in water flow caused by kinks. In each test, kinks were introduced into a 1 3/4-inch handline flowing 180 gpm. No more than one kink was placed in any single length of hose, and the changes in flow were noted using LED readout flowmeters, which had recently been recalibrated. Each

kink was formed by making a bend in the hose of approximately 90 degrees. What Chief Rice found is that a single kink will reduce the flow by about 20 gpm. When a second kink was placed in the line, the flow dropped another 30 gpm for a total decrease in flow of 50 gpm. A third kink reduced the flow by another 40 gpm or so. As a result of three kinks, what is believed to be a 180 gpm fire stream may only be half that, and the potential for burn injuries is greatly increased. In addition to the loss of flow volume, the excessive turbulence also reduces the reach of the stream and causes premature stream disintegration when solid-bore tips are used. In a smoke-filled fire area, however, stream impact noise alone may not be sufficient to tell the nozzleman or officer that there is one or more kinks in the line.

It is very important that the backup firefighter (and the door firefighter, if available) "chase the kinks." The engine company chauffeur can certainly chase kinks in the vicinity of his apparatus; ladder company personnel, on entering the fire building and walking up the stairs, should not hesitate to remove kinks as they encounter them as well. After all, ladder company firefighters assigned to operate on the floor above the fire will be in the most severely exposed position if the flow from the handline is compromised by kinks.

ADDITIONAL CONSIDERATIONS
Here are additional thoughts on improving the safety and effectiveness of any handline advance.

Many times, a fire is self-vented on arrival and any prevailing wind is in the nozzle team`s favor. If only one or two rooms are involved, these conditions may permit use of so-called "hit and move" tactics: hit the fire, shut down, advance a little bit, and hit the fire again. Other situations require that the nozzle be kept open throughout the advance. This might be necessary when several rooms are involved in fire; if ventilation is inadequate; when the fire involves a large, open area with high ceilings; when battling a wind-driven fire; and when heat conditions are severe, such as during a fire in a high-rise residential or office building with concrete floors. Advancing a charged line with the nozzle open can be very difficult, particularly 2 1/2-inch hose. Additional personnel will be required to ensure that the handline keeps moving.

Oftentimes, simply finding the seat of the fire in a dense smoke condition can be a challenge. I discussed the necessary operation of the nozzle on smoke earlier, but in most cases, you should not open the nozzle until you locate the fire. While searching for the seat of the fire, move in the direction of greatest heat (which itself can be deceiving, especially in cellars or fire-resistive buildings). Look for the orange glow in the smoke near the ceiling. As mentioned earlier, shutting off handlights or turning them behind you is a good idea. Handlight beams reflected and scattered by opaque smoke particles may help hide the fire. Constantly monitor radio reports from other firefighters, those operating inside as well as outside the fire building. Always be alert to fire below you, especially in houses with balloon framing. What appears to be an upper-floor or attic fire may have originated in the basement or cellar. Use the same precautions at commercial building fires and check the cellar for fire early in the operation.

After you have darkened down the fire, shut down the nozzle so any remaining pockets of fire can "light up" for final extinguishment. Shutting down after knockdown also permits the smoke and steam to lift, improving visibility. Sometimes, you may have to keep the nozzle open to cool a superheated fire area after a post-flashover fire has been controlled. Especially when walls and ceilings are constructed of concrete, gypsum block, or gypsum board, additional cooling of the area to reduce reradiated heat may be required.

The use of a 100-foot lead length in the handline stretch may prove advantageous. By using a 100-foot length as opposed to the standard 50-foot length, the one coupling that always seems to get caught on stair treads, door jambs, and newel posts is eliminated, easing the burden when only two firefighters are advancing the handline.

If you are using nozzles with pistol grip shutoffs, be careful not to let the pistol grip slide back so that it ends up alongside your body. This interferes with nozzle movement and reduces efficiency. Try to keep the nozzle about an arm`s length reach out in front.

One more point concerning nozzles: A nozzle is one of the two or three most important tools used by an engine company. At the start of every tour (or at least weekly), members should remove each nozzle from the hose and examine its condition. Pay specific attention to proper operation of the bail and the condition of the gaskets. In addition, perform any required lubrication, set fog nozzles to straight-stream position, and restore each nozzle to the hose hand tight.

During overhaul, you can reduce nozzle pressures. You might also consider using a 1/2-inch outer stream or "overhaul tip" when using solid-stream nozzles. If the initial nozzle team is fatigued, relief personnel must be available to prevent needless injuries. An incident commander should never hesitate to call an additional alarm, summon off-duty personnel, or request mutual aid in anticipation of needed relief at a difficult fire.

A LIFESAVING TOOL

The first handline is, without question, the most important lifesaving tool at a structure fire. Controlling fire spread and stopping smoke production save an untold number of lives every year. While smoke has its greatest impact on civilians, it is the fire itself that most threatens firefighter safety. Stopping the generation of smoke and toxic gases--especially asphyxiating carbon monoxide--is the best means of safeguarding civilian lives. Firefighters, equipped with SCBA and able to operate in smoke, are more concerned with rollover and flashover. Controlling fire growth to reduce the potential for burn injuries is how the first line best protects firefighters.


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Fire Nuggets

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HANDLINE SELECTION

BY ANDREW A. FREDERICKS

Stretching and operating the first handline at a serious fire is the key to saving lives and constitutes the very essence of the fire department's mission. The effectiveness of the first handline as a lifesaving tool is dependent upon several factors.

Simply put, it requires stretching the correct diameter (size) hose to the correct location in the correct amount as quickly and efficiently as possible.

We will concern ourselves here with the first factor—selecting a handline of the correct size.

Handline selection decisions occur on two levels. First-level decisions are strategic in nature and concern what sizes and amounts of attack and supply hose to carry on each engine apparatus. Decisions at this level require an understanding of community risk characteristics including predominant building types, occupancy hazards, height and area considerations, lot sizes, set backs, and hydrant spacing. These factors must be measured against average response times (which impact fire growth) and engine company staffing levels (larger handlines are more difficult to stretch and operate with fewer firefighters). Existing hosebed capacity may also be a consideration. In general, fire departments equip each engine apparatus with at least two sizes of attack hose: Smaller, more maneuverable 1¾-inch or 2-inch hose for fires involving automobiles and residential occupancies and at least one 2½-inch handline for use when larger flows are needed. (The omission of 1½-inch and 3-inch hose was intentional and will be explained below.)

Second level handline selection is based on a size-up of the fire problem once the engine company arrives "at the box." Tactical handline selection is influenced by one or more of the following factors: Fire department standard operating procedures; the nature of the fire occupancy; the amount of fire encountered; the length of the handline stretch; staffing levels; and the practical flow limitation imposed by each of the available handline options.

With the widespread adoption of 1½-inch hose by municipal fire departments after World War II, fireground tactics changed markedly. No longer was larger, heavier 2½-inch hose required for every fire. Coupled with improvements in turnout clothing and the

availability of self-contained breathing masks, fire departments everywhere gained the ability to attack residential fires quickly and efficiently from the interior.

But the residential fire environment of the 1940's, '50's, '60's, and '70's was much tamer than it is today. The 60-90 gallons- per-minute (gpm) flows typical of 1½-inch hose are now woefully inadequate. A minimum flow of 150 gpm is far safer.

While many residential fires can be extinguished with only 90 gpm and certainly the skill and tenacity of an experienced nozzleman should never be underestimated, 1½-inch hose offers no flow reserve for contingencies. In addition, the friction loss in 1½-inch hose can be significant, requiring a high pump discharge pressure (PDP) and severely restricting handline length.

The use of 1¾-inch hose, pioneered by the New York City Fire Department in the late 1960's, overcame many of these limitations. Not only is the practical flow limit much higher (about 200 gpm versus 125 gpm for 1½-inch), the friction loss per length is much more reasonable.

Consider the following example: A 150-foot, pre-connected, 1½-inch handline with a 100 psi combination nozzle flowing 125 gpm will require a PDP of almost 160 psi. The same flow with the same nozzle through 150 feet of 1¾-inch hose will require a PDP of only 135 psi. At the same PDP used in the first example (160 psi), the 1¾-inch handline will deliver 165 gpm—a 24 percent increase in flow volume.

A more recent introduction is the 2-inch handline. While the practical flow limitation of 2-inch hose is over 200 gpm, in reality there is a significant amount of "unused capacity." It has been suggested that actual fireground flows from 1¾-inch hose average a paltry 110 gpm or less. The reason is that as flow increases, so does nozzle reaction. Particularly for fire departments that employ 100 psi combination nozzles, reaction forces will exceed levels that can be safely and effectively controlled by a single firefighter at flows of only 130-140 gpm. The difference between potential and actual flows is even more dramatic with 2-inch hose. Since the upper-end flows through a 2-inch hose produce rather substantial nozzle reaction forces and make the line difficult to bend, the nozzleman usually ends up screaming for less pressure or the nozzle is partially closed in order to maintain control. As a result, 2-inch handlines often end up delivering less than 50% of their potential capacity. In practical terms, 1¾-inch hose is just as effective, plus it costs less and is easier to handle.

