Technical Rescuer
Lesson Two
Victim Management
Search

DOMAIN: COGNITIVE / PSYCHOMOTOR

LEVEL OF LEARNING: KNOWLEDGE / APPLICATION

MATERIALS

IFSTA Fire Service Search and Rescue, 7th Edition; IFSTA 5th Edition Essentials of Firefighting; NFPA 1006, Standard for Technical Rescuer Professional Qualifications; Water Rescue, Mosby Lifeline Productions; NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents; US Army Corp of Engineers 5th Edition (second printing) Urban Search and Rescue Field Operations Guidebook, Oct 2001; Wilderness Search and Rescue Manual; compasses; maps; optional: Lost Person Questionnaires from the AHJ. See the list of publications in NFPA 1006 for each rescue discipline. Laptop computer; multimedia projector; whiteboard or flipchart; and marking pens.

NFPA 1006, 2013 JPR

5.2.5 Conduct a search

Junior Member Statement:

Junior Member training activities should be supervised by qualified instructors to assure that the cognitive and psychomotor skills are completed in a safe and non-evasive manner. While it is critical that instructors be constantly aware of the capabilities of all students both mentally and physically to complete certain tasks safely and successfully, the instructor should take every opportunity to discuss with departmental leaders and students the maturity and job awareness each participant has for the hazards associated with fire and rescue training.

TERMINAL OBJECTIVE

The Technical Rescuer candidate, when given a search mission scenario, the appropriate PPE, equipment necessary for the mission, an incident location, and victim investigative information, shall correctly demonstrate the techniques used for conducting a search mission in the different rescue environments of the authority having jurisdiction (AHJ).

ENABLING OBJECTIVES

1. The Technical Rescuer candidate shall correctly identify in writing the concept of search and rescue, possible resources, and equipment necessary for conducting a search.

2. The Technical Rescuer candidate shall correctly describe in writing the various fitness factors, personal needs, and PPE that are used while conducting a search in the various search environments.

3. The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in a land search environment.

4. The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in a structural collapse search environment.

5. The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in an aquatic search environment.

6. The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in a confined space/silo search environment.

7. The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in a collapsed trench search environment.

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MOTIVATION

This course is designed to give the Technical Rescuer candidate an overall picture of what is involved with search and rescue procedures at the various rescue incidents. It exposes the Technical Rescuer candidate to the complexities of developing and carrying out a search and rescue mission. Search and rescue operations like trench rescues, water rescues, collapsed structures, silo, and confined space rescues require specially trained personnel to oversee the operation and insure that the operation will be conducted safely and successfully. This lesson serves as an introduction to the world of search and rescue, and exposes the candidate to information that will help them become useful members of a search team in the different search environments. Land search is discussed extensively in this lesson plan. Most searching done in North Carolina is land search, followed by water and structural collapse search. Other search specialties should not be ignored. If your jurisdiction specializes in different types of search, by all means cover in as much detail as you see fit, those search procedures for those search specialties.

PRESENTATION

ENABLING OBJECTIVE #1

The Technical Rescuer candidate shall correctly identify in writing the concept of search and rescue resources and equipment necessary for conducting a search.

1. Ask the students to define search and rescue.

a) Point out that the term “searching” is defined as the act of looking for an overdue or missing person.
b) Point out that the term “rescue” means removing a patient in a known location from peril or entrapment when time is of the essence.

2. Point out that in North Carolina, land search and rescue missions may come under the jurisdiction of various agencies. Such agencies may include: Law Enforcement, Fire Department, Rescue Squad, Emergency Management, Parks and Recreation, National Park Service and Tennessee Valley Authority, and Coast Guard.

3. List resources available to Search and Rescue teams.
   a) Dogs.
   b) Trackers.
   c) Helicopters.
   d) Fixed wing aircraft.
   e) Local, state and national emergency service agencies, such as the Civil Air Patrol (CAP), USAR Teams (Local, State and Federal), and Emergency Management.
   f) ATV teams.
   g) Horseback SAR teams.
   h) Boating clubs.
   i) Specialty specific rescue teams.

4. Obtain samples of the different types of compasses, GPS units and maps that are applicable to the AHJ for the class being taught. Describe and discuss the components of a compass.
   a) Base Plate.
   b) Direction of travel arrow.
   c) Index lines.
   d) Orienting lines.
   e) Scale.
   f) Bezel or degree ring.
   g) Magnetic Needle.
   h) Luminous points.
   i) A compass may also have a mirror and a lanyard depending upon its type.

