

Portland NET* Basic Training

*Neighborhood Emergency Team



Unit 7: Light Search & Rescue Operations

Incorporating FEMA CERT 2019 course material, with expanded content due to our regional challenges.

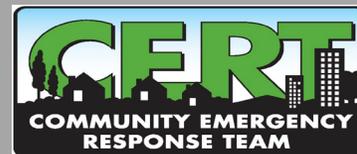


FEMA

Unit 7: Light Search & Rescue Operations



Part 1: Size-up & Search Methodology



FEMA

The “unexpected” happens...



- What do we know?
- What do we do?
- Is it over?



Unit 7 Objectives



- Identify and apply **size-up requirements** for potential search and rescue situations
- Demonstrate **common techniques** for light search and rescue
- Demonstrate **safe techniques** for survivor extraction

PM 7-1



Unit 7 Topics



- Search and Rescue Size-up
- Conducting Interior and Exterior Search Operations
- Conducting Rescue Operations

PM 7-1



Search and Rescue...



Consists of three separate operations:

- Size-up: Using 9-step, continual model
- Search: Locating survivors and documenting
- Rescue: Extricating survivors



PM 7-1



Deciding to Attempt Rescue



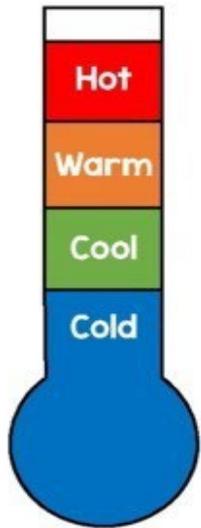
Decision is based on three factors:

- Risks involved for the rescuer and survivor
- Greatest good for the greatest number
- Resources and manpower available



PM 7-1

What's my Zone?



- **HOT:** Unsafe for operations—Evacuation only.
- **WARM:** Safe enough for essential operations
- **COOL:** Safe for medical treatment and command
- **COLD:** No operations needed or pending

Goals of Search and Rescue



- Rescue greatest number in shortest amount of time
- Get walking wounded out first
- Rescue lightly trapped survivors next
- Keep the rescuers and survivors safe

PM 7-1

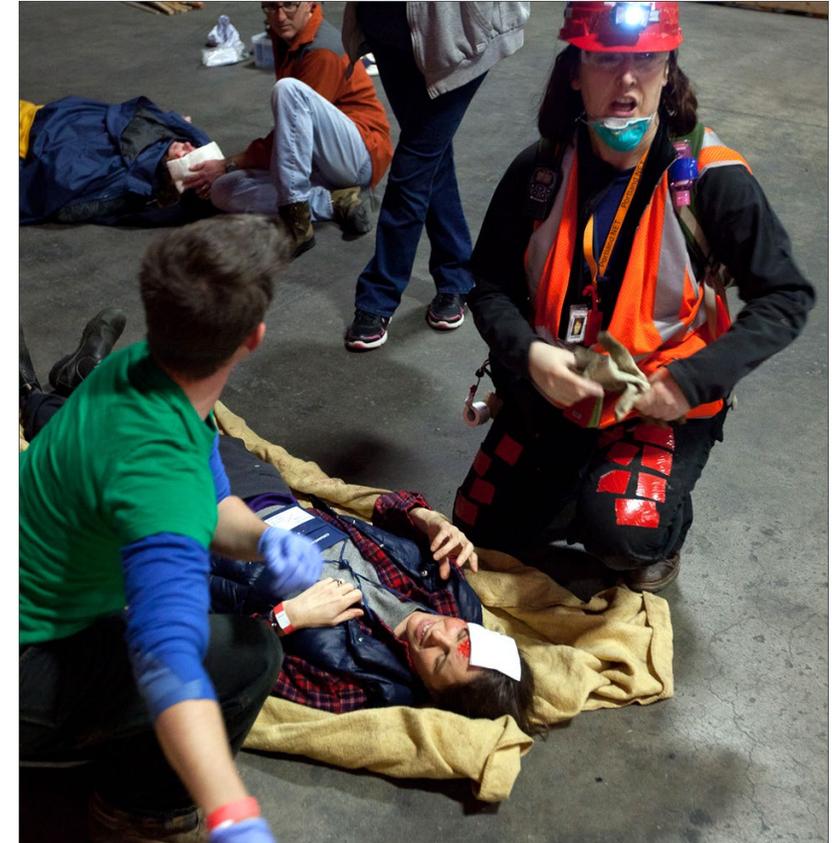


Effective Search and Rescue



Depends on:

- Effective size-up
- Rescuer safety
- Survivor safety



PM 7-1



Size-up



1. Gather Facts
2. Assess Damage
3. Consider Probabilities
4. Assess Your Situation
5. Establish Priorities
6. Make Decisions
7. Develop Plan of Action
8. Take Action
9. Evaluate Progress



REMEMBER:
CERT SIZE-UP IS
A CONTINUAL
PROCESS

PM 7-3



Size-up (condensed edition)



1. Gather Facts
2. Assess Damage
3. Consider Probabilities
4. Assess Your Situation
5. Establish Priorities
6. Make Decisions
7. Develop Plan of Action
8. Take Action
9. Evaluate Progress

THINK

PLAN

ACT



Size-up Step 1



Gather Facts:

- Time of event and day of the week
- Construction type/terrain
- Occupancy
- Weather
- Hazards
- Search subject profile



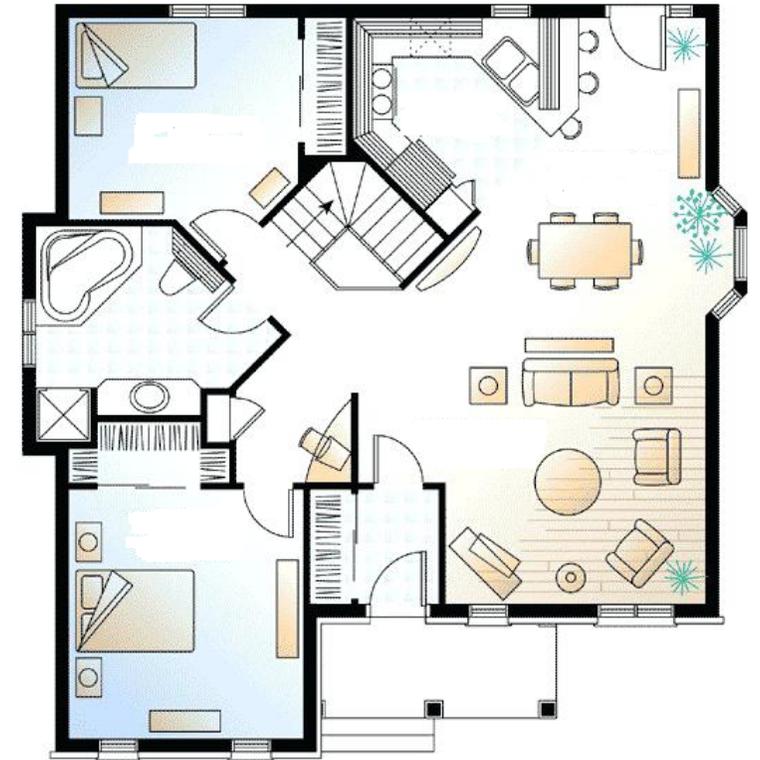
PM 7-5

Size-up: Conducting a “360”



Essentials of a 360:

- Minimum of 2 members
- Identify & communicate side labels
- Maintain contact with your Team Leader
- Avoid or deal with immediate dangers
- Report pertinent information



Street

Size-up Step 2



Assess and Communicate Damage

The CERT mission **execution** changes if:

- Damage is light
- Damage is moderate
- Damage is heavy

Light Damage



- Superficial
- Broken windows
- Superficial cracks or breaks in wall surface
- Minor damage to the interior contents
- **Safe to enter and remain**



PM 7-6

Moderate Damage



- Visible signs of damage
- Decorative work damaged or fallen
- Many visible cracks or breaks in wall
- Major damage to interior contents
- Building still on foundation
- **Enter only to save lives**



PM 7-6

Heavy Damage



- Partial or total collapse
- Tilting structure
- Obvious structural instability
- Building off foundation
- Smoke, fire, or other hazards
- Further movement is likely
- Rising water



Do not enter a building with heavy damage under any circumstances!

PM 7-7

Light, Moderate or Heavy?



Light, Moderate or Heavy?



Light, Moderate or Heavy?



Light, Moderate or Heavy?