While 150 gpm is adequate for most residential fires, commercial building fires demand a minimum flow per handline of at least 250 gpm. Characterized by large floor areas, high ceilings, and heavy fire loads, fires in commercial buildings require high-volume streams with long reach and superior penetrating power. In order to deliver 250 gpm without excessive friction loss per length, the use of 2½-inch hose is a must.

In addition to fires in commercial buildings, the 2½-inch handline is ideal for large outside fires, heavy fire conditions on arrival (regardless of the occupancy), vacant buildings, buildings under construction, defensive operations, and exposure protection. Although the size and weight of 2½-inch hose make it rather intimidating, with proper training, the right nozzle, and the use of modern, lightweight hose, it can be a highly effective handline, even for understaffed fire departments. Incident commanders must understand the benefit of a single, well-placed 2½-inch handline and should never hesitate to pair together engine companies to ensure its mobility and fire extinguishing prowess.

Although a few firefighting manuals indicate the use of 3-inch hose as a handline, and some fire departments utilize it as a pre-connected "blitz" or "bomb" line, it is too heavy and too large to be used effectively in the majority of fireground situations. Since 2½-inch hose can deliver well over 300 gpm and is smaller and more manageable, the use of 3-inch hose is an unnecessary waste of hosebed capacity and firefighter resources.

It is incumbent upon each fire department to evaluate its hose and nozzle systems using calibrated-flow and pressure-measuring devices to determine actual performance. Feedback from engine company firefighters on issues such as nozzle reaction and stream performance must also be considered when making strategic decisions on what sizes of hose to carry on each engine. This in turn will lead to more informed tactical decisions and ultimately, faster fire control and increased safety on the fireground.


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Fire Nuggets

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HANDLINE PLACEMENT

BY ANDREW A. FREDERICKS

Once a handline of the appropriate diameter is selected, the next decision is where to place this critical first line. Keeping in mind that the first handline stretched at a structure fire is the key to saving lives, placement decisions must be based on the need to safeguard building occupants from the encroaching flames and stem the production of blinding smoke and toxic gases as quickly as possible. We will limit this discussion to residential occupancies.

There is a widely held belief that structure fires should be attacked from the "unburned side." This rule most likely stems from the inappropriate use of fog streams in interior firefighting. The short reach of the fog stream combined with the danger of "pushing" fire into uninvolved portions of a structure often dictates that fire-attack efforts begin in the unburned area in order to minimize further property losses. Unfortunately, this approach does not address the issue of civilian (and firefighter) life safety. A more effective method is to attack structure fires directly using the main entrance or front door, regardless of where the fire is in the building.

In practical terms, consider the extra hose that would be required to reach the rear entrance of most residential buildings in your first due area. Even in the case of a relatively small private dwelling, think about the difficulties involved in stretching down a side alley, driveway, or gangway, over fences, under clothes lines, over piles of snow, around parked cars, and past that large and unfriendly dog roaming free in the back yard. Grade-level changes are another factor. The rear entrance door may actually lead to the basement. If the fire is on the first floor, the handline is now one floor below it with a consequent delay in getting water on the fire. Many preconnected handlines will fall short and additional lengths will be required. Rear entrances may also be heavily fortified, particularly in high crime areas. Using the front door is simply more efficient and will save valuable time.

In the case of a one-story private dwelling, the line can be quickly advanced through the front door to the involved bedroom or used to defend the bedroom areas from a fire located elsewhere in the house. In the case of a two-story house or a multi-story building with an open stairway, using the front door permits the line to be placed at the base of the stairs to defend them from a first-floor fire. Keep in mind that an aggressive attack on the fire should be initiated as soon as possible, but the attack must commence from a position that will drive heat, smoke, and flames away from the primary means of egress.

If the fire is above the first floor, the stairs will provide a secure "beachhead" for launching fire attack operations. This will protect the stairway and help limit fire extension from the room or apartment of origin.

In addition to safeguarding the means of egress for building occupants, securing the stairs also protects them as a means of *access* for firefighters assigned primary search duties. This is particularly important for firefighters ascending above the fire. In most private dwellings and many older multiple dwellings, the stairs are often painted or varnished wood and may be involved in fire. They must be extinguished quickly to preserve their integrity. The old adage "save the stairs, save the building" couldn't be any truer.

When a fire is located below grade in a basement, cellar, or sub-cellar, the objectives of protecting the means of egress and quickly extinguishing the fire remain unchanged, but different tactics are required. The first handline stretched at a basement or cellar fire *must not* be used to extinguish the fire. Rather, the first line should be brought to the top of the interior basement or cellar stairs to defend the upper floors against smoke and fire spread.

If the color and temperature of the smoke venting from the basement or cellar indicate a relatively minor fire, the first handline can be advanced down the stairs and the fire extinguished. If the fire is larger, keeping the interior basement or cellar door closed is imperative and the first line will be used to prevent the fire from burning through this door. The second line will be advanced via an outside entrance to extinguish the main body of fire. If the only entrance to the below-grade area is inside the building (as is often the case with cellars and almost always the case with sub-cellars), the first line will have to be advanced down the interior stairs. The second line will then be used to hold a position at the top of the stairs to protect the personnel assigned to the first line and limit fire extension.

Below-grade fires may also permit an exception to using the front door for stretching and advancing the first handline. It may be more expedient to utilize a side door if it provides ready access to the basement or cellar stairs. A proper size-up and knowledge of the residential buildings in your area will provide this information. Generally, the front entrance is still preferable.

Other situations in which the first line would not be immediately advanced to the seat of the fire are rare. One involves a civilian trapped at a window or on a fire escape and the immediate application of water from the outside is required to prevent him from jumping or burning to death. Another is when the fire building is well involved and an exposed building is severely threatened or already on fire. If the original fire has developed beyond the point of safe control by handlines, the first line should be advanced into the most critical exposure. If interior operations are possible in the original fire building, the first line should be brought inside to control the fire. Extinguishing a fire is still the best means of protecting exposures. Even when an interior fire attack is employed, taking a

moment or two while still outside and applying water on an exposed building (or even the original fire building, if a severe autoexposure problem exists), will "buy time" until additional handlines can be placed in service. This is a particularly effective tactic when a fire involves one or more closely spaced, wood-frame buildings and handline stretches are short.


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Fire Nuggets

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ESTIMATING THE STRETCH

BY ANDREW A. FREDERICKS

We have previously discussed the selection of handlines based on required fire flow and proper placement of the first handline to ensure its effectiveness as a life-saving tool. In this issue we will present several formulas for estimating the amount of hose needed to reach and cover the fire area.

Estimating a handline stretch is a two-step process. Step 1 is to determine the amount of hose needed within the fire building and Step 2 is to determine how much hose is needed between the fire building entrance and the engine. The objective is to have sufficient hose to reach the most remote room in the fire area without unrolling too much hose, which will increase the required pump discharge pressure, as well as the potential for kinks.

Some fire departments—New York City and Detroit among them—do not use preconnected handlines. Rather, they perform reverse hose lays using "static" or "bulk" hose loads. As an example of how a reverse lay is executed, consider a top-floor fire in a narrow, three-story multiple dwelling. Based on the size of the building, the location of the fire, and the initial position of the engine, the nozzle firefighter and officer immediately remove four lengths of hose. (A length is considered to be 50 feet, although some fire departments use 100-foot handlines.) Why four lengths? The distance between the entrance door and the point where the engine initially stops, just past the fire building, is about one length of hose. Three more lengths are needed in the fire building to reach and cover the "railroad flat" apartment on the third floor.

Once the hose needed for the fire building (plus one additional length to reach the building entrance from the street) is unloaded, the apparatus operator (chauffeur or engineer) drives to the nearest serviceable hydrant as additional lengths play out of the hose bed. If the engine is already positioned at a hydrant when the order to stretch is received, the hose needed to reach the fire building is determined by "eyeballing" it. Landmarks such as parked autos, sidewalk markings, building widths, and lot dimensions may be used to gauge the amount of hose required.

The use of preconnected handlines requires that the engine apparatus be positioned close to the fire building (generally within a length or two). Both parts of the stretch—the hose needed to reach the fire building and the hose needed inside the fire building—must be properly estimated. Particularly when engine apparatuses are equipped with preconnected lines of various lengths, deciding which line to "pull" requires a sound foundation in handline estimation. While an extra length of hose is rarely a problem and

acts as an insurance policy, not stretching enough hose can be disastrous. Stretching "short" is probably the most common mistake made when employing preconnected handlines.

Obviously, having enough hose to reach the fire building is important, but it is actually the second step in the handline estimation process. The first step is to estimate the amount of hose needed within the fire building and to ensure this amount of hose is removed from the engine. The question then is how do we determine this amount of hose? Since there are many families of buildings that share similar characteristics, developing hose estimation formulas beforehand is fairly straightforward. Generally speaking, hose estimation formulas depend on a building's frontage, depth, and stair configuration.