5. Make it a point to demonstrate and allow practice time for students to get familiar with a compass.

6. Discuss and display the 3 types of maps used in land navigation: Topographical, Orthophoto and Block-Square-Point.
   a) Topographical – shows a photographic image of an area in many colors. Various symbols represent the many features detailed on a topographical (topo) map, such as roads, contour lines, water, churches and schools. This is the most widely used.
   b) Orthophoto – These maps are used by local governments for county mapping. This is the actual start of a topographical (topo) map. These maps are usually made from aerial photography.

7. Using a topographical (topo) map point out that marginal information is the data placed in the margins of all maps that gives specific information about the map such as its scale, major landmarks, quadrangle and declination information.

8. Define and discuss the three different designations of North.
   a) True North – Geographic North Pole.
   b) Grid North – Map North.
   c) Magnetic North – The direction the compass points.

9. Use a topographical (topo) map to point out map symbols.
   a) Contour lines – usually brown, depict elevation.
   b) Roads – represented by solid, dotted or dashed lines.
   c) Railroad tracks.
   d) Bridges and dams.

10. Use a topographical (topo) map to point out map colors.
   a) Blue – represents all water.
   b) Red – represents major routes, boundary lines, fence lines and boundaries of townships.
   c) Black - represents public lines and boundaries.
   d) Pink – depicts areas that are built up usually greater than 3/4 of a square mile.
   e) Green – vegetation, pastureland.
   f) Brown – contour lines.

g) Purple – represents changes since the last time the map was revised.
h) White – areas with no standing timber such as a rock face.

11. Describe the factors dealing with US National Grid System.
    a) The US National Grid System provides for a standard unit of measurement anywhere on the earth's surface.

A Brief History and an Explanation of USNGS

In the late 1940s, following World War II, The U.S. Department of Defense in conjunction with North Atlantic Treaty Organization (NATO) began a coordinated mapping project for the entire planet. At this point the U.S. and NATO began moving away from latitude/longitude based coordinate systems. This process basically required that a globe be peeled like the skin of an orange and laid flat forming what is known as the Universal Transverse Mercator Projection (don't confuse this "map" with UTM coordinates just yet).

This projection required a new coordinate grid system which was named the Universal Transverse Mercator (UTM) Grid. The UTM Grid's straight lines and the distortion of the projection in the Polar Regions required the development of the Universal Polar Stereographic Grid system for those areas. The UTM and UPS Grid systems together cover the earth. For the remainder of this course we will not discuss nor reference the UPS system.

Grid Zones for UTM are 6° wide by 8° tall.

There are 360 degrees of longitude around the earth circumference. Vertical zones have been assigned for every 6° of Longitude beginning at 180°W proceeding eastward in Longitude. There are 60 longitudinal zones around the earth. Zones 10 - 19 cover the entire continental U.S.

These vertical zones are divided into rows horizontally forming a grid for every 8° of Latitude making 20 vertical rectangles, beginning at 80°S and proceeding past 0° at the Equator northward to 84°N.

In order to avoid confusion between northern or southern hemisphere these 6° X 8° grids were given a single letter designator in addition to their respective zone number beginning with C and ending with X. 10 row designators (letters) are located in each hemisphere with the equator being the center. Rows C - M are in the Southern, and rows N - X are in the Northern Hemisphere. Row C begins at 80°S. Rows M and N border the equator. Row X stops at 84°N. It should also be noted that X is 12° in latitude instead of the standard 8°. Rows R- U cover the Continental U.S.

(Note: The letters I & O were dropped to avoid confusion with the numbers 1 & 0. A, B, Y, and Z cover the Polar Regions in the UPS system.)

The 60 zones and 20 horizontal rows form a Global Grid Zone Designator system. Grid Zone Designators are much like international calling codes, allowing you to find them rather quickly and accurately since negative readings are not used.

The UTM system is based on the Metric system which is based on multiples or divisions of 10. This system provides for simple math, just like dealing with money $1 x 10= $10, $10 X 10 =$100, $100 X 10 = $1,000, 1,000 X 10= $10,000, $10,000 X 10= $100,000, and $100,000 X 10= $1,000,000

Each Grid Zone is broken down into 100,000m by 100,000m squares. These squares are broken down additionally to 10,000m X 10,000m squares. This process continues dividing by 10 each time eventually reaching 1m X 1m.

The U.S. Army with cooperation NATO formed the Military Grid Reference system based on the UTM projection. MGRS covers the entire earth including the polar regions in one single coordinate system. MGRS replaces the 100,000m coordinate pair for both easting's and northing's with a 2 letter designation. This 2 letter designation rotates for each Grid Zone and never appears within 1000 miles of the same 2 letter pair. This provides an added layer of insurance when sending and receiving the coordinates.

