To earn continuing education credits, you must successfully complete the course examination. The cost for this CE exam is $25.00. For group rates, call (973) 251-5055.
Educational Objectives

On completion of this course, students will

1. Develop an awareness of hazards likely to be encountered in an attached garage fire
2. State three reasons why not to position apparatus at the base of a driveway when it is known or suspected that there is a fire in the garage
3. List three reasons why fires in attached garages are most effectively controlled by hoselines stretched directly to the garage, not through the house
4. Give two basic rules for forcing garage overhead doors

BY BILL GUSTIN

The Garage of a Typical American Household contains a fire load that can cause an incipient fire to rapidly intensify and take possession of the entire house (photos 1-2). Most families would never think of storing plastic jugs of gasoline, liquefied petroleum gas (LPG) barbecue grill cylinders, lawn tractors, and snow blowers in their kitchen or a bedroom, but they have no problem storing them in their attached garage. They fail to realize that in many homes the garage is just another room in the house with little, if any, fire barrier separating it from the living areas. In South Florida and other hurricane-prone areas, homeowners, including several of my firefighter friends, store several gallons of gasoline, usually in plastic containers, in their attached garages, to fuel their generators during storm season. Gasoline and other flammables are often crammed into an attached garage in close proximity to common ignition sources, such as gas-fired clothes dryers, hot water heaters, and electrical panels.

Attached garages are convenient places for overhead storage. It is not uncommon for homeowners to lay boards or plywood on the lower chord of roof trusses for an improvised storage

(1) Attached garages in America are filled with fire loads that can cause an incipient fire to rapidly intensify and take possession of the entire house. Almost every hazard associated with a fire in a modern automobile is intensified when it is parked in an attached garage. (Photo by Steve Wilcox.) (2) A pull-down stair/ladder provides access to storage that can dangerously overload the roof structure and hasten its collapse. Installation of the ladder violates the integrity of a fire-rated ceiling. (Photo by Eric Baum.) (3) A plasterboard wall, partially removed by firefighters, was constructed directly behind the overhead door when the garage was converted to an apartment. (Photo by Enrique Rodriguez.) (4) The engine pulls past the base of a driveway when it is known or suspected that there is a fire in the garage. (Photo by Danny Moran.)
loft. When a garage has a ceiling, access to this space is achieved by installing a pull-down stair/ladder, which often nullifies any barrier provided by a fire-rated ceiling required by the building code. Overhead storage in a garage can dangerously overload a ceiling or roof assembly, which was never designed to support it and hasten its collapse when exposed to fire (photo 2).

Almost every hazard associated with a fire involving a modern vehicle is intensified when it is parked in an attached garage. These hazards include thick, toxic smoke from burning synthetic materials, burning magnesium, and spill fires from leaking fuel lines and tanks. Firefighters attacking a vehicle fire in a garage risk being struck by projectiles from exploding air bag-inflation devices, energy-absorbing bumpers, and gas-filled struts commonly used for the hoods, trunks, and hatchbacks of modern vehicles (photos 1-2).

Changing demographics and a decline in the economy have caused many homeowners to convert their attached garages into residential occupancies. This is quite common in neighborhoods with a large college student or immigrant population, where garages are legally and illegally converted into bedrooms, apartments, efficiencies, and single-room occupancies. These conversions often violate building codes that prohibit a garage from leading directly to sleeping areas. Regularly, firefighters in my department cut an opening in a garage overhead door and encounter a plywood or plasterboard wall directly behind it or three to four feet back from the garage door to provide storage space for bicycles and lawn equipment. Conversion of attached garages into living spaces significantly increases the risk to civilian lives, especially when partitions erected by the homeowner block a door or window in the garage that could be used as a means of escape. A fire originating in the kitchen or a bedroom can trap occupants in the garage when smoke or fire blocks their escape path through the house. Additionally, occupants attempting to escape from a garage with no outside openings may have to travel an excessive distance through a large house to reach an exit (photo 3). Emergency escape and rescue openings (windows or exterior doors) are required by building codes for all sleeping rooms.

**FIREFIGHTING OPERATIONS**

Do not position fire apparatus at the base of a driveway when it is known or suspected that there is a fire in the garage. Fuel leaking from vehicles and containers inside the garage can flow down a sloping driveway and result in a spill fire directly below the apparatus. Additionally, spotting an apparatus at the driveway may position it in the trajectory of flying missiles, a result of exploding struts or bumpers from a vehicle burning in the garage. Consider also that blocking the driveway with an apparatus will interfere with the positioning of a wrecker or a winch-equipped vehicle, which will be necessary to pull vehicles out of the garage for overhaul (photo 4).

**SIZE-UP**

You can make firefighting and rescue operations at fires in attached garages safer and more effective if you conduct them in accordance with an ongoing size-up that begins with a 360° view of the fire building. A size-up based only on what you can view from the front of a fire building can be terribly inadequate and dangerously inaccurate. A thorough and accurate size-up is important at every fire, but it is absolutely critical when firefighters have to operate with inadequate resources. Understaffed fire companies may be unable to perform more than one task at a time and may have to choose a single course of action that will most effectively use their limited resources and stand the best chance of saving lives and property. For example, a fire in an attached garage requires at least two hoselines: one stretched into the house to stop extension and protect occupants and a second line to the garage to directly attack the fire. A third hoseline may be necessary when fire has extended or has the potential to extend to bedrooms over the garage (photo 5).