For small multiple dwellings, the fire floor is the key. A fire on the third floor of a small apartment house would require three lengths of hose. A fourth-floor fire would require four lengths, and so on. This formula may be referred to as the "fire floor formula," and it works well for multiple dwellings with a frontage of 40 feet or less and depths up to about 85 feet.

In the case of large multiple dwellings (up to 100 feet by 100 feet or more), the fire floor formula is adjusted to compensate for the larger apartments, longer hallways, and enclosed stairways. The fire floor is still the key, but another length is immediately added to the hose estimate. This might be called the "fire floor plus one" formula. A fourth floor fire in a large multiple dwelling would warrant at least five lengths of hose within the fire building in order to avoid a "short stretch." If the building has a large lobby, a sixth length would be added in order to reach the base of the stairs from the entrance door.

Some large apartment buildings are divided into wings. Each wing may resemble a small multiple dwelling with its own entrance door and stairway. If this is the case, the "fire floor formula" may be appropriate. Large multiple dwellings may also feature deep exterior courtyards that will necessitate additional lengths. The best way to determine how much hose will be required is to calculate it in advance during drills or a trip to the building specifically for pre-fire planning purposes.

Handline stretches can also be modified based on the presence of a well hole. A well hole is an opening in the center of a stairway that allows a single length of hose to reach from the base of the stairs to the fifth floor. In addition, lines can be stretched utilizing hooks (pike poles) or utility ropes on the outside of the building. Utilizing a utility rope is a particularly effective tactic when the stairway wraps around a dumbwaiter or elevator shaft. Knowledge of your response area is vital.

For private dwellings, between one and three lengths of hose should be sufficient. In the case of both private dwellings and attached "town homes" (sometimes called "row frames"), always ensure sufficient hose is stretched to cover the entire building. Fires in

these buildings travel quickly through void spaces and interior shafts, as well as on the outside of the building, which is often covered by wood or asphalt siding.

Hose estimates for commercial buildings can vary widely, but two or three lengths will cover most small retail stores. A rule of thumb is to add the street frontage and the depth of the occupancy in order to obtain a hose estimate. In the case of a hardware store that is 50 feet wide and 80 feet deep, 50 + 80 = 130 feet. This is almost 150 feet, so three lengths of hose should be available for the store. This will account for the necessary bends and turns as the line is advanced.

Like all firefighting operations, planning and training are essential for accurate handline estimation. For years, engine companies in New York City have operated under the credo: "take the time to make the time." A few moments taken before placing a handline in service to ensure the proper amount of hose has been unloaded will pay huge dividends in terms of fire attack safety and efficiency.


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Fire Nuggets

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STREAM SELECTION

BY ANDREW A. FREDERICKS

What type of fire stream should be used during interior fire attack? This remains one of the most hotly debated issues in the fire service and to understand why requires that we briefly examine the history of fire attack methods in use since the end of World War II.

Up until the late 1940's, structure fires were fought directly using solid streams. Although significant experimentation with fog streams had been underway for some time, their role was limited to fires involving oils and other combustible liquids. Then the late Chief Lloyd Layman introduced his "indirect method of attack" as a means of efficiently controlling fires in structures using the cooling and smothering effects of expanding steam. This launched a revolution, and within a short time the fire service was divided into two camps. One continued to advocate the use of solid streams; the other embraced the use of fog and spray streams.

Those who argued for the use of fog streams were further buoyed by the introduction of the so-called "combination attack" in the late 1950's. Developed by Keith Royer and the late Floyd W. "Bill" Nelson of Iowa State University's Fire Service Extension, combination attack theory did not necessarily mandate the use of fog streams. Royer and Nelson's main concerns were the rate of flow in gallons per minute and the efficiency of water distribution within the involved area. The form of the applied water was secondary, but fog stream proponents largely ignored this point.

The 1950's also saw nozzle manufacturers begin to tout the advantages of their new (and more expensive) fog nozzles. Scanning the pages of *Fire Engineering* and *Firemen* magazines from the 1950's and 1960's, one gets the impression that to use anything other than water fog would brand you a tactical dinosaur.

Other influences were at work as well. The insurance industry viewed fog streams as a near miraculous remedy for water damage. Acting with the passion of religious zealots, representatives of various fire insurance rating bureaus managed to convince scores of fire chiefs that the greatest threat on the fireground was not the fire, but rather the water used to control it! By the time the late 1960's arrived, the majority of fire departments had replaced their solid bore tips with fog nozzles and the ranks of solid-stream advocates had grown desperately thin.

In the last several years, however, the fire service has undergone a rebirth of sorts in how it approaches interior firefighting. Not only have many fire departments abandoned the use of fog patterns during interior fire attack, solid stream nozzles are reappearing

on handlines from coast to coast. While I personally advocate the use of solid streams, if a combination (fog) nozzle is the only option, it should be used in straight-stream position. With an adequate rate of flow (at least 150 gpm for residential fires), a solid and/or straight stream will provide for rapid knockdown with less violent disruption of the thermal layering in the fire area. More importantly, the use of solid and/or straight streams can dramatically lessen the risk of burn injuries caused by unwanted and unnecessary steam creation.

What is “unnecessary” steam? We have been brainwashed into believing that fog streams are efficient because small droplets convert to steam more readily than large ones. While a fog stream will vaporize more quickly than a solid or straight stream, does the efficient conversion of these small droplets to steam necessarily equate to efficient fire extinguishment? The answer is no.

The goal of interior fire attack should not be to rapidly absorb heat energy from vapors burning remotely from the seat of the fire, but rather to apply water on the heated solid materials and prevent release of these volatile fuel vapors in the first place. By cooling the mattress, sofa, desk, or stuffed chair burning in the lower portion of a room, the dangers posed by the accumulation of flammable vapors in the upper portion of the room is eliminated.

Another argument against the use of solid and straight streams involves the compactness of the streams themselves. Fog streams are better, it is said, even when being applied directly to the burning solid materials, because the wider pattern covers a much greater surface area. The problem, however, is that many times, little if any part of the fog pattern actually contacts the heated surfaces. Solid streams and straight streams are more likely to reach the seat of the fire because they are less prone to suffer premature conversion to steam or be carried away by convection currents. In addition, their long reach provides a greater margin of safety by permitting stream operations to commence at a safe distance. This is particularly important when a high heat condition makes a close approach to the fire impossible. The stream should be directed “out front and all around” in order to distribute water over the burning materials, using the ceiling and upper walls as baffles to splatter water into areas otherwise difficult to reach and to agitate (not overcool) the burning vapors at the ceiling.

Still others argue against solid and straight streams (solid streams in particular) because they lack the “protection” offered by fog streams. Although the nozzle team may feel secure behind this wall of water droplets, what is occurring on the other side of the fog pattern? Is the fire being driven into remote areas of the building or structure? Is the fire being pushed towards firefighters performing search operations? In many cases, it is the nozzle crew itself that receives steam burns. On still other occasions, the fire is forced over and around the fog pattern, causing burn injuries or possibly jeopardizing the nozzle team’s escape route.

Fog streams have their place, but not during interior firefighting. The safety of both building occupants and firefighters rests on the success of the first handline. An adequate flow volume delivered in the form of a straight or solid stream is the best means of ensuring this success.


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Fire Nuggets

October/November 2000

ADVANCING THE FIRST HANDLINE: PART 1 -PREPARATION

BY ANDREW A. FREDERICKS

In the firefighting business, preparation is everything. Preparation includes both regular drills and training to maintain basic skills; pre-fire planning to reduce the number of curve balls thrown at you during firefighting operations; and preparations that take place on the fireground as each important step in the fire attack process is executed. This article will concern itself with the latter — specifically the preparations necessary at the entrance to the fire area in order to ensure a safe, aggressive, and unhindered advance to the seat of the fire.

The first important consideration for the nozzle team is to ensure that at least one full length of hose is available at the entrance to the fire area. More than one length may be needed, depending on size-up or pre-fire planning information, so one length represents a minimum.

The next consideration is how this working length should be "flaked out" for an efficient advance. This depends largely on where the line is to be flaked out (the front lawn of a private house or a small stair landing in an apartment building), the layout of the fire area, and the location and direction of swing (to the left or right) of the entrance door. If sufficient room is available, the line should be neatly flaked out in a series of "S" shaped curves. Sharp bends, which will inevitably lead to kinks, should be avoided. For fires in private dwellings, the line can be flaked out on the lawn, in the driveway, on the sidewalk, or even in the street. Commercial building fires also often permit the line to be arranged neatly outside. Multiple-dwelling buildings, on the other hand, often pose difficulties due to the narrow hallways and small stair landings found in many of these buildings.