The Department of Home Land Security adopted the U.S. National Grid System (USNG) in 2008, as the primary "Language of Location" for ground based SAR units. This grid system is based on the MGRS system which the U.S.

military has used for over 50 years. In fact the USNG and MGRS system read exactly the same when used with the NAD 83/ WGS 84 datum's for maps and GPS receivers. The USNG system can be used in any datum setting without the 2 letter pairs changing. (MGRS cannot be used in place of USNG in any other datum settings, because the 2 letter pairs roll in a different sequence.)

Putting the Global Positioning System Receiver and map together is simple. With modern electronic map software it's even easier.

Modern USGS maps are UTM ready, older versions need the blue tick marks in the margins connected with straight lines. Map Software allows the grids to be printed on maps when needed.

Demonstration USNG Coordinate 17S LV 56583 42868

17S- Grid Zone Designator
LV- 100,000m grid designation
57869- Easting coordinates
42603- Northing coordinates

To find a location on the map with the coordinates you must:

First, ensure you are in the proper zone (represented by 17S above).

Secondly, you must locate the 2 letter designator; in UTM this represents the million and hundred thousand meter 2 digit number pairs in bold along the map margins.

Next, starting from the lower left hand corner of your map read from left to right locate the first two digit pair of the easting in your bottom margin (57 above).

Next, find the first two digits of the northing by reading along the vertical edges of the margins (42 above).

Following the above two values across and up you should now arrive at the lower left hand corner of the 57/42, 1 kilometer grid square.

From this point the 1km x 1km square is further broken down into 100 smaller 100m x 100m squares (100m = approximately the length of a football field) which can be done with simple estimation or a grid square reader.

Find the next digit in the easting (Represented by 8 above) reading left to right along the bottom of the 1 Km grid this represents 800m from the lower left corner.

Find the next digit in the northing (Represented by 6 above) reading from bottom to top of the of the grid vertically along the 1km grid this represents 600m up from the lower left corner.

From this point finding the remaining coordinates on a map for the easting and northing are done in the same fashion, breaking the new square down by 10m x 10m then by 1m x 1m to the precise location. It should be noted that 1m x1m accuracy is not achievable with non-military, civilian owned GPS receivers. Additionally the width of pencil lead is hardly fine enough to accurately locate anything smaller than 10m x10m.

When using any coordinate system not just the USNG/ MGRS system's it is strongly suggested to give the entire coordinate reading shown on the GPS, for your position in the field, getting in the habit now makes it real easy to use in the event of a large scale disaster. Truncated coordinates without grid zone designators and 2 letter designators are repeated every 60 miles.

12. Note that the map must be in a grid pattern to use the above system.

13. Identify and discuss orientation.
    a) This is a system used to find a location from map to field or field to map.

14. Discuss the process for using north to orient a map.
    a) First, find north using a magnetic compass and compensate for the magnetic declination.
    b) Rotate the map until its north arrow is aligned with north as found with the compass. With this method it is not necessary to know your position on the map in order to orient it.

15. Discuss the process for using features to orient a map.
    a) To orient a map you must use features seen around you that can also be identified on the map. You must know your position on the map to use this method of terrain association.
    b) Rotate the map aligning the features seen around you with the approximate position of those features that are visible on the map.

16. Demonstrate orienting the compass to the map, and then allow students to practice the techniques.
    a) Place the edge of the compass along the imaginary line from where you are to the location you wish to go, so that the direction of travel arrow will point in that direction.
    b) Rotate the bezel until the reference arrow points toward true north parallel with the vertical grid lines. Read the bearings at a marked point on the bezel.

17. Discuss the process for resection, or triangulation, or cross bearings.
    a) Take bearings of two or more landmarks that are shown on the map and visible on the ground.
    b) The point at which these two lines intersect is your present position on the map.
    c) Using only one landmark will only relate your position somewhere along that bearing.
    d) Try to choose landmarks that will be at ninety degrees from one another. If bearings are very close together or 180 degrees apart, the intersection will not be as precise.

18. Demonstrate the use of a Global Positioning System (GPS). Use a type from the AHJ if possible.

19. Discuss the definition and process for enroute surveillance or collecting features.
    a) This refers to the technique of continually monitoring your progress and anticipating obstacles, problems or difficulties.
    b) This surveillance basically means matching the features on the ground with the symbols on the map as each one is passed.
    c) Examples of collecting features would include determining from the contour lines whether the

route is uphill, downhill, across a hillside, the down slope is to the left or right, or irregular and the anticipation of little knolls, bends in creeks, railroad tracks, junctions of trails, vegetation changes and the boundaries of these changes.

d) If observed ground features do not appear on the map, is it because of their insignificant size or because of changes since the map was made? Make certain that the discrepancy is not the first indication of a faulty course.

e) En-route surveillance clearly requires that there be sufficient visibility and features to guide your travel. This is contrasted with the technique of dead reckoning where a compass course is followed from start to finish in situations involving poor weather or during a night search.