Ideally, you would stretch and position these hoselines simultaneously, but what if there are insufficient personnel to stretch two lines or difficult forcible entry delays their placement? A first-arriving company that cannot stretch and position two lines in a timely manner must decide, based on the conditions observed in size-up, where a single hoseline will have the greatest effect on the fire, prevent extension, and protect occupants. Is it realistic to expect an understaffed engine company operating alone before the arrival of additional companies to take the time to force entry and advance a hoseline into the house when fire is burning through the overhead door of a fully involved garage? I can’t think of any fire where directing a straight or solid stream from outside the building made conditions worse than if an interior attack was delayed.

Let’s consider what a first-arriving fire officer can learn from observing all four sides of a fire building and how this reconnaissance can influence his choice of tactics. A 360° size-up can begin from the cab of the first-arriving apparatus if the chauffeur drives and positions it slightly past the fire building. This allows a cursory view of sides 1, 2, and 4 (A, B, and D). Remember, do not position the apparatus at the driveway or under electric wires that could fall. Position the engine appa-
ATTACHED GARAGE FIRES

(6) Smoke pushing from soffit vents is a strong indication that fire has extended from the attached garage to the attic over the house. Power saws are needed to ventilate the laminated impact-resistant glass. (Photo by Corey Logan.)

ratus where it can effectively direct its prepped master stream on a large volume of fire and where it will not interfere with spotting and the operations of a later-arriving aerial apparatus. From the cab, the first-arriving company officer can observe if the garage overhead door is open or has fire burning through it. Is smoke pushing from soffit vents under the eaves or from the ridge or gable vents on the house? This is a critical determination, because it is a strong indication that fire is not confined to the garage and may have already extended to the attic above the house (photo 6).

Are bedrooms above the garage, and are they being auto-exposed by fire burning out of the overhead doorway? This observation calls for the immediate application of an exterior stream from a handline or a master stream to prevent extension to the bedrooms and protect their occupants. Under these conditions, avoid laddering windows directly above a garage door opening. If you must ladder these windows, that exterior hoseline will be vital for protection.

Before we consider observations made by viewing the sides (2 and 4) and the rear (side 3), a word of caution: The officer conducting the 360° walk-around must watch closely for electrical service wires that have burned off the fire building. Additionally, he must keep in mind that fallen wires may have energized a metal fence. If you must open a fence gate to reach the sides or rear, make the initial contact with the back of your hand so that your arm muscles will hopefully contract and pull your hand away from the energized fence. This is not a failsafe technique by any means and comes with no money-back guarantee. It is, however, much safer than grasping an energized fence, causing muscle contractions that may prevent the hand from releasing its grip.

Look at the windows at the sides and rear for trapped occupants and indications of the fire's location. Flames blowing out of a window are obvious; look closely for more subtle signs, such as hot, cracked, or sooty glass. Use a thermal imaging camera (TIC) to rapidly scan all sides of a fire building. If possible, check the roof for heat patterns that can indicate the location and extent of the fire. Check for the presence of curtains or blinds in garage windows, a sign that the garage may have been converted to a bedroom or an apartment. Similarly, an air-conditioning unit in a garage window or installed in a garage wall should be reported to the incident commander (IC). How do these observations affect search operations? They probably won't when there are sufficient personnel to rapidly search all areas of the house, including the garage. It becomes very important, however, when you don't have enough search personnel. In this situation, an IC must prioritize the areas to be searched in the order of where occupants would most likely be found, such as the bedrooms. A report of curtains or an air-conditioning unit in a garage elevates its priority as a search area. Look for a gas meter or LPG cylinders that will need to be shut off to stop the flow of gas to a dryer or hot-water heater in the garage. Similarly, many new and remodeled homes are required by code to have an exterior main electrical shutoff, which is usually at or near the electric meter. Shutting off power there will deenergize the electrical panel, which is probably in the attached garage.

HOSELINES

As mentioned above, a fire in an attached garage requires at least two hoselines—three lines are necessary if there is a possibility of fire extension to the second floor in a two-story home. Take one hoseline into the house and stretch a second hoseline directly to the garage. Usually you stretch the hoseline positioned inside the house to the front door and advance it toward the doorway that leads to the garage, which is usually in the kitchen or utility room. This hoseline is critical to stop fire from extending into the house and to protect occupants and the firefighters searching for them. Advancing this hoseline toward the door leading to the garage positions it between the fire and any occupants who may be trapped in the bedrooms. Further, this line must protect the open stairway leading to second-floor sleeping areas. The hoseline positioned in the house may ultimately extinguish the fire in the garage if there are not enough personnel to stretch a second hoseline; there is a delay in forcing garage doors; or the garage has been converted into a living space and, consequently, can be reached only from inside the house. If you must attack a garage fire from inside the house, it is very important to provide ventilation openings in the garage. This will the reduce the tendency for smoke and expanding steam to flow into and contaminate the house by providing a path for them to escape to the outside directly from the garage. Additionally, pressurizing the house with a positive-pressure blower can also reduce the flow of smoke into the house. This technique is detailed in “The ‘Routine’ Garage Fire,” by Bruce Richard, one of my former battalion chiefs, in Fire Engineering (May 2002).