Size-up Step 3



Consider Probabilities:

- How stable is the situation?
- What secondary factors should be considered?
- What else could go wrong?
- What does it mean for the search and rescue?

$$\begin{aligned}
 & |b(\tau, z, a, b)| \leq 2 \\
 & \varphi(\sigma_1 t) \varphi(\sigma_2 t) = \varphi(\sqrt{\sigma_1^2 + \sigma_2^2} t) \\
 & \ell(\omega) = \frac{\sum_{k=1}^n p_k^* \log_2 \frac{1}{p_k}}{\sum_{k=1}^n p_k^*} \quad \text{where } \sigma_k^2 = \lambda; \text{ } c_{ik} \\
 & y = \phi(x) = \frac{1}{\sqrt{2\pi}} \int_0^x e^{-\frac{t^2}{2}} dt \quad S(\alpha, \tau) = \frac{2}{\pi} \int_0^{\pi} \frac{\sin \alpha t}{t} dt \quad P(\eta < y | \xi = x) \\
 & W_k = \binom{n}{k} p^k (1-p)^{n-k} \quad P(\eta < y | \xi = x) = \sup_{\gamma, \delta, \theta} P(\eta < y | \xi = x) \\
 & S_n = A_n U_n A_n \quad |A_n| = \frac{n!}{2} \left| \int_{|x|>A} f(x) \log_2 \frac{1}{f(x)} dx \right| < \epsilon \quad g^{-1} \cdot g = e \\
 & \int_{-A}^{+A} dG_k(x) \geq \frac{1}{2} \quad \sum_{k=1}^n e^{-\frac{k^2 \pi^2}{4t}} = H(k) \quad \prod_{k \leq b} \bigcup_{i=1}^{n-1} M_i; \bigcap_{n=0}^{\infty} X_n \\
 & \int_{-A}^{+A} f_n(u) f_1(t-u) du = \frac{2^{n+1} \pi^n e^{-2t}}{n!} \quad \lim_{t \rightarrow 0} (e^t) = 0 \quad \lim_{n \rightarrow \infty} \frac{f_n^{(k)}(x)}{n!} = P_k \\
 & \log \varphi(t) = i \gamma t - c |t|^\alpha [1 + \beta \frac{t}{|t|} \omega(t, u)] \quad \beta(w) = \sum_{k=1}^n \psi^*(b_k w) \quad C_{iv} = \sum_{j=1}^n a_{ij} b_{jv} \\
 & \int_{-\infty}^{\infty} e^{-\frac{u^2}{2}} du = \sqrt{2\pi} \quad |\Psi_S(t)| = \left| \int_{-\infty}^{\infty} e^{itx} dF(x) \right| \leq \int_{-\infty}^{\infty} e^{-|x|} dF(x) = \varphi_S(iv) \\
 & \Gamma_m = \Gamma_l \Gamma_{m-r} \quad g^{-1} N_g = \{g^{-1} n_g | n \in N\} \quad Q = F^{-1}(q) \quad g_n(u) = \frac{p_n^*}{\sum_{j=1}^n p_j^*} \quad PCT = \\
 & |X \cup \Psi| = |X| + |\Psi| - |X \cap \Psi| \quad \lim_{n \rightarrow \infty} \frac{1}{n} \ln \binom{cn}{n} = \frac{1}{2\pi} e^{-\frac{x^2}{2}} \quad P_n(b) = \frac{c^n}{n!} \quad P(\limsup \frac{|h_n|}{2n \log \log n} \leq 1) = 1 \quad (R_n) = 1 - \sqrt{1 - c^{2n}} \\
 & Q(x) = \int_1^x \lambda(w) dP \quad \ell'(x) = -\log_2 \left(\frac{\sum_{k=1}^x p_k^* \log_2 \frac{1}{p_k}}{\sum_{k=1}^x p_k^*} - \left(\frac{\sum_{k=1}^x p_k^* \log_2 \frac{1}{p_k}}{\sum_{k=1}^x p_k^*} \right)^2 \right) \quad f(g(u_i)) = f\left(\sum_{j=1}^{dim u_i} a_{ij} v_j\right) = \sum_{j=1}^{dim u_i} a_{ij} \left(\sum_{k=1}^{dim v_j} b_{kj} w_k\right) \left(\frac{2k}{2k}\right) \approx \frac{1}{\sqrt{2\pi}} \\
 & q\left(c^{-x} \sqrt{\frac{1-q}{nq}} - 1\right) = x \sqrt{\frac{q(1-q)}{n}} + o\left(\frac{1}{n}\right) \quad \prod_{k=1}^r \left[\int_{\frac{t}{\sqrt{2k}}}^{\frac{t}{\sqrt{2k}}} \right]^{N_{0, \alpha_k}} = e^{-\frac{t^2}{2}} \quad P_{ij}^{(m)} = \sum_{c=0}^m P_{ij}^{(r)} P_{ik}^{(m-r)} \quad \frac{1}{2\pi} \int_{-\infty}^{\infty} \text{Re} \left\{ \varphi(t) \frac{e^{ita} - e^{-itb}}{it} \right\} dt \\
 & \liminf_{N \rightarrow \infty} \int_{-N}^N f(x)^n dx \geq \int_{-N}^N f(x)^x dx \quad M(\log_2 -1)^2 = \int_{-\infty}^{\infty} (1-x)^2 e^{-x} dx \quad \lim_{N \rightarrow \infty} \int_{-N}^N f(x) \log_2 \frac{1}{f(x)} dx = \int_{-A}^A f(x) \log_2 \frac{1}{f(x)} dx \\
 & D^2(J_n) \leq \frac{k}{n} + 2k \left(\frac{1}{k} \sum_{k=1}^n R(k) \right) \quad \det(M') = \det(M) + \det(M^*) = \det(M) \quad h(x, y) = \frac{1}{2\pi} \int_{-\infty}^{\infty} (e^{-\frac{t^2}{2}} - e^{-xy}) \frac{1}{t} dt \quad |M(\epsilon_n, \delta_n)| \leq C_2 \sqrt{\frac{n}{m-n}}
 \end{aligned}$$