APPLICATION

After completion of this enabling objective, divide the class into groups of two. Pass out compasses to each of these groups. Have the groups use the compasses to find bearings to assigned objects or markers that you have placed in the area.

Depending upon availability of topographical maps for the AHJ, divide the candidates into groups and give each group a map. Working from a central point, have each group follow an assigned set of coordinates to a distinguishable reference point on the map. Upon completion of this portion, you can use these groups and assign them the following scenarios.

Scenario 1 – Divide the class into equal groups. Give each group a map and several compasses. Give each group map coordinates to four locations on the map and have them identify the landmark found for each set of coordinates.

Scenario 2 – Set up four milk jugs with a different colored tape on each one at different locations and distance away from the classroom area. Divide the class into equal teams. Give each team a map of the area and each team member a compass (if possible). Using terrain association techniques have each team locate all four milk jugs and log the coordinates where each milk jug was found. The instructor should verify all coordinates for accuracy.

PRESENTATION

ENABLING OBJECTIVE #2

The Technical Rescuer candidate shall correctly describe in writing the various fitness factors, personal needs, and PPE that are used while conducting a search in the various search environments.

1. Since search and rescue (SAR) work involves strenuous activities, discuss the importance of being in excellent physical condition.
   a) Long operational periods.
   b) Temperature extremes of hypothermia and hyperthermia.
   c) Using and carrying heavy equipment.
   d) Use of respiratory protection.
   e) Climbing and tunneling. Fear of heights or claustrophobia.
   f) Swimming ability.

2. Discuss the following terms and have the students explain their relationship to a land SAR mission.
   a) Agility - ability to change or move around.
   b) Flexibility - ability to flex or stretch the body.
   c) Endurance - the ability to go for long periods of time without rest.
   d) Strength - must have the physical strength to perform actions necessary to remove the patient from peril.

3. Discuss the following prerequisites to allowing a SAR worker to continue in a prolonged SAR operation. It is important to discuss with the students that these same necessities apply to the victims.
   a) Will to live - in order to maintain the presence of mind in adverse conditions, to be able to obtain the other necessities of life.
   b) Air - without it, bodily functions cannot survive for more than 5 minutes.
   c) Water - since the body is made up of 2/3 water, and the body uses approximately 2 quarts daily to carry out normal bodily functions, one should curtail activities in a survival situation in order to reduce the body's need for water.

d) Shelter - a must in order to be protected from the elements.
e) Food - most people can live without food longer than they realize. Food should be last on the priority list for survival.

4. Discuss how a tactical equipment pack used during urban collapse missions could be in the form of a fanny pack with approximately 600 - 1,200 cubic inches of volume. This will allow for appropriate items to be carried.

5. Discuss the necessary items in a tactical equipment pack to be carried such as safety glasses, hearing protection, gloves, dust mask and respirator, harness and emergency escape kit, water and high-energy snacks, and elbow and kneepads.

6. Discuss how a 24-hour ready pack should be used to allow the SAR worker to carry adequate equipment for protection, improvising shelters, building fires and other necessary items needed on a search.
   a) The pack should be made of durable material, easily adjusted and have adequate space.
   b) A pack of approximately 1500 cubic inches works well for land search activities.

7. Discuss with the students the various pieces of equipment that may be appropriate for search missions.
   a) Additional clothing suitable for the search environment.
   b) Lightweight shelter material such as tarpaulins, ponchos, and trash bags.
   c) Water or the capabilities of purifying water such as being able to boil water for five minutes, or commercial type filtration straws or iodine tablets.
   d) Food. The high-energy type, high nutrient content.
   e) Personal safety gear such as a whistle, flashlight, small signal mirror, small pop flares, fishing line hooks, knife, small ball of twine, and survival tarp.
   f) General SAR equipment such as a compass, flagging tape, paper, pencil, personal ID, and tracking stick.
   g) Personal hygiene supplies.

8. Discuss personal first aid kits and what they should contain.

9. Discuss the types of clothing that rescuers should use to protect themselves.

10. Point out that one's clothing should be adequate for the climate, terrain, and environments and should afford protection from the elements.

11. Also point out that for wilderness rescues one's clothing should be in layers that can be added to or removed as needed.

12. Discuss other clothing protection factors such as heavy gauge material, fire resistive material, wild-land fire apparel, and jumpsuit designs.