It is important to understand that although it is critical to position a hoseline in the house, it may not flow a drop of water. For example, consider this scenario: Firefighters respond to a report of a house fire in a new suburban development. The first-arriving company officer reports smoke is pushing from the top of a closed overhead door in a two-car garage that is attached to a large ranch house. The first-arriving
ing officer begins his 360° size-up at the front of the house and notices that paint on the metal sectional garage door is blistering from the heat, but he sees no smoke in the house when looking in the windows. As he makes his way around the house, he notes that no smoke is issuing from attic vents anywhere on the house. Firefighters stretch two 1¾-inch hose-lines—one to the garage and a second to the front door of the house. After forcing the front door, the company confirms what was noted in the size-up: The house is completely clear of smoke. Additionally, there is no indication of extension into the attic above the house, such as smoke or soot stains around penetrations in the ceiling for HVAC vents and recessed light fixtures. How is it possible that there is a heavy fire condition in the garage and there is no indication of any extension into the house? It is entirely possible because this home was built in compliance with a building code that requires a barrier to fire spread between the house and the garage. Although this is not a true complete “fire-rated” assembly, the code requires the garage walls and ceilings to be covered with ½ inch gypsum board, ⅜ inch Type X for ceilings if there are habitable rooms above. It is common for building codes to require that the walls separating the house and garage contain insulation and extend to the underside of the roof to protect the attic over the house. The code typically requires metal-clad doors and door frames or solid core wood doors in the openings to the garage from the house.

When there is no indication that fire has extended into the house, do not open the door between the house and the garage! It makes no sense to open this door and allow smoke to enter and damage the house. The most effective, least damaging way to extinguish this fire is for the firefighters who stretched a hoseline to the garage to attack the fire directly through the overhead door, a swinging exterior door, or a window—that’s right, a window.

Another word of caution: Do not hastily enter a garage with a heavy fire condition when there is no indication that there is a risk to civilians, such as if it had been converted to a bedroom or single-room occupancy. As mentioned, a garage is a very dangerous place, filled with things that can burn firefighters or fall on their heads; you don’t have to get “nose-to-nose” with the fire. Enter a garage that has sustained heavy fire damage only after the smoke has cleared enough to assess the hazards of its contents and its structural stability. Firefighters operating near a garage’s overhead doorway must realize that the vertical load of the structure above the doorway is supported by a steel lintel or a concrete tie beam in masonry wall construction and a steel I-beam or a wood header in frame construction. Years ago, many frame homes were built with garage door headers consisting of relatively massive wood beams of solid dimensional lumber, 2 inches × 12 inches. Beams were commonly doubled or tripled to span garage doorways. Homes constructed in the past 20 to 30 years are more likely to use “manufactured” wood garage door headers, such as laminated veneer lumber or lightweight engineered parallel chord girder trusses. Lightweight truss garage door headers are marvels of modern engineering, except for one fundamental flaw: They are prone to failing after a few minutes of fire involvement, which can precipitate the collapse of everything above them (photos 7-8).

A fire in an attached garage has a great potential of spreading to the house through the attic. When you suspect extension to the attic, you must be proactive and aggressively pull ceilings. Should you pull ceiling in the house or the garage? When there is no indication that fire has extended to the attic over the house and you can rapidly and safely enter the garage, pull the ceiling in the garage, and leave the ceiling in the house intact. To limit damage, examine the attic over the house through a scuttle opening. On the other hand, indications of fire in the attic over the house call for decisive action: Pull ceiling immediately on entering the house, and have a charged hoseline.
(9-10) You must verify the presence and effectiveness of fire separation between a house and garage; never take it for granted. In photo 9, the hollow-core door leading to the garage burned through and allowed fire to spread into the kitchen. In photo 10, the garage walls and ceiling are covered with fire-resistant plasterboard, but the glass panel door leading to the house provides no separation. (Photos by Enrique Rodriguez.)

ready to do battle. Remember to check the attic for combustible cellulose insulation that is prone to smolder below its surface and rekindle an attic fire several hours after the fire department has left the scene.

The preceding scenario begs the question, If the fire is confined to the garage and will be extinguished directly, why drag hose into the house? The answer is, firefighters must never assume that a house is built with a fire-rated separation between the house and garage and that it will stop extension. You must verify the presence and effectiveness of fire separation; never take it for granted (photos 9-10).

Remember that a home could have been built with fire separation and inspected by the building department, but the fire and building departments have no control after the house is occupied. Install a nonrated pull-down stair/ladder in a fire-rated ceiling, for example, and all bets are off. In the previous scenario, the firefighters operating inside the house were lucky: The separation held the fire to the garage, but they better not push their luck because it could fail at any moment and allow fire to extend into the house. How is this possible?

1. When gypsum board is exposed to fire, it can undergo calcination or thermally degrade because of a loss of moisture. Gypsum board that has calcined becomes brittle and can crumble, allowing fire to pass. This failure can be hastened if the weakened gypsum board is struck by a hose stream.

2. A fire in a closed garage may have subsided because it has consumed the oxygen necessary for it to grow; fire researchers call this a ventilation-controlled or a ventilation-limited fire. When the garage is opened to attack the fire, oxygen flows in and causes the fire to rapidly intensify to a point where it can overwhelm the fire barrier.

3. As mentioned, the typical American garage is filled with containers of flammables that could fail at any moment and suddenly provide fuel to a fire that could defeat the separation protecting the house.