Size-up Step 4



Assess Your Situation:

- Is the situation safe enough to continue?
- What risks will rescuers face?
- What resources are needed?
- What resources are available?



PM 7-10

Rescue Resources



Personnel:

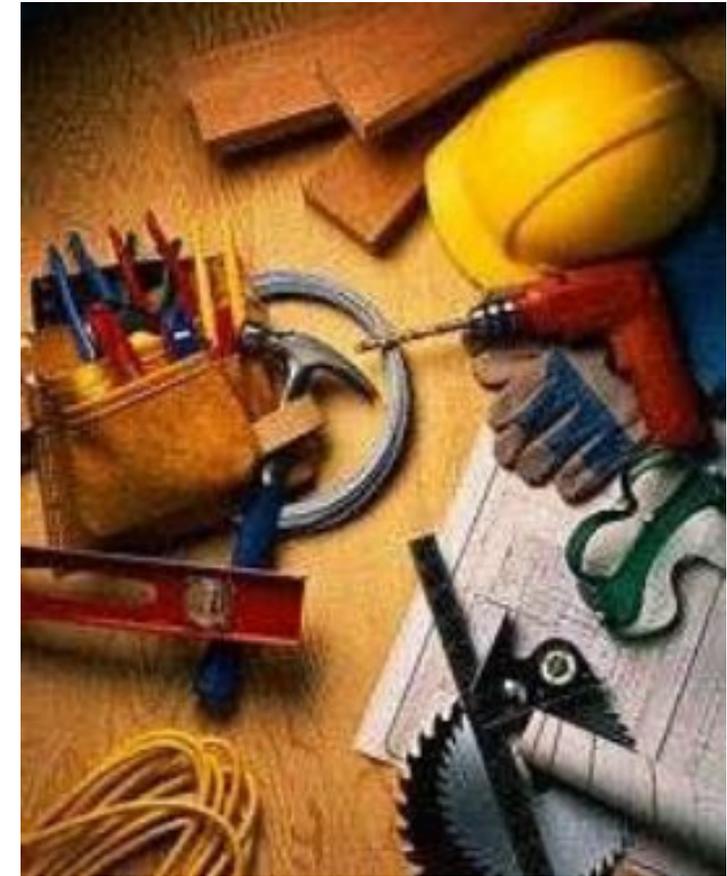
- Firefighters
- Police officers
- Doctors,
Nurses
- Contractors

Tools:

- Crowbars
- Auto jacks
- ~~Chainsaws~~

Equipment:

- Additional PPE
- Mechanization



PM 7-11

Size-up Step 5



Establish Priorities:

- What should be done?
- In what order?
- How do you rescue the greatest number in the shortest amount of time?