13. Point out that clothing for land searches should be quick drying, non-abrasive, and easy to care for.

14. Point out the need for having layers of clothing - underwear, clothing layer, insulation layer, outer shell layer, and footwear.

15. Discuss the importance of good footwear for land searchers.
    a) Sized to accommodate various thickness of socks.
    b) Lug sole design.
    c) Provide good ankle support.

16. Discuss the choice of PPE and equipment specifically for aquatic searches. Include the ice environment and discuss specific PPE and equipment needs.
    a) PFDs.
    b) Throw-bags.

Reference: Wilderness Search and Rescue, page 586.

PRESENTATION

ENABLING OBJECTIVE #3

The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in a land search environment.

1. Point out that in order to perform effective search and rescue activities, one must be able to apply the L.A.S.T. theory - Locate, Access, Stabilize and Transport in all the SAR environments.

2. Discuss the priorities of organizing a search.
   a) Verify that the person is missing.
   b) Interview family and friends.
   c) Establish a 'point last seen.'
   d) Identify circumstances surrounding the disappearance. Was there a domestic dispute? Suspicion of foul play? Was the person traveling? If so, by what mode of transportation? What is the person's age and physical status? Did the person wander away from a group or facility? What is the medical history?

3. Discuss the different types of victims that may require the use of land search procedures such as the elderly, children, Alzheimer's patients, hikers, kidnapped persons, and victims of MVAs.

4. Discuss the importance of securing a search scene to preserve vital evidence and information that will assist in the successful completion of the search mission.

5. Stress to the candidates that the information covered in this lesson plan is of basic nature and only touches the surface of search and rescue training.

6. Discuss how searching can be a classic mystery; searchers must look for clues, thus, knowing what clues to look for will enhance the search effort.
   a) Discuss the theory of searching for clues, not subjects during a land search operation. A person walking a distance of one mile could leave over 3,000 clues, including tracks, scent, or other evidence such as cigarette butts, tobacco, candy wrappers, articles of clothing and equipment.

7. Based on initial assessments that may be given, discuss the need to establish the necessary

components of the Incident Management System to begin organizing the search.

8. Point out the importance of the notification process for potential resources.

9. Discuss developing strategies for the search as information becomes available.

10. Discuss why a grid search should only be used as a last resort or as a means for evidence search. This is more costly in both manpower and other resources. It requires a large number of people. The average trained grid search team will take approximately 3.5 hours to cover one square mile of area with a 95% success rate using 528 rescuers spaced 10' apart.

11. Have someone who is trained in interviewing techniques come into the class to demonstrate proper information gathering methods.

12. Discuss the search techniques listed below.
    a) Confinement techniques - use of road blocks (law-enforcement officials), road patrols (on and off-road vehicles), trail blocks (hiking clubs, rescuers), trail patrols (multiple resources), string lines (established by trained searchers).
    b) Attraction techniques - sight (controlled fires, smoke, search lights), sound (siren, horns, guns, megaphones).
    c) Clue finding - interrogation (law-enforcement, trained volunteers), visual tracking (trained personnel), and tracking dogs (trained handlers).
    d) Clue/Subject finding - scratch search (trained personnel), sign cutting (trained personnel).
    e) Subject finding - team search (trained teams), line search (trained teams).

Reference: Wilderness Search and Rescue, page 108.

13. Discuss the tactical considerations for search.
    a) Hasty Teams.
    b) Trackers.
    c) Dogs.
    d) Electronic devices.

14. Emphasize the importance of conducting periodic briefings to keep all searchers and family members up to date on the progress of the mission.

15. Point out that as the search mission expands, adding additional components to the Incident Management System to maintain control of the operation may be necessary.
    a) Discuss examples of an expanding mission. Why would a mission expand?

16. Also note that as the search mission contracts, terminating components to the Incident Management System may be necessary.

17. Discuss how rescuers should concentrate only on aspects which are under the control of the Incident Commander, otherwise there might be wasted time, effort and money.
    a) If a victim has the ability to walk, rescuers must attempt to confine the victim to a manageable search area by using various confinement techniques. Rescuers must continue to verify that the victim is still in the established search area.

18. Discuss with the candidates that since many searches are handled by law-enforcement agencies, and are considered crime scenes until proven otherwise, an established procedure for handling of evidence should be part of the pre-plan search methodology.
    a) Explain to the class that the procedures for handling evidence should be discussed during the briefing portion of the mission.
    b) Point out that all evidence should be marked and left alone unless told otherwise by the IC.
    c) It is a good idea to leave someone with the evidence if the manpower is available.

19. Discuss techniques for conducting an interview.
    a) Include and discuss a Lost Person Questionnaire of some type.
    b) It is a good idea to have two people do the interview at different times. Keep re-interviewing to see if anything has changed.