Companies operating inside the house must thoroughly examine bedrooms above the garage for fire extension. Firefighters sent to the second floor should consider stretching an additional hoseline using the interior stairs and be prepared to pull baseboards and open walls to check for extension. Every firefighter and fire officer should be familiar with the tests on nonfire-rated structural assemblies conducted by Underwriters Laboratories (UL) at their Northbrook, Illinois facility. These tests demonstrate how quickly lightweight engineered roof and floor assemblies will collapse when involved in fire. But just as important, the tests revealed some startling data on the extreme differences in temperatures measured on the underside of the floor directly exposed to a free-burning fire and temperatures measured on top of the floor. Remarkably, the tests demonstrate that ordinary ½-inch oriented strand board floor decking, carpet pad, and carpet insulate the top of the floor to an extent that firefighters would not feel any appreciable rise in floor temperatures or observe any significant difference in heat in a TIC. The UL tests teach a valuable lesson: Firefighters searching and checking for extension in bedrooms above a burning garage may be unaware that there is fire raging directly below and that the floor is in imminent danger of collapse.

As mentioned, fires in attached garages are most effectively controlled by hoselines stretched directly to the garage, not through the house. Why?

1. It maintains a smoke-free environment inside the house by keeping the door between the house and garage closed.

2. It is faster to stretch a hoseline straight to the garage than to snake it through the house, so water is rapidly applied to the source of heat and flammable and toxic gases that threaten the house.

3. A heavy fire condition in a large two-car garage demands the flow of a 2½-inch handline or portable master stream device. It is a lot faster and easier to position and operate these “big lines” from outside of the house than from the inside, because of their lack of mobility (photo 11). Consider also that one firefighter can stretch a 2½-inch hoseline and operate it by himself by kneeling or sitting on it; similarly, it takes only one firefighter to set up and operate a portable master stream.

Many cities and suburban towns have seen the construction of three-story townhouses in recent years. The first floor of these residences consists of a garage and doorways from the garage and the exterior to a stairway to reach living areas on the second and third floors. There’s no question that the first hoseline operated at this fire must be applied to suppress the fire in the garage and to protect the stairway. The faster that water can be applied directly to the fire burning in the garage, the sooner it will stop the production of heat and fire gases that threaten to spread fire to the upper floors and kill the occupants.

It’s important here to review two basic rules of firefighting: First, a large volume of fire requires a large volume of water; second, if firefighters initiate an interior attack on a fire, water must be applied directly to the burning fuel to absorb the heat and stop the production of flammable fire gases. I mention this because there have been some disturbing incidents in
recent years where firefighters have been killed and terribly burned in flashovers with a charged hoseline in their hands! A hoseline capable of flowing hundreds of gallons per minute (gpm) will do no good unless you can apply its stream to the burning fuel; it must reach the seat of the fire.

At this point, you may be asking some valid questions:

1. Doesn't directing streams into the garage from outside the house violate the concept of attacking the fire from the uninvolved side?
2. Won't a stream directed into the garage “push” the fire into the house?
3. If fire extends into the house, wouldn’t the hoseline operated directly into the garage and the one operating inside the house be considered opposing streams?

In answer to the first two questions, water applied directly to the fire from the involved portion of a structure will not push it toward uninvolved areas if it is applied in a straight stream from a fog nozzle or a solid stream from a smooth bore nozzle because water does not push fire. The air entrained in the stream has a tendency to push fire. A straight and a solid stream entrains very little air because they are compact. This has been documented by research on air movement induced by nozzles conducted by Jerry Knapp, Christopher Flatley, and Tim Pillsworth at the Rockland Fire Academy in New York (“Nozzle Tests Prove Fireground Realities, Part 1,” Fire Engineering, February 2003). The Rockland tests quantify what seasoned firefighters have learned from experience—that is that a straight and a solid stream will have a negligible effect on pushing fire because they move a negligible amount of air, as measured in cubic feet per minute. Conversely, the Rockland tests demonstrate that a fog pattern moves a tremendous amount of air and, hence, can push smoke, steam, and fire into uninvolved areas. This notion of exterior streams pushing fire deeper into a building has also been disproven in tests conducted by Underwriters Laboratories and documented in its University training program “Impact of Ventilation on Fire Behavior in Legacy and Contemporary Construction.”

In answer to the third question, communication and coordination can reduce or eliminate most of the adverse effects of opposing streams. The IC should coordinate companies operating hoselines in different areas; he should ensure that they do not get into competition with each other to see who can put out the most fire. The IC does this by clearly communicating what he expects each company to accomplish, and where. Let’s see how this applies to a fire in an attached garage.

Fire companies arrive to find a large volume of fire burning through the overhead door of an attached garage. Two hoselines are stretched: a 2½-inch line to the garage and a 1¾-inch line to the front door of the house. Heavy smoke is pushing from soffit vents, so firefighters entering the house pull ceiling to check for fire in the attic immediately inside the front door and will continue to pull ceiling at 10-foot intervals as they advance their hoseline toward the kitchen. In this case, any fire rated separation between the house and garage has failed or was never present; consequently, firefighters encounter fire in the kitchen and utility room and operate their handheld flowing 180 gpm. At the same time, the company on the 2½-inch hoseline knocks down the main body of fire in the garage with a 325-gpm stream from its 1¼-inch nozzle. Each hoseline operated at this fire has a vital job to do; it would be very difficult for one line to rapidly control the large volume of fire in the garage and stop the extension inside the house.

FORCING OVERHEAD GARAGE DOORS

Any review of techniques for forcing garage overhead doors must be preceded with an understanding of two rules:

1. When conditions permit, try to gain entry through a swinging door and raise an overhead door from inside the garage. This permits the door to be raised without damage, and a fully opened door provides the largest possible opening for access, egress, and ventilation.