The next factor that affects how the line should be flaked out is the layout of the fire area. Will the line be turning left or right after entry? Does a long hallway lie ahead? Does the line have to advance down a set of stairs for a cellar or basement fire? Does the line have to advance up a set of stairs, as might be required for a fire in a split-level house or duplex apartment? If a hard right turn is anticipated, arrange at least part of the first length on the left side of the entrance door. Conversely, a hard left turn would warrant arranging the line to the right of the entrance door. While this is not always possible, the goal is to facilitate the advance and the smooth movement of the handline.

The swing of the entrance door may also be a factor, particularly when the door seals off a hallway leading to another part of the occupancy when it is opened. This is a common arrangement in "railroad flat" style apartments but is certainly not limited to

them. If the fire is located in the area "sealed off" by the open door, the line will have to be advanced around the door — a difficult task at best. The nozzle team may have to feed part of the handline into the occupancy in a direction opposite the fire area prior to entry. This will ensure sufficient hose is available for the advance and avoid at least some of the problems involved in trying to maneuver the line around the entrance door (possibly a 180-degree turn).

Once sufficient hose is in place, the door to the occupancy can be partially closed and the line advanced to the fire. When space is at a premium, where to put the uncharged handline can be a problem. Apartment buildings with small floor landings may require the line to be flaked out on the floor below or on the stairs leading to the floor above. When flaking the line out on a staircase, make wide turns around the newel posts, but avoid pushing the line into the corners where kinks can form. Flaking out the line on the floor below, while sometimes unavoidable, increases the difficulty of the advance because many times staffing is short and there may not be a firefighter available to feed hose up the stairs to the advancing nozzle team.

Often the best option is to flake the line out in an apartment adjacent to the fire apartment or, better still, in one across the hall. Never drape a loop of hose out of a window in order to avoid congestion on the landing. Not only does each 50-foot length of 1¾-inch hose weigh some 80 pounds when charged, a severe kink will form at the bottom of the loop.

Another effective action prior to advancing into the fire area is to take full advantage of whatever visibility exists below the smoke layer. Once the nozzle begins operating, most, if not all, visibility will be lost, so this opportunity must be seized early. In some cases, it may mean lying on the floor and directing a handlight beam into the fire area. The floor layout will be at least partially revealed, and sometimes the exact location of the fire discovered. The glow of the fire may be visible or just the shimmering reflection of the flames on a tile or hardwood floor. Either way, the advance will be much more efficient.

Another reason to look below the smoke is to increase safety. Hazards such as extension cords, sharp objects, and holes in the floor will be discovered and injuries avoided. Utilizing the visibility available at floor level is also very effective during primary search operations. At one fire, a firefighter scanning with his handlight prior to entering the fire apartment noticed a hand dangling below the smoke layer. He told his officer he was going to make a beeline for the hand and quickly discovered two children overcome on the living room couch. His officer found their mother, and the three victims were all successfully removed to the outside just as the fire entered the living room. If a few moments hadn't been taken to look below the smoke with the light, the search would have taken longer and perhaps the end results would have been different.

For fires in multiple-dwelling buildings, taking a quick look at another apartment can provide a wealth of valuable information. This might be an apartment on the floor below

the fire (apartments in the same vertical line generally have the same layout from floor to floor) or an apartment adjacent to the fire apartment. Apartment units that are located side by side, particularly in older apartment buildings and garden apartment complexes, often have floor layouts that mirror one another.

More next time.


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Fire Nuggets

December 2000/January 2001

ADVANCING THE FIRST HANDLINE: PART 2

BY ANDREW A. FREDERICKS

In the last installment, we left off with the line flaked out and ready for water.

At this point, the nozzle firefighter should be crouching or kneeling on the hose behind the nozzle to prevent the nozzle shut-off from being inadvertently and unknowingly opened. Staying low and to the side of the door also protects the nozzle firefighter and other members of the nozzle team from venting heat, flame, and smoke and affords each firefighter much better control while donning gloves, face piece, and hood. The nozzle firefighter should tuck his helmet between his legs to prevent some clumsy “truckie” from inadvertently kicking it down the hallway or off the front porch and into the snow. All personal protective equipment should be quickly double-checked to ensure proper fit before the line is moved.

In the case of preconnected handlines, either the last firefighter in the stretch or the pump operator must ensure that all the hose has been removed from the apparatus. Charging a handline with hose remaining in the hosebed is not just embarrassing — it costs valuable time, which in turn increases the risks faced by the fire-attack team. As the last firefighter moves forward toward the nozzle, he must ensure the line is not stuck under any automobile tires, fence gates or doors, which will effectively become hose clamps once the line fills with water. The officer (or designated firefighter) can now call for water. As the line fills and is bled of trapped air, the second (and third) firefighters, if available, can don their face pieces and protective hoods, and make final adjustments to their turnout gear and SCBA. Once the line is charged and bled, everyone should be ready to advance.

The act of bleeding the line warrants some additional discussion. Besides exhausting the air trapped in the hose, opening the nozzle briefly prior to the advance verifies that the line is properly pressurized and a satisfactory stream is available. If the pump operator (or engineer) hasn't placed the engine into pump gear or hasn't throttled up yet, it will be quite evident when the nozzle is fully opened and an ineffectual stream results. Radio communications should quickly remedy the problem and the advance can proceed. If the problem is not at the engine, kinks in the handline may be the cause of the poor stream and will have to be straightened.

All members of the nozzle team should be positioned on the same side of the handline. Ideally, when at least two firefighters are available, the second (or “backup”) firefighter will be positioned immediately behind the nozzle firefighter to help resist the nozzle-reaction burden and provide any other necessary physical and emotional support. The

latter can be an important concern when an inexperienced firefighter is assigned the nozzle position for the first time. In reality, however, due to insufficient staffing, the backup firefighter is usually forced to move between a position near the nozzle firefighter and a point several feet behind. This is necessary in order to keep the line free and moving. Due to this situation, the need to use hose-and-nozzle systems that reduce the nozzle-reaction burden without compromising flow volume and stream reach is critical and will be the topic of a future installment.

In the event a third firefighter is available, he should be positioned at the first bend or turn behind the nozzle team as the line is advanced. Staying at this position and resisting the temptation to become the “second assistant nozzleman” requires a high degree of discipline.

To ensure a smooth advance without the danger of “pushing” the nozzle firefighter forward, the “bow” technique is very effective. The third firefighter (called the “door” firefighter in FDNY) simply forms a bow in the line — either on the floor ahead, against the wall in a narrow hallway or even across a bent knee — and observes the hose. When smoke or obstructions such as walls obscure the nozzle team, a straightening of the bow indicates the line is moving. The door firefighter then feeds enough additional hose forward to restore the bow. Eventually the door firefighter must also move forward to keep up with the advancing nozzle team. In order to keep the line moving without unnecessary effort, he may elect to pull a loop of hose forward with him instead of having to go back for more line when it inevitably becomes stuck.

Although specific nozzle techniques will be covered next time, a few points bear mentioning here. One frequently asked question concerns when to open the nozzle. Generally, the nozzle should not be opened until the fire is encountered. An exception might be a situation in which the nozzle team encounters dense smoke and extremely high heat conditions. In this case, opening the nozzle briefly and sweeping the ceiling with a straight or solid stream may be the only means of preventing flashover and severe burn injuries.

If access to the fire area is difficult and fire is encountered at the entrance portal, the following techniques may prove helpful:

- The stream may be directed over the top of a partially open door. Vigorous nozzle manipulation will cause the stream to splatter off the ceiling and upper walls. Hopefully this will “darken down” the fire sufficiently to allow the door to be more fully opened and the advance continued. The stream may sometimes need to be directed through the top of a door which has partially burned away or through an open transom.

- Another effective technique is to drive the water through the space between the open door and jamb. Moving the nozzle up and down several times with the tip inserted in this gap may permit water application into this hard-to-reach area.

- Don't overlook breaching a wall in order to apply water on an otherwise inaccessible fire.

- If multiple rooms are involved on either side of a long hallway, they must be “knocked down” one at a time. Generally, applying water “out front and overhead” will drive back the rolling flame front at the hallway ceiling and permit water to be directed into each side room as the advance is made. Many times the stream can be applied from the door opening, making physical entrance into each room unnecessary. Be sure to control the fire in each room sufficiently to prevent its re-ignition after the line moves forward. As soon as each room “blacks out,” sweep the hallway ceiling again. If a closed door is encountered, be certain to open it and check for fire extension before moving past.

More next time.


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Fire Nuggets

February/March 2000

ADVANCING THE FIRST HANDLINE: PART 3

BY ANDREW A. FREDERICKS

This installment will discuss proper nozzle technique (also called “nozzle mechanics”) and burn-injury prevention during fire attack. The two most frequent mistakes I observe when training firefighters in proper nozzle mechanics are these: 1.) Failure to open the nozzle fully for maximum flow and stream reach and 2.) Being too timid when manipulating the nozzle. Previous installments have discussed why only straight or solid streams should be used for interior attack. It is vital that these streams have adequate volume, reach, and penetrating power in order to achieve rapid fire control and keep the nozzle team safe. While straight and solid streams provide many benefits for the fire attack team, the compactness of these streams requires vigorous nozzle movement in order to distribute the water efficiently over the heated fuel materials.