20. Emphasize that many of the general search techniques can be utilized for most rescue disciplines.
    a) Remember, initially, every search is an emergency.
    b) The subject may need emergency care, or may need protection from the elements.
    c) Time and weather will destroy clues and make the search more difficult. A quick response will greatly reduce the search area.

APPLICATION

Divide the class into two groups. From each group select one student to portray a lost hiker and two students to portray family members. Sequester the hiker and family members for 10-15 minutes so they can develop a lost person scenario. Bring the actors back to the group. Assign each group one half of the lost person questionnaire. Using the questionnaire, have each group interview the family members. Group A will be responsible for the first half of the questionnaire and Group B will fill out the second half of the questionnaire. Each group should develop a lost person profile. Allow approximately 30 minutes for this exercise.

PRESENTATION

ENABLING OBJECTIVE #4

The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in a structural collapse search environment.

1. List and discuss the types of collapsed structure searches.
    a) Physical or initial surface search.
    b) Canine search.
    c) Technical search that requires specialized training & equipment.

2. Discuss components of surface patient removal.
    a) 50% of patients are found and removed from danger during this phase of operations.
    b) First responders and bystanders can assist with the removal of the uninjured, walking wounded and lightly trapped victims.

c) An accountability system is set up to account for all known victims; such as who has gone home, who has been transported to a medical facility, and who is still on the scene, either in triage or in the hot zone.

3. Discuss components of void access and search.
   a) 30% - 40% of the patients are found during this phase.
   b) Natural voids are located and types of collapses are identified such as pancake, v-shaped, lean-to, and cantilever.
   c) All voids should be visually searched or searched by canine teams.
   d) Little shoring is done during this phase.
   e) This search is conducted by technically trained personnel.

4. Discuss selective debris removal.
   a) 15% of the patients are found during this phase.
   b) May involve breaching, tunneling and trenching.
   c) Personnel must be able to discern the difference between load-bearing and non-load-bearing elements of debris piles.
   d) Personnel must be wary of potential secondary collapse and prepared to evacuate if the work area becomes unstable.
   e) A specialized rescue team with specialized equipment is used during this phase.

5. Discuss general debris removal.
   a) Begins after all live victims have been located and removed from the scene.
   b) This phase should be viewed as a recovery operation.
   c) Heavy equipment will be used more extensively.

6. Discuss and display specialty equipment that can assist rescuers with the technical search. Point out that this equipment requires specially trained personnel.
   a) Motion detectors.
   b) Listening devices.
   c) Search cameras.
   d) Thermal imagers.
   e) Search dogs.

f) Hailing devices.

7. Discuss the search marking system for structures.
   a) 2’ x 2’ box located near entry point - indicates minor damage.
   b) 2’ x 2’ box with diagonal slash - indicates significant damage (some areas safe, others need bracing).
   c) 2’ x 2’ box with “X” - indicates structure unsafe for continued search and rescue operations.
   d) Arrow indicates safest entry.
   e) Put other information beside the box.

8. Discuss the search assessment marking system.
   a) A 2’ long diagonal slash mark is made on the side of the building prior to entry.
   b) Upon completion of the search assessment and exit from the structure, a 2’ long diagonal slash is made forming an “X”.
   c) In the top portion of the “X” put the date and time of exit.
   d) In the right hand portion of the “X”, note any hazards.
   e) The bottom portion of the “X” contains victim information.
   f) The left hand portion of the “X” contains the search team designation.

9. Discuss the search marking system for victim.
   a) “V” – indicates potential victim location.
   b) “V” enclosed by a circle – indicates confirmed victim location.
   c) Circle with a “V” inside and a horizontal line across the “V” – indicates confirmed fatality.
   d) Circle with a “V” inside and an “X” over the “V” – indicates all victims have been removed to specific location.
   e) These markings may be located throughout the search area.
   f) A total accounting of the victims needs to be placed on the outside wall along with the other markings.

Reference: IFSTA Fire Service Search and Rescue, 7th Edition, pages 223 through 230; US Army Corp of

Engineers, Urban Search and Rescue Field Operations Guidebook, 5th Edition, Oct 2001.

APPLICATION

Demonstrate the building search marking system and the victim location marking system. Divide the class into small groups. Give each group a series of problems regarding a building search and locating a victim and have them select the appropriate marking system for each problem. An old structure would make a great prop for this exercise.

If the instructor is familiar with some of the specialized equipment listed in this enabling objective such as a search camera, or search dog, and has access to them, conducting a show and tell session could be very informative.

PRESENTATION

ENABLING OBJECTIVE #5

The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in an aquatic search environment.