PM 7-11

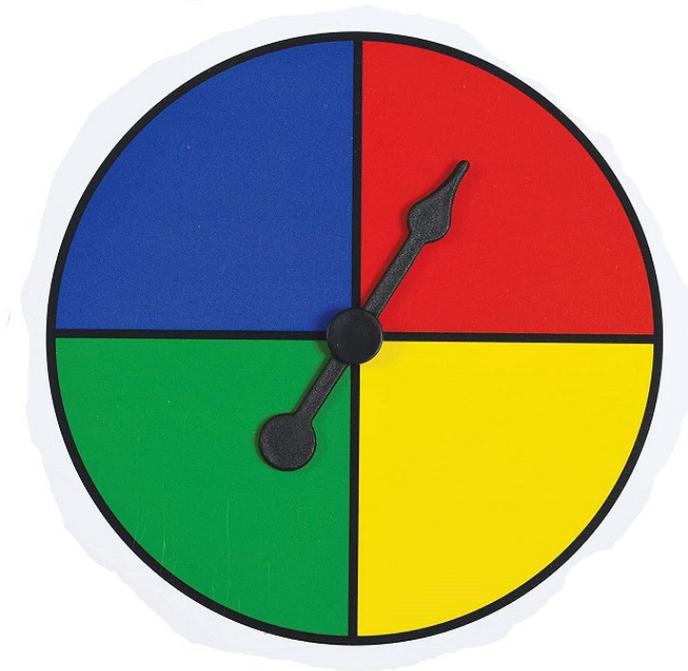
Size-up Step 6



Make Decisions:

Keep in mind:

- Safety of team members
- Life safety for survivors and others
- Protection of the environment
- Protection of property



PM 7-11

Size-up Step 7



PLAN AHEAD

Develop Plan of Action:

- Focus operation on established priorities and decisions
- Provide documentation to give to responding agencies
- Provide documentation to become part of team records

PM 7-12

Size-up Step 8



Take Action:

- Base action on the plan you developed



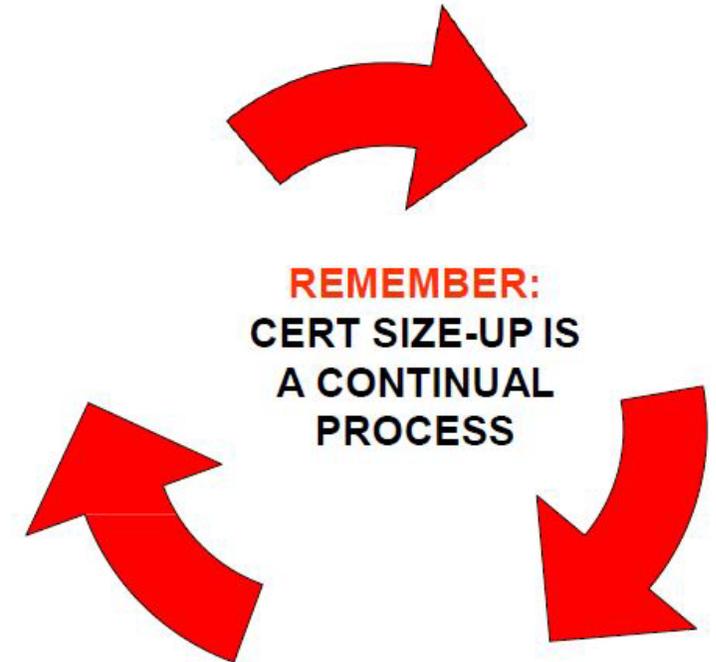
PM 7-12

Size-up Step 9



Evaluate Progress:

- Most critical step
- Monitor plan's effectiveness and safety
- Make necessary changes to plan or operations



PM 7-12

Size-up Exercise



- We will breakout into groups of 6-8.
- Each group will be given a disaster scenario to size up and will choose a scribe to take notes and report out.
- Size up your disaster using the 9-step size up process. You will have 10 minutes plus 2-minutes to wrap up.

1. Gather Facts
2. Assess Damage
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Size-up Exercise #1



Event: Magnitude 5.6 Earthquake

Day/Date/Time: Saturday, May 13th, 11:30 hours

Weather: Cloudy with occasional rain, 44 degrees F.

Construction: 1995, 1 story, wood frame with brick façade

Additional Info:

360 reveals hissing sound coming from corner (DE), and wheel chair ramp at front entrance covered with bricks.

Size-up Exercise #3



Event: weeks of rainy weather and a major wind storm today

Day/Date/Time: a Tuesday in March, 18:00 hours (6:00 PM)

Weather: gusty winds, upper 40's temperature, more rain expected overnight

Construction: unknown

Additional Info:

The neighborhood is built on a steep incline, and you have encountered a few downed trees as you made your way to this location.

Size-up Exercise #4



Event: an ice storm

Day/Date/Time: a Friday in January, 0330 hours (3:30 AM)

Weather: below freezing temperatures, light winds and light snow falling

Construction: 1990's wood frame

Additional Info:

You have cell phone service and have learned that the care center for senior citizens has lost power (and heat) and that a tree has fallen onto one corner of the facility.