2. When fire is burning uncontrollably behind a garage door, there’s no time for fancy forcible entry. Simply cut a hole or knock out a panel to insert a nozzle and knock down the fire (photo 12).
Choosing the most effective and appropriate method of forcing a garage overhead door depends on a door's design and the type and strength of the materials used in its construction. Fire conditions and the condition of the door are equally important considerations. For example, when fire conditions are light and a garage door has not been significantly damaged by heat, first attempt to raise the door by making small openings to allow you to reach in and release a lock, latch, or linkage for an automatic garage door opener. On the other hand, heat from an intense fire in a garage can warp and distort an overhead door to a point that it cannot be raised. Additionally, heat can attack the powerful torsion springs used to counterbalance the weight of a door, causing them to lose their tension and make the door too heavy to raise. When a door cannot be raised, you will have to cut a large, man-size opening to permit you to enter and, more importantly, rapidly exit a garage.

The focus here is on forcing overhead sectional doors because they are most commonly installed in residential garages; however, many of the techniques presented are applicable to other types of garage doors. I wrote an article “Forcing Overhead Sectional Doors (Fire Engineering, November 2004). However, today’s overhead doors are much stronger, heavier, and more difficult to force than those manufactured and installed before 2004. This is primarily because of new wind-load requirements in building codes, especially in hurricane-prone regions of the country, such as South Florida. Since the 2004 article, my department has gained a lot of experience by forcing overhead doors at fires, buildings scheduled for demolition, and many of our own fire stations when overhead doors were replaced with new ones that will withstand higher winds.

Additionally, our department is fortunate to have a facility that tests overhead doors and other wind-resistant assemblies in our jurisdiction. At this testing facility, overhead doors are installed in steel and concrete frames and are subjected to hurricane-force winds and flying projectiles. On completion of the tests, firefighters are invited to the facility to practice forcible entry on the doors. Over the years, we have gained considerable experience in cutting some of the strongest, most wind-resistant doors in the industry.

Older garage doors constructed of wood framework with wood pressboard panels are relatively easy to force. Punch through a panel next to the handle for the latch mechanism, then reach in and release the latch (photos 13-14). Similarly, if you suspect that it is equipped with an automatic garage door opener, knock out a panel at the center of the top section of the door, reach in, and release the linkage mechanism. If raising a wood-panel garage door is not successful, chop or batter the door and tear it apart, or cut a “barn door” using the same techniques described later in this article.

You can raise metal-clad sectional doors in a similar fashion by cutting a triangular opening to access the latch (photo 15) or linkage to an automatic garage door opener (photos 16-17). When you raise an overhead door in fire conditions, take measures to prevent the door from closing and trapping you in the garage. As mentioned, torsion springs counterbalance the weight of sectional overhead doors. Torsion springs exposed to fire temperatures can lose their tension and allow a door to close unexpectedly. The torsion springs, located above the top of the doorway, rotate a shaft and pulleys that are connected to cables fastened to the bottom panel at each end of the door. Heat concentrated at the top of an overhead doorway can cause this assembly to fail where the cables are connected and result in a door that suddenly falls like the blade of a guillotine. Failure of torsion springs or the cable assembly is not the only cause of a door's closing unexpectedly. A short circuit or an errant radio signal can cause an automatic garage door opener to close and trap firefighters. Prevent overhead doors from closing by bracing them open by standing a pike pole in the door's roller track. Use a pike pole long enough to reach as close as possible to the bottom of the door. Clamping vise grips to the door's track is also effective, provided that they are clamped no more than a few inches below the door.

If you must cut an opening in an overhead door to gain entry into a garage, make sure it is large enough to allow firefighters to rapidly escape. Firefighters are accustomed to cutting a triangle, also known as an inverted "V" or "tepee" cut. A triangular opening usually works on conventional sectional doors because their overall thickness, as measured from their outer "skin" to the inside of their reinforcing framework, is generally less than five inches. This makes it possible to cut completely through these doors with a rotary saw equipped with a 14-inch-diameter metal-cutting blade. Modern residential sectional doors designed to withstand hurricane-force winds are strengthened with large horizontal wind bracing of heavy gauge steel. Cutting a large triangular opening in a strong, wind-resistant door can be difficult and time-consuming because the overall thickness exceeds

www.FireEngineeringUniversity.com
the maximum depth of cut possible with a 14-inch rotary saw (photo 18). My department has learned that cutting a “barn door” or a “door within a door” will yield a much larger opening than a triangle, and it is much more effective for thick wind-resistant doors.

**CUTTING A BARN DOOR**

Begin accessing a “barn door” by cutting vertically from the top down to the bottom of the door, about six to 12 inches from one of the ends; this is to avoid unnecessarily cutting a door’s vertical framework. Begin the cut at the top of the door by holding the saw in place until the blade has penetrated the door to its maximum depth, then cut in a downward direction, cutting the door’s exterior skin and horizontal wind bracing that is fastened on the inside of the door. An experienced saw operator will know when the blade is cutting horizontal wind bracing because he will sense a reduction in the saw’s revolutions per minute and the speed at which the saw cuts. These are indications to “back off” on the saw and allow it to regain its speed. Do not attempt to force a saw to cut faster than it is capable of cutting; doing so will bind the blade and burn its clutch.

After cutting a few feet, stop cutting and push on the door to see if the cut portions move independently. If they do not, it is probably because the door has large-dimension horizontal wind bracing that makes it too thick to cut completely through the door’s skin and reinforcement at the same time. If this is the case, it will be necessary to first cut and remove a strip of the door’s skin and then cut the wind bracing. Continue the vertical cut, but stop attempting to cut completely through the door; a depth of three to four inches should be sufficient. Then, make another vertical cut about four to six inches from the first cut, connect the cuts at the top, and strip the skin off the door (photos 19-20). This will provide sufficient space to insert the saw’s cutting arm and blade guard and cut wind bracing of any size and dimension (photos 21-22).