The first mistake, partially closing the nozzle shut off (often done in order to manage excessive nozzle reaction) will produce several negative consequences depending upon the specific type of nozzle involved. In the case of solid-stream nozzles, partially closing the shut-off not only reduces flow volume; the intrusion of the ball valve into the waterway creates significant turbulence that has a negative effect on both the reach and quality of the stream. With a combination (fog) nozzle, both flow volume and effective reach will be compromised. Automatic fog nozzles can be rather deceiving. While stream characteristics (reach, compactness) are maintained and the stream may “look good,” the consequent reduction in flow volume will lessen fire-control effectiveness.

Being overly timid when manipulating the nozzle is another common mistake. Fires are controlled quickly when an adequate volume of water is efficiently applied on the heated fuel materials. If the nozzle firefighter fails to move the nozzle in a vigorous, almost violent fashion, fire control is delayed and the risk of burn injury is increased. It seems there are two main causes for this problem. One is simply a lack of experience and/or poor training. The other is the widespread use of pistol grips. Pistol grips, particularly when installed on 100-psi fog nozzles with their high reaction forces, tend to end up alongside the nozzle firefighter's body. The arm holding the pistol grip is bent at a 90-degree angle and nozzle movement is severely restricted.

While rapid nozzle movement is important, the pattern of these movements must also be discussed. Most of us have heard at one time or another that the nozzle should be rotated with a clockwise motion. If the nozzle were to be rotated counterclockwise, heat, smoke, and flame would be drawn to the nozzle and increase the threat of burn injury. Although this phenomenon has been demonstrated repeatedly and is a proven scientific fact, it applies to fog streams, not straight or solid streams. (It should be noted that the

reason for this phenomenon has been debated for many years and explanations have ranged from the effects of charged ions in the atmosphere to the Coriolis force caused by the rotation of the earth.)

In my own experience, the exact pattern of movements will depend on both the size and shape of the fire area and how close I can get to the fire before opening the nozzle. While I generally use a clockwise rotation, side-to-side movements and even up-and-down movements may also be incorporated into the mix. If one combination of movements isn't having much effect, try another. If this still proves less than satisfactory, you may need to seek another vantage point for stream application.

The nozzle should initially be pointed toward the ceiling of the fire area in order to agitate the fire gas layers and break up the stream. This creates coarse droplets that will rain down on the heated contents, efficiently knocking down the fire by eliminating the release of fuel vapors into the atmosphere. Be careful not to let the stream contact the heated ceiling and walls in your immediate vicinity, as this will cause scalding water to splatter about, increasing the burn-injury potential. As the fire “darkens down,” the nozzle angle should be reduced and the stream aimed into the lower portion of the fire area.

Once the fire is controlled sufficiently to permit the forward advance of the line, the floor must be swept with the stream. Sweeping the floor accomplishes several important safety objectives. It pushes aside sharp objects from the nozzle team's path. These may include nails, screws, glass, and hypodermic needles. It extinguishes burning carpeting and cools molten floor tiles and plastics. Sweeping with the stream also “sounds” the floor. A change in the sound of the stream will indicate the presence of an opening ahead. This opening may be the entrance to the cellar stairs, an unprotected shaft, or even a hole in the floor caused by fire burning through from below.

A new burn prevention poster sponsored jointly by the New York City Fire Department (FDNY) Safety Command and the New York Firefighters Burn Center Foundation encourages the nozzle team to “sweep-switch-squat-shift” when advancing the line.* Sweeping with the stream dilutes and cools the runoff water cascading down the walls and collecting on the floor. This runoff water will be scalding hot — as high as 150 degrees Fahrenheit. Water this hot will cause a third-degree burn after only one second of contact with human skin. Even bunker pants will not protect against scald burns.

Switching knees will reduce the contact time between the heated floor and your anterior shin and knee. Consider that when you kneel, your bunker pants are stretched tight over the knee joint, eliminating the air space between the protective layers and increasing the risk of conductive heat burns. Squatting or “duck” walking is also effective, but it is rather difficult for the average firefighter to maintain this posture for an extended period.

Until next time, stay safe.

Fire Nuggets

April/May 2001

ADVANCING THE FIRST HANDLINE: PART 4

BY ANDREW A. FREDERICKS

After a fire has been knocked down, the nozzle should be closed to allow the swirling steam and smoke to "lift." In order to improve visibility still further and to reduce the heat and humidity in the fire area, a window should be located and a fog stream or broken solid stream directed through the opening. If done correctly, the negative pressure created by the stream will produce a noticeable draft into and through the fire area, effectively clearing the atmosphere of lingering combustion products. Any remaining pockets of fire will be revealed and smoldering materials will "light up" for final extinguishment.

If a combination nozzle is used, simply change from a straight stream to a fog pattern. If a solid stream nozzle is used, simply close the shutoff part way to break up the stream and effect ventilation. Removing the nozzle tip will further increase efficiency. It is best to remain several feet back from the window and to stay low in order not to impede air movement. The pattern should be adjusted until the stream fills most of the window area.

At this point, truck company personnel should enter the fire area and begin "opening up" in order to expose any hidden fire extension and to ensure complete extinguishment. During overhaul, it is usually best to remove the handline from the fire area to prevent it from being buried by sheetrock or lathe and plaster. This will also allow the secondary search to be conducted with increased efficiency.

It is tempting to open the nozzle as soon as a hole is made in a wall or the ceiling and fire is seen, but all this will do is create unwanted steam and eliminate almost all visibility. Particularly in the case of ceilings, it is best to wait until the entire ceiling has been "pulled" before operating the nozzle. An important consideration during this phase of the firefighting operation is the need to replace the initial nozzle team with fresh troops. The physical effort exerted during firefighting activities coupled with the physiological performance limitations imposed by bunker gear will rapidly fatigue these firefighters. When personnel resources are less than what they should be (as is almost always the case), the onset of fatigue will be even more rapid and the need to relieve the first due engine company becomes critical in order to avoid injuries.

The so-called "one-cylinder rule" should apply whenever possible. During overhaul, the nozzle pressure can be reduced in order to avoid unnecessary injuries to personnel and damage to property. Water point should be directed into any area of the structure or

contents where the potential for a rekindle is likely. If there is any doubt, have the truck company personnel open up further or turn the pile of debris one more time.

Foamed plastic seat cushions and mattresses must be thoroughly soaked (even submerging chair cushions in the bathtub is an option to be considered) or removed to the outside for further extinguishment. NEVER enter a stairway or elevator car with a partially extinguished foamed cushion or mattress. The draft created by moving the cushion or mattress may cause the foamed insulation to burst into flame, trapping you with no escape. It is best to thoroughly soak it first, or toss it out the window to a clear area on the ground below.

In order to efficiently overhaul the exposed studs and joists in the fire room, it is best to first overhaul the contents remaining on the floor before bringing the handline back inside the room. This reduces the chances of the line sitting in smoldering debris, which could unknowingly damage the hose. Utilizing only a single firefighter (remember, the nozzle pressure has been reduced and no one really wants to get wet, particularly in winter), position at a far corner of the room with the nozzle pointed back towards the entrance. While leaning against the wall and using your leg and foot to anchor the handline and resist the nozzle reaction, sweep the stream back and forth along each joist from sidewall to sidewall. Concentrate on the joists that are the most deeply charred and don't hesitate to agitate the stream by shaking the nozzle. Once the joist bays have been washed down, perform the same operation on any studs that look charred (pay close attention to the framing around window openings) and direct the stream from ceiling to floor and back again. Let the officer take a peek, and, if all looks good, reposition the line at the door opening and repeat the process. This will ensure that both sides of each charred joist have been washed down, as well as all affected wall studs and window framing materials.

Don't forget to drive the stream into any area where a pipe (steam, soil, or water), electrical wires, or ductwork pierces the floor above. At this point let the officer make another examination to ensure a satisfactory job has been done. This is actually a good time to bring a thermal imaging device into the room and scan the area for hot spots.

Consider, as well, the following additional points:

- Unlike fire attack operations, water application during overhaul should be very specific. Use water judiciously to avoid unnecessary property damage. Move undamaged valuables if possible.

- Reckless overhauling can destroy evidence of arson. Use care and limit water application to only what is absolutely necessary until the officer or fire investigator takes a look at the area.

- It is easy to confuse steam and smoke. If it is smoke, additional water application is necessary.

- Be cautious of holes in the floor, water accumulations, protruding nails and screws, untrimmed window glass, and other sharp objects.

- Ensure the area is properly illuminated to help avoid injuries.

Until next time, stay low and stay safe!