1. List and discuss the four components that a rescuer must apply to complete a successful aquatic rescue/ recovery operation.
   a) Knowledge of the techniques available.
   b) Skills necessary to perform the techniques.
   c) Physical fitness needed to apply the skill.
   d) Judgment in determining which techniques to apply and when.

2. Discuss the importance of interviewing potential witnesses for information regarding aquatic search incidents.
   a) What is the location where the victim went into the water?
   b) Was the victim in the water?
   c) Why was the victim in the water?
   d) What is the description of the victim and clothing worn?
   e) When last meal was eaten?
   f) What time the victim went under?

3. Discuss the importance of properly assessing the scene for information.
    a) What hazards are present in the aquatic environment?
    b) What is the current weather forecast?
    c) How will this assessment affect the IAP?
    d) How will this assessment affect the resources and equipment that will be needed?

4. Establish the point last seen (PLS).
    a) Is there physical evidence – outer clothing, fishing gear, other personal effects located on shore, empty boat, an unattended personal water craft?
    b) Is there a witness statement – obtain witness's name and a contact number. Interview witnesses separately.
    a) Have witness physically identify victim's last known location and document the time the victim was last seen, document all witness statements.
    b) A compass or GPS can be a valuable tool.
    c) Determine the search area and search effectively.
    d) Identify and mitigate hazards.
    e) Utilize up to date maps.

5. Identify physiological factors than can assist with recovery of a submerged victim.
    a) Statistically most victims of drowning will sink to the bottom.
    b) A victim of a dry drowning has air in the lungs and may be moved some distance by the current of flowing water.
    c) A victim of a wet drowning has water in the lungs, and especially in still water, will usually be found directly below the point last seen or within a radius equal to the depth of the water. Example: a water depth of 20' = 40' radius.
    d) Victims not found during the search eventually will re-float if not trapped by debris.
    e) Re-float is caused by gas produced by bacterial action in the intestinal tract that makes the body buoyant. Water temperature content of the digestive system will determine the timing of the re-float. Re-float can occur in a few hours or several days.

6. Discuss general procedures for conducting an aquatic search.
    a) The search area should be marked off.
    b) The area should be thoroughly searched.
    c) The search may be done by trained divers or with grappling hooks or drags.
    d) In shallow water, probing with pike poles can be effective.

Reference: IFSTA Fire Service Search and Rescue, 7th Edition, pages 332 through 338 and 345 through 347.

7. For an aquatic search, discuss the procedures for conducting a watercraft-based search in inaccessible areas such as those containing drop-offs, ledges, and heavy debris.
    a) Use several cross-search patterns for drop-offs.

8. For an aquatic search, discuss the use of Sonar Graphs and divers to enhance the search effort.
    a) Slow movements through a search area allow sonar graphing to be more effective.

9. For an aquatic search, explain that watercraft operators should move slowly over established search areas when using grappling hooks and drags so that these devices will stay in position during the search.

10. For an aquatic search, discuss the correct procedures for conducting a circular search pattern.
    a) Tie a line to an anchored watercraft or to a spot on the shoreline.
    b) The anchored watercraft allows for a full circle search pattern to be used while the shoreline anchor allows for a semi-circle type search pattern.
    c) A predetermined length of line is deployed for each consecutive search sweep.
    d) Overlap on the search sweeps.
    e) Marking the line prior to each sweep is an easy way to keep track of the search area. This can be accomplished with plastic marking tape or by tying a knot in the line

11. For an aquatic search, discuss the correct procedures for conducting a parallel track line search pattern. This

type of search pattern should only be used when the victim's point last seen (PLS) is approximate.

12. For an aquatic search, discuss the correct procedures for conducting an expanding search pattern.
    a) Used when the victim's PLS has been well established.
    b) The first leg of the search is done in the direction of the wind drift and/or current flow.
    c) All course changes are made at 90-degree angles and all in the same direction (right or left).

Reference: IFSTA Fire Service Search and Rescue, 7th Edition, pages 345 through 346; Water Rescue, Chapter 9.

13. For an aquatic search, discuss the correct procedures for conducting a shoreline search.
    a) Check strainers, eddies and deep pools with pike poles or long grab hooks.
    b) Maintain a safety boat downstream during all search operations.

14. For an aquatic search, discuss the correct procedures for conducting a watercraft-based search on a river.
    a) Establish the victim's point last seen, if possible.
    b) Determine the area of the river to be searched at one time. Obstacles in the river or changes in the current flow may dictate area covered.
    c) Establish two static lines. One static line is placed at the start of the search area. The second static line is placed downstream of the starting point. The second static line also serves as a safety line for watercraft that may get into trouble.
    d) A safety watercraft should be positioned a short distance downstream from the second static line to serve as a safety back up.
    e) Place the watercraft abreast at the starting point and sweep the search area.
    f) The number of sweeps in an area will be dependent on how many watercrafts are available in relationship to the width of the river.