Often, it is difficult to cut the very bottom of the door because in many parts of this country overhead doors close in front of a raised floor slab, which may be as much as two inches high. To cut the bottom of the door, lift it off the concrete slab by prying upward with a long crow bar or a steel roof hook. For more
leverage, use a halligan or the head of a maul as a fulcrum (photos 23-24). Also, the large profile of a rotary saw's blade guard and cutting arm may prevent the blade from completely cutting the bottom of the door. If this is a problem, cut a small triangle in the bottom of the door and peel back the skin. This will provide room for the blade guard and arm of the saw to be inserted and allow the blade to cut through the bottom of the door (photo 25). To complete the barn door, cut horizontally across the center of the highest section at which you can hold and operate the saw. A row of windows across an upper section would be an obvious choice for the site at which to make the horizontal cut. Cutting through the center of a section avoids the hinges, which will require additional and unnecessary cutting. Connecting horizontal and vertical cuts will yield a large section of door that can be hinged open (photos 26-27). Cutting overhead with a rotary saw is physically demanding and requires skill; it is not an "equal opportunity" machine. Clearly, tall, strong firefighters will be able to cut higher than firefighters who are not. Don't be overly ambitious when beginning the horizontal cut. If you start cutting too high, the cut will get progressively lower as you begin to tire. This is especially important when you do not have enough firefighters to rotate in as fresh saw operators.

**SAW AND BLADE SELECTION**

The techniques for cutting garage doors described in the previous paragraphs were all performed with a rotary saw. You can also use a high-performance ventilation chain saw equipped with a quality carbide tooth chain, which can be very effective in cutting wood and lightweight metal residential garage doors. In fact, a chain saw can outperform a rotary saw because it is lighter and easier to handle. Additionally, a chain saw has a much greater depth of cut, equal to the length of its guide bar. This makes it possible to cut completely through a door and its wind bracing at one time. Another advantage a chain saw has over a rotary saw is that it can cut the bottom of an overhead door without the need to cut a triangle to complete the vertical cut. Unfortunately, a chain saw is limited in its ability to cut through a wind-resistant overhead door constructed with heavy-gauge steel reinforcement. Try using a carbide tooth chain saw to cut a heavy metal sectional door. You'll end up ruining the chain before you make the desired opening. The decision of whether to use a chain saw or a rotary saw should be based on the design and construction of overhead doors in your area.

Since I wrote the sectional door article in 2004, my department as well as many others have replaced their metal-cutting aluminum oxide abrasive disks with diamond blades. Although aluminum oxide disks cut metal faster than diamond blades, their diameter diminishes with use, resulting in a reduced depth of cut. This is a huge drawback when cutting a thick overhead sectional door equipped with wind bracing. Diamond blades are, however, not without limitations. Most notably, they are very poor at cutting wood. That is because a diamond blade is really not a blade at all. It is technically a grinding wheel. A blade, such as a carbide tooth blade, chops material; a grinding wheel grinds. A diamond blade does not cut wood as much as it tends to burn through wood because of friction. I am well aware that some blade manufacturers and sales representatives claim their diamond blade will cut wood, and it will for the short time that it is being demonstrated, but this capability will diminish with use. Diamond blades can also be ineffective in cutting aluminum, plastic, fiberglass coated with plastic.
resin, and other relatively soft materials. A diamond blade may be ineffective in cutting residential sectional garage doors constructed of both wood and metal such as wood doors equipped with galvanized-steel wind bracing and metal doors equipped with 2-×-4-inch wood wind bracing.

Arguably, there is no true “universal” rotary saw blade that will effectively cut every material. A segmented carbide “chip” blade is, however, an excellent choice for cutting sectional doors because it is second only to a carbide tooth blade for cutting wood; but, unlike a carbide tooth blade, the carbide chip blade can cut through the heaviest gauge steel-reinforcing members (photo 28). The newest generation of carbide chip blades is thinner and cuts a narrower kerf than those manufactured in the past. The thinner profile blade cuts faster because it cuts less material than a wider blade. For a more detailed examination of techniques for forcing overhead doors, refer to Truck Company Operations, second edition, by John Mittendorf (Fire Engineering, 2011).

Determine the most effective saw blade and technique for cutting overhead doors by becoming familiar with the doors in your area. Visit homes under construction, and consult with a local overhead door contractor to learn the design and construction of new door installations.

OVERHAUL

Don’t be in a big hurry to overhaul a heavily damaged garage. First, assess the collapse hazards, such as heavy storage on burned roof trusses. Closely examine the structural stability and load-carrying capacity of the header spanning over the garage doorway. Don’t hesitate to seek the help of specialists. Consult with building department personnel, and request a collapse rescue team for technical advice and to shore fire-weakened portions of the structure. After the structure has been determined to be relatively safe, completely remove any collapsed garage overhead doors that partially obstruct the doorway and could hinder a hasty retreat from the garage. Use a wrecker or a winch on a fire department vehicle to pull damaged vehicles from the garage. Be on guard for flareups caused by disturbing damaged containers of flammable liquids. Assign a firefighter to remain on the nozzle of a charged hoseline and a second firefighter to watch over personnel with a large dry chemical fire extinguisher.