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ANDY FREDERICKS'S PARTING GIFTS:

A PERSONAL REMEMBRANCE

BY PAUL SCHULLER

This wonderful photo was captured during FDIC-West's Hands On Training (H.O.T.) Program in May 2001. We were all enjoying a break when a young firefighter, who was simply intrigued by Andy's turnouts, arranged his gear for this incredible shot. Obviously, no one realized then how meaningful this picture would become.

Andy left us with another special memory. His last published article, titled "Father's Day," was presented in the August 2001 issue of Fire Nuggets. The content of this article was a total departure from Andy's engine operations theme. I remember him asking, "Hey Paul, do you mind if I do something a little different?" Naturally, he received our blessing. After all, never would we question the master! In this writing, Andy shares his personal and exhausting experience during the Queens Father's Day fire and recovery of three fallen brothers. Andy's message to us is emotionally charged and packed with encouraging words that may help us all deal with the tragedies we face in this most stressful profession.

Most of all, Andy touches on the importance to make time for family and never forget or be afraid to say I love you for you never know what tomorrow will bring. I know Andy loved his family and missed them when he was on the road teaching all of us. I remember us both sharing many stories about our families, and found many similarities between us. After spending time talking about our wives and kids, we would have to pull

out the cell phones and call them to say, “Hi,” because we missed them so much. To Michelle, Andrew Jr. and Haley, I pray you will find a little comfort in knowing your husband and dad has impacted so many lives as a firefighter and friend; and let’s not forget all the lives he saved too! Andy along with many others are our true heroes!

I never spent too much time wondering why the picture and “Father’s Day” article came about, but I can tell you this; four months after receiving these gifts from Andy, he was gone. Why we have these memories is much more clear to me today. Andy, I know I will see you again and be honored if you save me a spot on your heavenly squad.

I love and miss you, dear brother.

Paul (Schoo) Schuller
Co-publisher, Fire Nuggets

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"Take the time to make the time."


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"The garbage man doesn't get excited when he turns the corner and sees trash, because he's expecting it. Likewise, you should be expecting fire on every run."


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APPENDIX B
Back to Basics Training Articles


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COMMACK FIRE DEPARTMENT

"Back to Basics Training Bulletin"

Engine Company Responsibilities @ Private Dwelling Fires

First Due: The first due Engine at any working fire sets the stage for how smooth an operation has the potential to run. The main objective of that first due Engine is to get that first attack line in operation. With getting that first line into operation also comes securing a water source. The first due Engine should *ALWAYS* intend to pick up their own water source. Remember, we are not a staffed department with crews in-house, your second due unit could be more than a booster tank of water away. With this being said, sometimes it's just not feasible, be guided by the OIC and utilize the information from our size-up. The chauffeur should make the effort to pull just past the fire building if possible. This leaves access to the front of the building for a Ladder and it also gives us a three side size-up. As mentioned our main objective is ***to get that first attack line in operation***, usually a 1 ¾ ". We need to be mindful that every fire is going to be different and depending on our fire load and man-power situations a 2 ½" or even master streams could be the necessary option. Be sure to relay necessary information to either the OIC or next due units such as shorthanded crews or water supply status so the next due can fill in the voids

Second Due: The second due Engine has the responsibility of augmenting the first due Engine in ***any ways needed***. Just like our first due Engine, the main responsibility of the second due is ***to get that primary attack line into operation***. Remember the main objective is to get water on the fire, if the first attack line is not in operation by the time the second due Engine arrives, then they need to help out in any way possible to ensure that it gets into operation. This is to be done prior to stretching a second attack line. Along with this, other tasks might include securing a primary water source if the first due Engine didn't already do so. They might also supplement positions on the first attack line if a lack of man-power exists or stretching a second attack line. As always be guided by the OIC.

Final Thoughts: It is important for all of us to have knowledge and understanding of what is expected of units as they arrive. As it would be nice for the appropriate number of Engines to show up and be fully staffed, we know as a volunteer department this is tough to come by. It is the responsibility of each and every one of us to stay sharp in our skills and knowledge of what is expected of each engine as they arrive on scene and be prepared to operate and fill in the voids as needed by Command. Follow the direction of the officer of the Engine and instructions from Command, this will reduce freelancing, increase work speed and allow for all of the fireground operations to be handled. In a later edition we will discuss riding positions and responsibilities of Engine Companies.

Stay safe and keep training...

This week's edition written by: Chief Bobby Wilkins

COMMACK FIRE DEPARTMENT

"Back to Basics Training Bulletin"

Making the Stretch

Selecting the proper amount of hose for a handline operation is a vital task that the Engine Company must perform. It should go without saying that without the proper amount of hose we will never get to the seat of the fire. For many years our Engines have always had 200' crosslays, which we would normally pull for the majority of our fires. Our philosophy was that if it was a setback residential or a large commercial then we would pull off the rear and get ourselves 5, 6 or even more lengths. For the most part this worked, and yes sometimes we were short, and sometimes we just made it but we always figured it out one way or another. The crosslays made it easy, pull it all off and fight the fire. The unfortunate thing, for many of us, is that the reliance on operating from the crosslay never forced us to think about how much hose we actually need. That thought process and size-up is an important function of the Engine Company. Fast forward to today, we are operating with more and more engines that don't have crosslays or have dead crosslays. So now we are being forced to pull off the rear, and the skillset of selecting the proper number of hose is lacking. For the most part we are still using that safety net of pulling 4 lengths, which again for the majority of our fires this works, but it doesn't work on every single one. So what do we do about it? We have to start to train ourselves to get into the habit of determining the proper amount of hose during our size-ups. The fire service loves acronyms so if you ever read about this topic somewhere else you will probably see the D.O.S.E. model. Stands for Distance, Obstacles, Stairs, Elevation. It makes sense on paper but lets be honest here, no one is stepping off the rig with a clipboard and a checklist. We must do this on the fly. So what is the best way of simplifying this? For me what works the best is (1) Distance to my entry point and (2) how many floors there are.

Distance to the entry point: It's important to have somewhat of a basic idea of your district, know the general setbacks for houses. The majority of houses in our district have about a 50' setback from the curb to the front door. So even if we are pulling just past or stopping just short of the fire building we have to account for 1 length (50') for that, *if* we are going through the front door. If command says we are going through a side or back entrance throw on another length making it 2 lengths (100'). Keep in mind, if you show up and it looks longer than 50', then add lengths as needed.

Floors: A good general rule is to add 1 length (50') for each floor for a standard house in our district. Remember, a lot is going to depend on layout and where we choose to make entry but that should be our guideline. So, if we have a single story ranch we should be thinking we need 2 lengths inside regardless of where the fire is showing from or where we think it might be. We are selecting 2 lengths because we need 1 length for the first floor and 1 length for a potential basement. A 2-story would be the same selection if we are entering on floor 1. For a commercial or much larger house, it's a good idea to double the lengths per floor. A single story commercial could easily use 4 lengths inside. 2 to get to the back staircase and then another 2 to get down and back to the seat of the fire downstairs.

Add the extra length: Whatever number we come up with we always add an extra length just in case we are short in our estimate, the layout eats hose, or we lose a bunch in a service loop somewhere.

Putting it all together: Lets use the above as an example. We pull up and we have a longer than usual setback and we determine it to be a 100' to the front door for a single story ranch. It's 5 lengths. 2 lengths to the door, 2 lengths inside (1st floor and basement) and 1 additional length for a total of 5 lengths (250'). Depending on staffing, whoever breaks the line has to be sure that the right amount of hose is deployed or else the whole operation falls short.

Final thoughts: Being able to determine distance without using a tape measure is an art and skill that we as firemen must all possess. Remember, we aren't gauging distance to the quarter inch. We are determining it for the number of 50' hose lengths. Its something that you need to train your mind on at every call. Get outside of the engine and take a guess as to how far away you are and then check it, stretch a dry line or even a search rope and see if your estimation was close. Use landmarks on the property, look at fenceposts (typical 8' apart), or see how many cars you think can fit in the driveway if they were in line (use 15' per vehicle) or anything else you can identify, then put a length to it and estimate how many can fit.

Stay Safe and Keep Training… This week's edition written by Chief B. Wilkins

COMMACK FIRE DEPARTMENT

"Back to Basics Training Bulletin"

Smooth Bore vs, Fog Nozzles (TFT's)

Each nozzle has its place where its most effective. In this quick article we will touch on why you would choose to stretch one or the other for any given event.

The smooth bore nozzle should always be your first choice for a structure fire. There are multiple reasons for this choice. We won't be getting into nozzle pressures (psi) and gallons per minute (gpm) too much as there is not enough room, well just use the terms more/less for both.

Pressure and Gallonage: At 120psi at the pump, a smooth bore with 7/8's tip, you're going to be getting about 160gpm. In order to receive the same amount of water from a TFT, it needs to be pumped at around 175psi. Pumping a line at a lower pressure gives you a few major advantages. The biggest one is one FF with a smooth bore can "flow and go" without a back-up man. So, in limited manpower situations, the nozzle can still make it to the seat of the fire with relative ease. The stream with a TFT at that low of a psi is ineffective Vid #1

https://youtu.be/y3g058kHhi8

Nozzle Reaction: 50lbs at the tip smooth bore, compared to 80lbs for TFT.