Size-up Exercise #5



Event: Magnitude 5.6 Earthquake

Day/Date/Time: Tuesday, March 5th, 09:30 hours PDT

Weather: Overcast, 45 degrees

Construction: 1926, 3 story, wood frame with brick façade

Additional Info: High school and grade school with 600 students aged 5 through 18



Size-up Exercise #2



Event: Magnitude 5.6 Earthquake

Day/Date/Time: a Sunday in August, 15:30 hours (3:30 PM)

Weather: hot and dry

Construction: 1980's shopping mall, renovated early 2000's

Additional Info:

It's a busy shopping day and the local mega-mall is crowded. There is an outdoor carnival – complete with Ferris wheel, other rides, and petting zoo in the east parking lot.

Search Markings



Upon entering search area:

- Make a slash from top left to lower right
- Enter team ID, number of team members to the left of the line, then date & time above line

Upon leaving search area:

- Complete 'X' only after all of the team have exited
- Enter areas searched & survivor info



PM 7-15

Search Markings



Completed
Search
Sample

2/15/08
In: 1430
Out: 1515

CERT-23

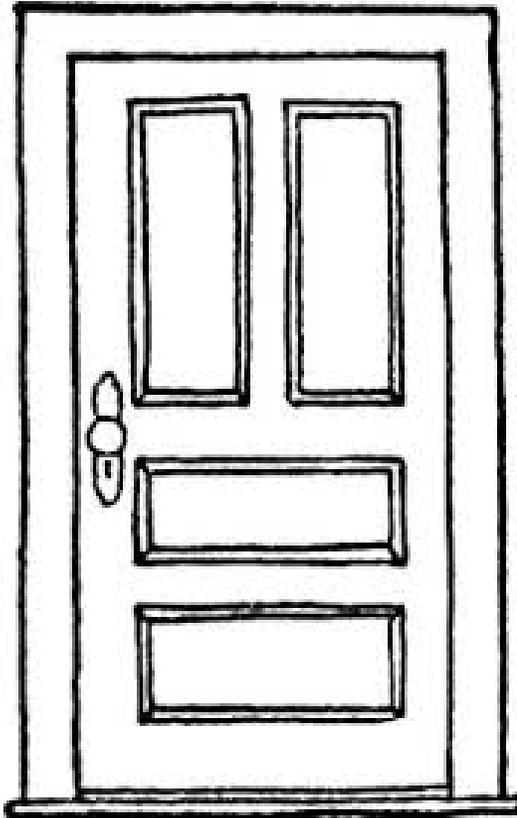
FL 1-2 searched
Stairs to FL-3 unsafe

2L
Moved to
CERT-23 med
ops

PM 7-15



Search Markings Exercise



Step 1: Mark the following Search Entrance Info in an appropriate location:

Five members of the Sunnyside NET Team Rover 1 entered on May 6th, at 14:00 (2:00 PM)

Step 2: Mark the following Search Exit Info in a different color*:

Five members of the Sunnyside NET Team Rover 1 exited on May 6th, 2017, at 14:45 with the following results: 2 survivors moved to Med Area 1, survivor reported missing 6-year-old male, 1 deceased, floors 1 & 2 searched, basement inaccessible due to water.

*The different color is used for instructional purposes only to differentiate between entry & exit notes.

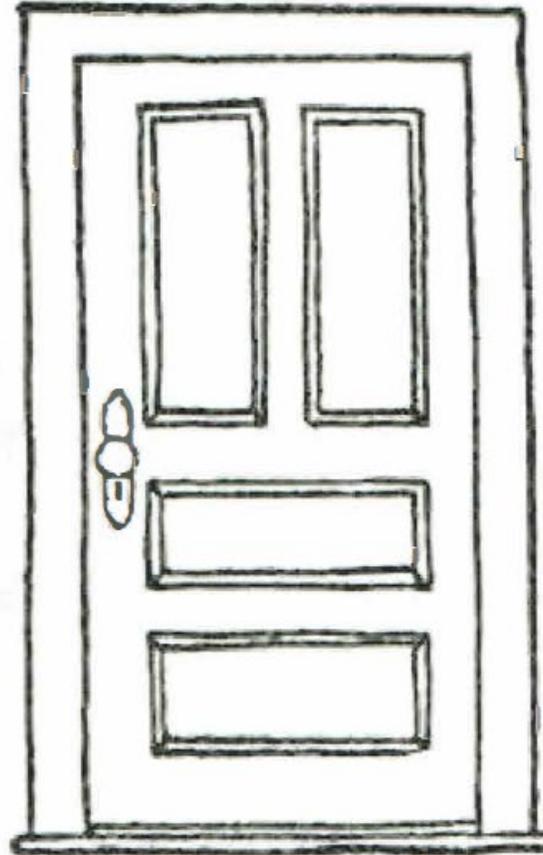
Markings Exercise Solution



Enter:

5/6/17
IN: 14:00

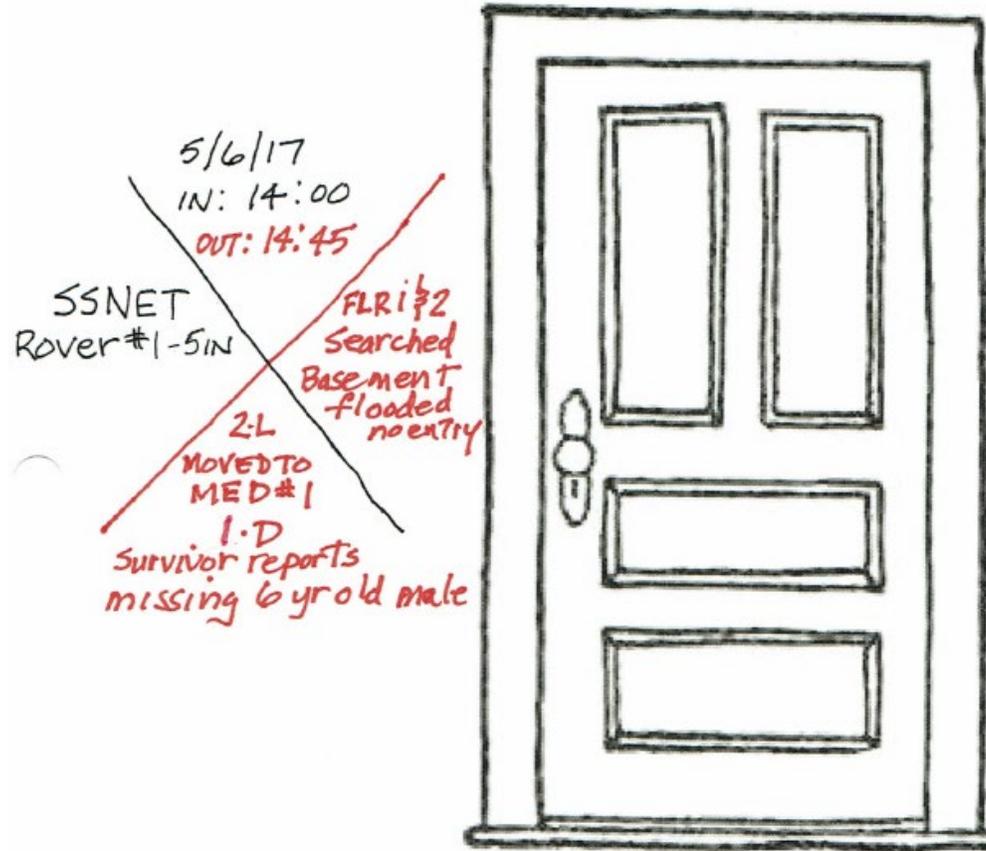
SSNET
Rover #1-5IN



Markings Exercise Solution



Exit:



Search Methodology



- How many sides does a room have?
- Which is the most dangerous?