15. Point out that when rivers have shorelines a great distance apart, techniques such as the circle search,

parallel track-line search, and using expanding search patterns may be more appropriate to use.

Reference: Water Rescue, Chapter 10; IFSTA 5th Edition Fire Service Rescue Manual; IFSTA Fire Service Search and Rescue, 7th Edition, Chapter 9.

PRESENTATION

ENABLING OBJECTIVE #6

The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in a confined space/silo search environment.

1. Discuss search procedures and the equipment necessary to implement these procedures for confined space operations.
   a) Techniques used for searching a burning building can be used for a confined space search.
   b) Utilize harnesses, lifelines and appropriate breathing apparatus for the different types of hazardous atmospheres.
   c) Obtain maps of the search area if available.
   d) Conduct continuous air monitoring.
   e) Provide ventilation when necessary.
   f) Implement lock-out/tag-out procedures when indicated.
   g) Search in a systematic and logical sequence.
   h) When possible, search in pairs.
   i) When searching pockets or isolated areas in the space, keep one person in a fixed location while a second rescuer conducts a sweep of the area.
   j) Maintain constant communication with each other and Incident Command or Operations.
   k) Stop frequently and call out to victim and listen for a reply.

2. Discuss search procedures for silo/grain bin operations.
   a) Point out that victims may be partially or completely buried.
   b) Treat silos and grain bins as a confined space.
   c) Search procedures and safety precautions are basically the same as searching a confined space.

3. Discuss types of entrapments and other hazards that may require a search for a victim in a silo or grain bin.
   a) What are the dangers of flowing grain columns?
   b) Collapse of horizontal crust.
   c) Collapse of crusted over grain.
   d) Point out that silo gases are at the highest concentrations for first 72 hours after the product is loaded into the silo, and can produce an IDLH atmosphere.

4. Discuss search procedures and equipment necessary for gaining access into a vessel such as a grain bin or silo to search for a victim.
   a) Protect rescuers from contaminated or oxygen deficient atmospheres.
   b) Dust and mold spores may be present to contribute to a hazardous atmosphere.
   c) Establish points of reference on the vessel.
   d) Access to silos is usually made through the top, but access doors on the sides may be used as product is released.
   e) Access to grain bins may be made through the top, or access holes may be cut into the bin to evacuate product and make locating the patient faster and easier.
   f) Take necessary precautions to prevent the occurrence of a fire.
   g) Implement air monitoring, lock-out/tag-out procedures and ventilation when appropriate.
   h) Provide a stable platform inside the vessel for rescuers to work from. Materials such as plywood, or using a long spine board work well.

Reference: IFSTA Fire Service Search and Rescue, 7th Edition, pages 165 through 173, 422 through 429; IFSTA 5th Edition Essentials of Firefighting, pages 306 through 327.

PRESENTATION

ENABLING OBJECTIVE #7

The Technical Rescuer candidate shall correctly identify in writing various search methods used by search and rescue teams in a collapsed trench search environment.

1. Discuss search procedures and equipment at a collapsed trench operation.
    a) Locate and interview foreman, competent person and co-workers.
    b) Determine how long patient has been totally buried.
    c) Determine point last seen (PLS).
    d) Search for clues such as a laser target, location of the last pipe in the trench, a hard hat, a ball cap, shovel, or lunch pail.
    e) Search nearest manhole entrance, patient may be partially trapped in the pipe.
    f) If the patient is not buried deep, pike poles or long sticks can be useful as probing devices.
    g) Consider implementing a canine search.

2. Treat the trench as a confined space; neutralize all hazards.

3. Discuss considerations for access.
    a) Monitor the atmosphere.
    b) Thermal imagers, heat detecting devices and listening devices may be helpful.
    c) Provide appropriate PPE.
    d) Provide ventilation when necessary.
    e) Heat detecting devices may be effective during the early phase of the search. The body will lose heat rapidly.

Reference: IFSTA Fire Service Search and Rescue, 7th Edition, pages 263 and 264.

SUMMARY

Stress to the candidates that the information contained in this lesson plan is of a basic nature and only touches the surface of search training for the various rescue environments. Review with the candidates the various search environments and discuss the proper fitness, PPE, equipment, and methodology required for the operation to be safe and successful. The information provided should be used as a planning tool for search operations. Additional instruction based on Chapters six through eighteen of NFPA 1006 will provide additional training for the Technical Rescuer to become proficient in the specific search and rescue environments.