My department learned to take these precautions when things got ugly while overhauling a garage a few years ago. Admittedly, there were too many personnel getting in each other’s way in a small garage filled with gasoline containers and gasoline-powered lawn equipment. While personnel were moving smoldering materials, gasoline spilled from a partially melted container. Suddenly, the garage became a sea of flame with firefighters tripping over bicycles, lawn mowers, and a collapsed overhead door that obstructed their path of escape.

A fire in an attached garage can endanger the lives of firefighters and occupants, particularly if bedrooms are above the garage or if the garage had been converted to a living space. A fire in an attached garage is personnel-intensive. There are few, if any, fires in a private dwelling that require firefighters to perform so many functions at the same time. They include stretching a hoseline directly to the garage to attack the fire and to the first and second floors of the house to protect occupants and keep the fire from extending. At the same time, firefighters performing ladder company functions must ventilate the house and garage, search for occupants, open ceilings and walls to stop the fire from extending, and force heavy overhead doors. Chiefs who must defend and justify fire department staffing in these days of budget cuts could use a fire in an attached garage as an example of how devastating reductions in personnel can be to a fire department and the community it is committed to protect.

Thanks to Deputy Chief (Ret.) Greg Havel and Lieutenant Steven C. Hamilton for their assistance with this article.

BILL GUSTIN is a 38-year veteran of the fire service and a captain with the Miami-Dade (FL) Fire Rescue Department. He began his fire service career in the Chicago area and conducts firefighting training programs in the United States, Canada, and the Caribbean. He is a lead instructor in his department’s officer training program, is a marine firefighting instructor, and has conducted forcible entry training for local and federal law enforcement agencies. He is an editorial advisory board member of FDIC and Fire Engineering.
Fire Tactics for Attached Garages

1) Which of the following is the most common item found stored in attached garages?
   a. Gasoline
   b. Liquid Petroleum Gas cylinders
   c. Lawn tractors
   d. Snow Blowers

2) Which of the following common ignition sources may be found in an attached garage?
   a. Gas-fired clothes dryer
   b. Hot water heater
   c. Electrical panel
   d. All of the above

3) Overhead storage in an attached garage can overload a ceiling or roof assembly. What other feature associated with overhead storage contributes to fire spread and collapse?
   a. Pull-down stair/ladder
   b. Christmas decorations
   c. Flammable gas containers stored overhead
   d. Roof trusses

4) Almost every hazard associated with a fire involving a modern vehicle is intensified when it is parked in an attached garage. These hazards include all of the following except:
   a. Thick, black smoke from burning synthetic material
   b. Burning magnesium
   c. Spill fire from leaking fuel lines and tanks
   d. All of the above are correct

5) A decline in the economy has caused many homeowners to convert their attached garages into living quarters. What primary factor makes this a violation of building codes?
   a. Occupancies are often only one bedroom
   b. Absence of adequate restroom facilities
   c. Building codes prohibit a garage from leading directly to sleeping areas
   d. Vehicles parked in garages release carbon monoxide gas into sleeping areas

6) Which of the following is a reason not to position fire apparatus at the base of a driveway?
   a. Fuel leaking from vehicles and containers can flow down the driveway causing a spill fire under the apparatus
   b. Stretching hose from an engine is more difficult up-hill
   c. The aerial apparatus may not be able to position in the ideal location
   d. The incident commander usually positions at the base of the driveway

7) A fire in an attached garage requires at least two hoselines: one stretched directly into the garage to attack the fire. Where is the other hoseline stretched primarily?
   a. To back-up the initial hoseline
   b. To the rear of the garage
   c. To an exposure building adjacent to the garage on fire
   d. To the house to stop extension and protect occupants

8) Which of the following is a strong indication that a fire in an attached garage has extended to the occupied structure?
   a. Heavy fire in the garage
   b. The garage door is closed when the first firefighting company arrives
   c. Smoke is pushing from soffit, gable or ridge vents
   d. Smoke is pushing from under the closed garage door

9) What is a major hazard to initially observe while conducting a 360°?
   a. Electrical service wires that have burned off the fire building
   b. Fences that may obstruct the rapid stretching of handlines
   c. Holes in the grass or ground that may cause tipping hazards
   d. The lack of a rear garage service door

10) If there is a possibility of fire extension to the second floor in a two-story home, how many hoselines should be stretched?
    a. Two
    b. Three
    c. Four
    d. One per sleeping quarter found in the fire building
11) Which of the following is a component of a typical “fire-rated” garage assembly?
   a. Garage walls and ceilings covered with ½” gypsum board
   b. Garage ceilings covered with ⁵⁄₈” ‘Type-X’ gypsum if habitable rooms above
   c. Insulation extending to the underside of the roof to protect the attic over the house
   d. All of the above are correct

12) If there is no indication that fire has extended into the house from a fire in an attached garage, which of the following is correct:
   a. Open the door slightly to determine if fire is still present in the garage
   b. Open an inspection hole in the drywall above the door leading to the garage with a pike-pole to determine if fire may eventually spread to the interior of the structure
   c. Do not open the door between the house and the garage
   d. Remove the handline from the interior immediately

13) When should you enter a garage that has sustained heavy fire damage?
   a. Only after the smoke has cleared enough to assess the hazards of its contents and structural stability
   b. Immediately to determine the extension to the occupied areas of the structure
   c. Only after the fire is completely extinguished
   d. Never enter a garage that has sustained heavy fire damage