Droplet Size: Even though the pressure is lower, the stream is more effective in cooling because of the larger size water droplets. Now some people contend that because the droplet size is so much smaller, the fog nozzle turns everything to steam extinguishing the fire faster and in some cases this may be true. However, every test I can find proves that this does not cool the fire area or the fire building quicker than the smoothbore. *Because* everything converts to steam, it still stays hot as the water you applied is in a gaseous state instead of a liquid state. Water is what cools, not water in a steaming gas state.

Reach of the stream: The stream of the smooth bore not only goes farther than the TFT, but the stream is more effective when it arrives

No Chance of Opening The Nozzle on A Full Fog: I have seen it a million times, either the nozzle was not checked before entering or, upon crawling in the adjustable tip of the TFT gets moved into a full fog position and when the nozzleman opens up, all that shit comes right back at him. This cant happen with a smooth bore. Vid #2

https://www.youtube.com/watch?v=KcICp7_95n8

Conclusion: By no means are we saying that the TFT nozzle doesn't have its place. Its great for protecting exposures, car fires dumpster fire and the like. Were just saying the smooth bore nozzle is the most effective line for a structure fire out there.

Bottom line, you want the most water, with the least amount of pressure you can get and the smooth bore fits that mold.

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"Back to Basics Training Bulletin"

The Nozzleman

The guy who gets the glory! Face it, unless a grab is made, the nozzle man gets all the credit at a job, and why not? He puts the fire out. Everyone will tell you it's a team effort, the back up man feeding line and taking a beating behind the nozzle man, the control man chasing kinks and humping hose around corners, up stairs etc. all key components. But none as fun as the nozzle man position.

The Stretch – As the nozzleman, you should take your folds, whatever they may be, a flat load, horseshoe, whatever is on your engine and drop it approximately 30' from your point of entry. Now grab your nozzle and first coupling and bring to the entry point or door and lay the nozzle down on top of the big loop you just made, making sure the bail is closed and immediately call for water as you mask up. Preferably, you want to be about three feet from the door and off to the hinge side of the door out of the way for the truck to force the door or maybe go in and start the search. Once water arrives, we bleed out the nozzle.

Bleeding the Nozzle – Don't just crack the nozzle! Open the nozzle fully for at least 5 seconds. Doing this accomplishes three things. One, your getting ALL the air out. Two, you're ensuring you have a good solid stream of water. Three your giving the pump operator a chance to see what pressure your flowing at and he can adjust the pressure accordingly. Three very important things. Now it's time to read the conditions.

Conditions – Read the smoke. A multitude of knowledge can be gleaned by reading the smoke before entry. If the fire location is unknown, smoke lifting to the top of the doorway is a good indication the fire is above the floor of entry. If the smoke is laminar (meaning not turbulent) coming out of the door and it stays on the floor, chances are pretty good you have a fire below grade. If the smoke rises to only halfway up the door, chances are your fire will be on the floor of entry. If you have turbulent smoke spinning violently out the door, one, you have a real good fire going and there's going to be lots of heat and two don't be afraid to wash that ceiling before you start in. Those of you who attended the live burn drill at the old hotel can use those fires as a mental slide in your experience memory banks for a reference guide. Now it's time to make a push.

Make the Push – Two techniques out there that work well for getting down a hallway or advancing into a fire room with high heat are known as the "The Hit & Go" or the "Flow & Go". The hit & go is a technique in which you open the nozzle on the ceiling and towards the fire room, close it , move a few feet and repeat until you arrive at the fire room. The flow and go is the same general principle where you open the nozzle fully, hitting the ceiling and towards the fire room, but the difference is, instead of closing the nozzle fully, you close it halfway AS you are advancing toward the fire room. If conditions get bad you can stop, open the nozzle and repeat the whole process over again. Both of these techniques are designed to cool the fire area and beyond as your advancing in. At this point you've arrived at the fire room…

The Fire Room – Read the swing of the door, if it opens left into a wall, you know you're going to have to go right, and the opposite can be said for a right swing door. Open the nozzle fully! Start at the ceiling sweeping back and forth, don't be afraid to be violent with it. Use a clockwise sweeping motion, an up and down motion, a side to side motion pushing that heat away from you. As you advance, don't forget to sweep of the floor. Make sure to advance into the fire room and out of the doorway where all the heat and steam is trying to escape. Listen for the sound of the water changing from when it hits a wall and when it an opening like a window or another door way. Now get in there and put the fire out!

Stay Safe and Keep Training

This weeks edition written by Former captain Billy Wieck

COMMACK FIRE DEPARTMENT

"Back to Basics Training Bulletin"

ENGINE COMPANY BACK-UP FIREFIGHTER

One of the most important positions on the hose line is the backup firefighter. Without the backup firefighter the hose line doesn't move- or it doesn't move very fast. The backup firefighter is third in line behind the engine company officer and nozzle firefighter. The firefighter's job is to act as an anchor and make the nozzle firefighter job as easy as possible. The two positions need to work together as one, as well as with other members on the line.

The backup firefighter is responsible for helping with the stretch. They need to take the appropriate amount of folds from the hose bed and bring it next to the nozzles horseshoe at the front of the fire building. Then he or she needs to start flaking out the hose in front of the building. When the nozzle man drops his folds, he pulls the extra line back so that he has 25' of hose to his left and 25' to his right so that he has a 50' loop behind him. The way he ensures this is by having the nozzle and the first coupling next to each other at the point of entry. The back up man , as he flaking his folds out should be doing something similar in that his 1st coupling is closer to the entry point. Flaking out the hose so it can easily flow into the structure without kinking is absolutely crucial to stretching in on a fire. Taking a few extra seconds to flake out the hose before entering could make or break the initial push. Once hose is flaked out and charged the firefighter should don his SCBA Face piece and crawl in on the line until he gets to the nozzle firefighter and officer. Use the hose line as a guide to find them.

Firefighting is a team effort. Even though every member has their own position and assignment they all work together to accomplish the same goal. Where the nozzle firefighter usually gets all the glory, they will always say it was because of a great backup firefighter.

Stay Safe and Keep Training…

This week's edition written by Captain Bob Spencer

COMMACK FIRE DEPARTMENT

"Back to Basics Training Bulletin"

"Controlling the Stretch"

It is essential to the operation that the first due engine gets a positive water source and get that first line into operation as smooth as possible. The control/hydrant position is by far the most crucial position on the fire ground. The key components to this evolution are the Engine Chauffer and the control position.

Keep it as simple as possible. The priority is getting that first line into operation; the chauffer can always give the first line booster water. But the chauffer needs to know a few things first before he/she can do that in order to give them the correct pressure. The number of lengths of 1 ¾ and 2 ½ hose that are stretched & the type of nozzle that is on that line.

As the control man, the first few minutes at a fire is the most chaotic, you're helping the chauffer establish a positive water source, as the nozzle and back up are stretching that line to the front door and calling for water. So how do you know how many lengths and the type of nozzle they stretched? While you are helping the chauffer, you also should be estimating the stretch and or counting how many lengths come off it possible. It all goes back to the basics.

Knowing where everything is on the engine including how many lengths of hose and what nozzle is on each bed, packing all the hose correctly (from left to right) and just knowing the engine, can help you give the chauffer that estimate so he/she can give the first line the correct pressure. For example, 2-11-4 red hose has 6 lengths of 1 ¾ (the first 2 lengths are horseshoes) into 8 lengths of 2 ½ with a smooth bore nozzle with a 15/16ths tip. Knowing a rough estimate, every 3 folds is equal to 1 length of hose (if it is packed correctly). By just counting the hose that's left, if you see all the 2 ½ hose there, and 6 folds of 1 ¾ hose (100 ft) is left on the bed, you know there is about 200 feet of 1 ¾ stretched already.

After you told the chauffer the number of lengths of 1 ¾ & 2 ½ hose stretched with what type of nozzle they have and he/she gives them water, you can now chase all the kinks and meet up with the nozzle and back up team to become another door man and help get that line to the seat of the fire.

Conclusion: By knowing the engine, we can help the chauffeur get a positive water source while simultaneously getting that first line into operation. It is critical that the control/hydrant position knows their job and aids the chauffer in breaking the line properly for him to put the right pressure in the line. Then chase the kinks and get to work!

"As the First Line Goes, So Goes the Fire"

Stay safe and keep training… Lt. Pollens

COMMACK FIRE DEPARTMENT

"Back to Basics Training Bulletin"

Mother Goose and her Hens

If your lucky enough to have a 5 man engine crew first due to a job, someone is going to be the control man. If you don't catch a hydrant on the way in, there is going to be 3 guys stretching the line plus an officer. We've all been there, we all want a piece of the fire…I get it. That being said, the control man can make or break the stretch. He needs to be Johnny on the spot pulling line into the building to make for a smooth easy crawl down the hallway or the cellar stairs. Whether you have 3 guys and an officer or 2 guys and the officer, it doesn't matter. No matter what your manpower, you do not want to be all bunched up at the nozzle like mother goose and her hens, going nowhere fast (Fig1).