14) When there is no immediate indication that fire has extended to the attic over the house, and you can rapidly and safely enter the garage, where should you pull the ceiling to determine if there is any extension to the attic?
   a. Pull the ceiling in the garage and leave the ceiling in the house intact
   b. Pull the ceiling in the house and ensure the ceiling in the garage is not compromised
   c. Pull the ceilings in both the garage and house near the doorway between the garage and house
   d. Never pull ceilings during an attached garage fire

15) There are two rules for forcing overhead garage doors: One is, when conditions permit, gain entry through a swinging door and raise the overhead door from the inside to provide the largest possible opening for access, egress and ventilation. The other is:
   a. During an advanced fire, always attempt to access the manual lock by breaking a window and reaching down to manipulate the lock
   b. When fire is burning uncontrollably, there is no time for fancy forcible entry. Cut a hole or knock out a panel to insert a nozzle and knock down the fire
   c. If the fire is burning uncontrollably, cut a hole in the side of the garage and place the stream into the garage
   d. Never conduct forcible entry operations on an overhead door if there is fire burning uncontrollably behind it so the fire will be contained to the garage

16) On older garage doors constructed of wood framework and pressboard panels, how could you force entry if the door is suspected to contain an automatic garage door opener?
   a. Knock out a panel near the center of the door, reach in, and release the linkage mechanism
   b. Knock out a panel near the bottom of the door, reach in, and release the linkage mechanism
   c. Knock out a panel at the center of the top section of the door, reach in, and release the linkage mechanism
   d. It is not advised to force entry to garage doors that are operated with an automatic door opener

17) Which method of cutting an overhead garage door yields a much larger opening than the “triangle” or “tepee” cut?
   a. The “box” cut
   b. The “barn door” or “door within a door” cut
   c. Cutting two “V” cuts side-by-side
   d. Cutting the door's guide-tracks to remove it from it's framing

18) Although aluminum oxide saw blades cut metal faster than diamond blades, what is the main disadvantage they have when compared to diamond blades?
   a. They are more likely to bind when cutting wind-bracing
   b. They can not be used on certain types of metal doors
   c. Their diameter diminishes with use
   d. They are considerably heavier than diamond blades

19) What is the most effective way to determine which saw blade to use in your department for cutting overhead garage doors?
   a. Becoming familiar with the design of garage doors in your area
   b. Visiting homes under construction
   c. Consulting with contractors to determine the construction of new door installations
   d. All of the above are correct

20) What is the first thing to consider when overhauling a heavily fire-damaged attached garage?
   a. Assess collapse hazards
   b. Determine if a vehicle(s) is present in the garage
   c. Force entry to all doors to the garage
   d. Flammable liquid containers stored in the garage
Fire Tactics for Attached Garages

PROGRAM COMPLETION INFORMATION
If you wish to purchase and complete this activity traditionally (mail or fax) rather than Online, you must provide the information requested below. Please be sure to select your answers carefully and complete the evaluation information. To receive credit, you must receive a score of 70% or better.

Complete online at: www.FireEngineeringUniversity.com

PERSONAL CERTIFICATION INFORMATION:

Last Name (PLEASE PRINT CLEARLY OR TYPE)
First Name
Profession/Credentials License Number
Street Address
Suite or Apartment Number
City/State Zip Code
Daytime Telephone Number with Area Code
Fax Number with Area Code
E-mail Address

TRADITIONAL COMPLETION INFORMATION:
Mail or fax completed answer sheet to Fire Engineering University, Attn: Carroll Hull, 1421 S. Sheridan Road, Tulsa OK 74112
Fax: (918) 831-9804

PAYMENT & CREDIT INFORMATION
Examination Fee: $25.00 Credit Hours: 4

TRADITIONAL COMPLETION INFORMATION:
Examination Fee: $25.00 Credit Hours: 4

Please provide the following (please print clearly):
Exact Name on Credit Card
Credit Card # Expiration Date

EDUCATIONAL DISCLAIMER
The opinions of efficacy or perceived value of any products or companies mentioned in this course and expressed herein are those of the author(s) of the course and do not necessarily reflect those of PennWell.
Completing a single continuing education course does not provide enough information to give the participant the feeling that she is an expert in the field related to the course topic. It is a combination of many educational courses and clinical experience that allows the participant to develop skills and expertise.

AUTHOR DISCLAIMER
The author(s) of this course has/have no commercial ties with the sponsors or the providers of the unrestricted educational grant for this course.

No manufacturer or third party has had any input into the development of course content. All content has been derived from the author(s) and peer review. All content is based on the best information available at the time of publication. Your opinion of the author's grasp of the topic is a personal one. It is simply one of many opinions expressed in this field.

We encourage participant feedback pertaining to all courses. Please be sure to complete the survey included with the course.

All participants scoring at least 70% on the examination will receive a verification form verifying 4 CE credits. Participants are urged to contact their state or local authority for continuing education requirements.

Please photocopy answer sheet for additional participants.

COURSE EVALUATION

Please evaluate this course by responding to the following statements, using a scale of Excellent = 5 to Poor = 1.

1. To what extent were the course objectives accomplished overall?
2. Please rate your personal mastery of the course objectives.
3. How would you rate the objectives and educational methods?
4. How do you rate the author's grasp of the topic?
5. Please rate the instructor's effectiveness.
6. Was the overall administration of the course effective?
7. Do you feel that the references were adequate?
8. Would you participate in a similar program on a different topic?
9. If any of the continuing education questions were unclear or ambiguous, please list them.
10. Was there any subject matter you found confusing? Please describe.
11. What additional continuing education topics would you like to see?