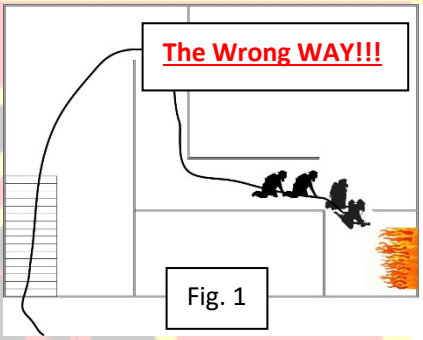

Fig. 1

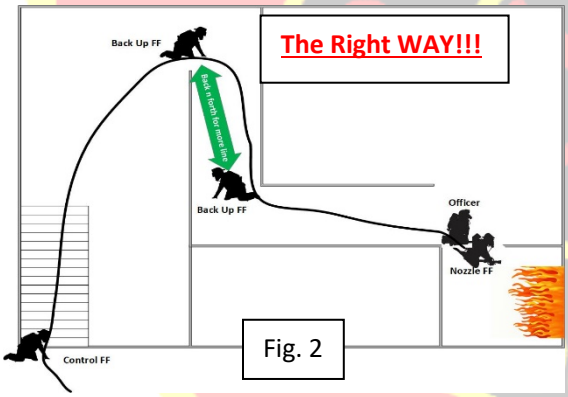

Fig. 2

At the door, and at every turn a FF should be left to feed the line into the building and/or around the corner. This means that the officer could wind up becoming the back-up FF. This also means that anyone along the line could have to work more than one corner, going back and forth to advance the line to the seat of the fire (Fig2). If there are more turns than FF's it could mean multiple guys working multiple corners.

Quick Tips for Advancing a Handline:

1. **Don't pull the line around the corner, It's labor intensive and will get stuck, go back, pick up the line and drag it around the corner.**
2. **Don't bring what you need to get to the corner, bring more, make a loop**
3. **Don't put yourself between the corner and the line**
4. **If you need help, yell for the guys behind you to bump up**

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COMMACK FIRE DEPARTMENT

"Back to Basics Training Bulletin"

The 2&1/4 Inch Handline

The 2&1/4" attack line is pulled at commercial fires and any fire where the volume of fire/fire load present can overwhelm an 1&3/4" attack line. Do we just stretch it because it's a commercial fire? No. There are multiple reasons for stretching the larger diameter line.

Pro's

- Fire volume/fire load. The 2&1/4 with a 1&1/8" tip delivers around 266 gallons of water per minute. When encountering large volumes of fire/fire load, the two and a half will beat back the fire much more effectively than our 1&3/4" with a 7/8" tip flowing about 160 GPM's.
- Reach of the stream is another big pro for the two and a quarter. Starting the water from further back starts cooling quicker, keeps steam production from enveloping the engine company as much and it gets water on the fire much sooner.
- Cooling the ceilings, especially in a Type II building with steel flooring/roofing immediately stops the steel from expanding lessening the risk of collapse. With 260 GPM's, the entire environment is going to cool much faster as a result of a massive amount of water being delivered.

Con's

- Each length of 2&1/4 is about 70lbs when full. Its heavy, labor intensive and it consumes manpower
- It's stiff and much harder to make turns.
- In our SOG's the 2nd due engine's 1st responsibility is to ensure the first line gets into operation. With a 2&1/4, this cannot be overstated, the 2nd due engine could make or break this fire. Make no mistake, it is a 2-company line with the 2nd engine chasing kinks, working turns/corners/doors/stairs and bumping up with the advancement of the line. If the 2nd engine decides to pull a 2nd line and not help out, good luck. "As the 1st line goes, so goes the fire" - Lt Andy Fredericks FDNY, LODD, 11 Sept. 2001

Operating

Once you choose it, you must commit to it. You cannot be half bailing the nozzle and or not advancing the line. Opening the nozzle halfway is like firing a pellet out of the barrel of a tank. When the nozzle is fully opened and being used as designed, the solid bore of water coming out will knock down tiles, sheetrock sometimes even wood. It will open up ceilings and walls exposing and extinguishing fire you didn't even know about. Yes, it's tough to handle, yes, it's tiring, but there are ways to mitigate these problems, at least a little bit, so you can be more effective with it. You may have to kneel/sit on it, open it up fully, knock back some fire, do some cooling shut down, move in and repeat. If that's the case, so be it, this is an effective way of handling the nozzle. But that nozzle must be fully opened, if not what was the point of bringing it in there and breaking your ass in the first place? Another tip would be when ascending a staircase, once on the fire floor, take the line and move it over the handrail at the top of the stairs, this will give you more line to play with on the fire floor, especially if the staircase has a return and you have to actually make a turn on the stairs. If this is the case, each turn needs a FF on it to move the line around it and up the stairs, instead of one FF just feeding it up and over the railing. The only way an engine company will be proficient at it is to train with it. Even if its stretching and advancing in the burn building and giving the inside a good wash down on a Sunday morning, it doesn't matter. You must remember one thing, sets and reps are the only way to get better at anything in this job. Stretching, advancing and operating handlines are not just skills that can be done one month a year. The chief's office sets out a training schedule yearly, but things like stretching operating handlines, searching and forcing doors just to name a few are all perishable skills. What does that mean? It means If you don't use it, you lose it. The only way to build muscle memory is with repetition. These basic skills need to be trained on at least monthly if you truly want to make yourself and or your company better. It is on you, the individual firefighter, to stay sharp on the basics and be adept at them all. There are no shortcuts for the basics, and the basics always work…

Stay safe and keep training…

This edition written by Joe Digiose

COMMACK FIRE DEPARTMENT

"Back to Basics Training Bulletin"

Engine Company Chauffer (ECC)

First Due ECC has a pivotal role on the fire ground. Many may think that their only job is to get water to the first line. Not to minimize the importance of that task but, there are many responsibilities and tasks that have to happen before water gets into that line.

The work of the ECC starts at the receipt of the alarm. Once the pager goes off, on the way to the firehouse every chauffer should be thinking about their size up, time of day, occupancy type (residential, commercial), and type of call, ECT. When you get to the firehouse, you should get dressed, grab the print-out, look up the address on the map and confirm with officer the route that you are going to take. Only after all those tasks are completed should you proceed to the alarm. If you do this for every call and you're active enough, this will eventually become muscle memory. Upon responding to the alarm, the dispatcher and or officer will give you updates on hydrant locations and you should keep in mind the routes the other companies might be taking and the hydrants they might pick up as well. Remember every engine should be looking for both a primary and secondary hydrant every time.

The first due engine can set the tone for any job. If the first due engine is out of position or can't get water it can send the rest of the operation down a bad path. The engine should either stop before the house or building if the hydrant is on that side of property or pull past the occupancy to leave the front of structure open for truck companies to ladder building. If not too far away, the engine should be on the hydrant. If you're stopping in front of house to let crew off to stretch a line, let the control firefighter grab their tools and nozzle firefighter and back up firefighter grab their folds, then proceed to hydrant. Once you stop the rig, pull out the air break and put the rig into neutral. Then move the PTO lever into pump and put rig back into drive to engage pump. Again, if you do this on every call when you arrive, it becomes muscle memory, second nature… At this time the chauffer should exit rig and head straight to the pump panel. You should now be looking for the green light that lets you know the pump is engaged, then pull the tank to pump lever which allows the water from the tank to drop into the pump. Now its time to put water in the line. If line is not already hooked up, you should proceed to rear of rig and break the line. It should be hooked up to a discharge on pump panel and charged ASAP.

Second due Chauffer has all the responsibilities of the first due and once on scene and rig a squared away on a hydrant, and then proceed to the first due engine and make sure they have everything they need.

Remember your pressures and friction loss. You want 50 psi at the nozzle of a 1 ¾ inch line (primary attack line for residential fires) and 40 psi at the nozzle of a 2-½ inch line (primary line for commercial fires). Friction loss for 1 ¾ inch line is 20 psi, per length and 5 psi per length for a 2-½ inch line. 3 inch and 5 inch also known as large diameter hose (LDH) have minimal friction loss and should not be equated into figuring out friction loss. Also remember you as the ECC are responsible to getting yourself and the rest for the crew on scene safely.

You have to realize as a chauffer that the days of the crosslays are pretty much gone. Where you used to be able to know exactly how much line was out (200') and just give 150lbs and adjust from there as the officer tells you, are over. It was sort of set it and forget it…You can't do that anymore. You need to know exactly how much hose is off the static bed and you need to know your friction losses as close as possible for the amount of lengths out. It's a must…

Stay Safe and Keep Training…

This week's edition written by Captain B. Spencer

HANDLINES

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