Search Methodology



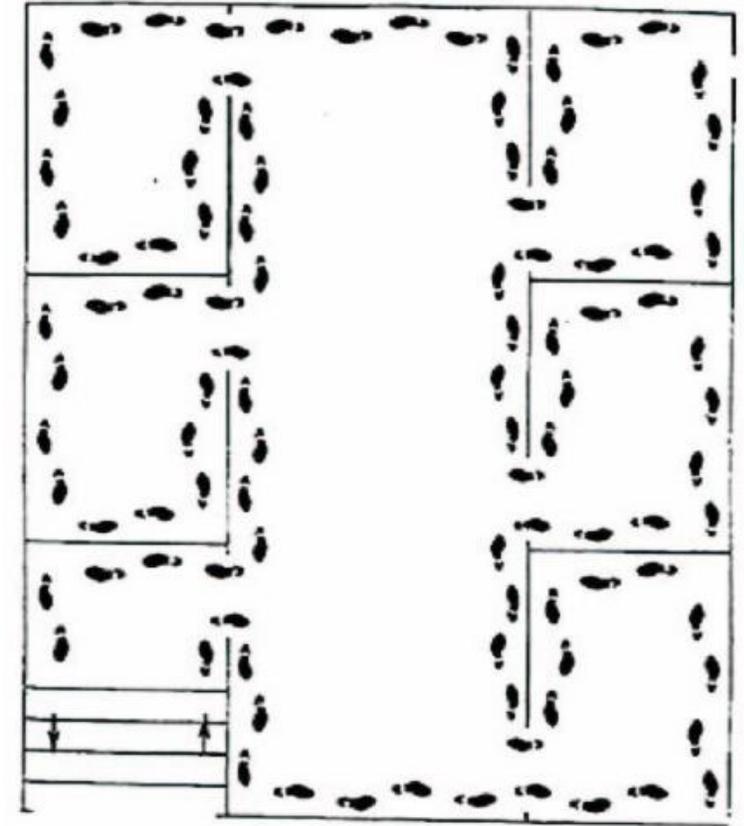
- Call out LOUDLY, “If you can hear my voice, come here”
- Ask any survivors for information about the building and other people
- Survivors might be disoriented or confused
- Search in pairs, maintaining communication with your lead
- Remain within arm’s reach of your buddy
- Scan all 6 directions, and don’t forget closets or nooks.
- Keep records and report to command



Search Methodology



- Bottom-up vs top-down for a multi-story building
- Right hand vs left hand for a single floor
- **Use the back of your hand**
- Stop frequently to listen
- Stay with your search mate

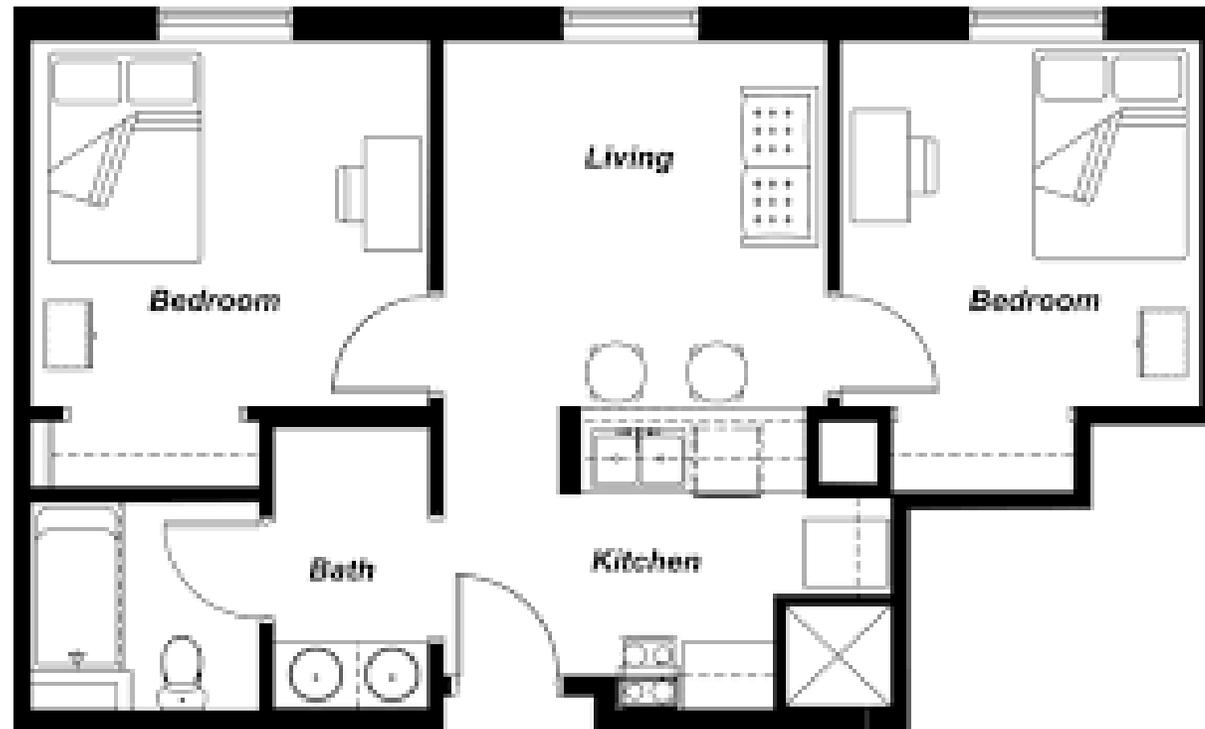


PM 7-15

Search Methodology



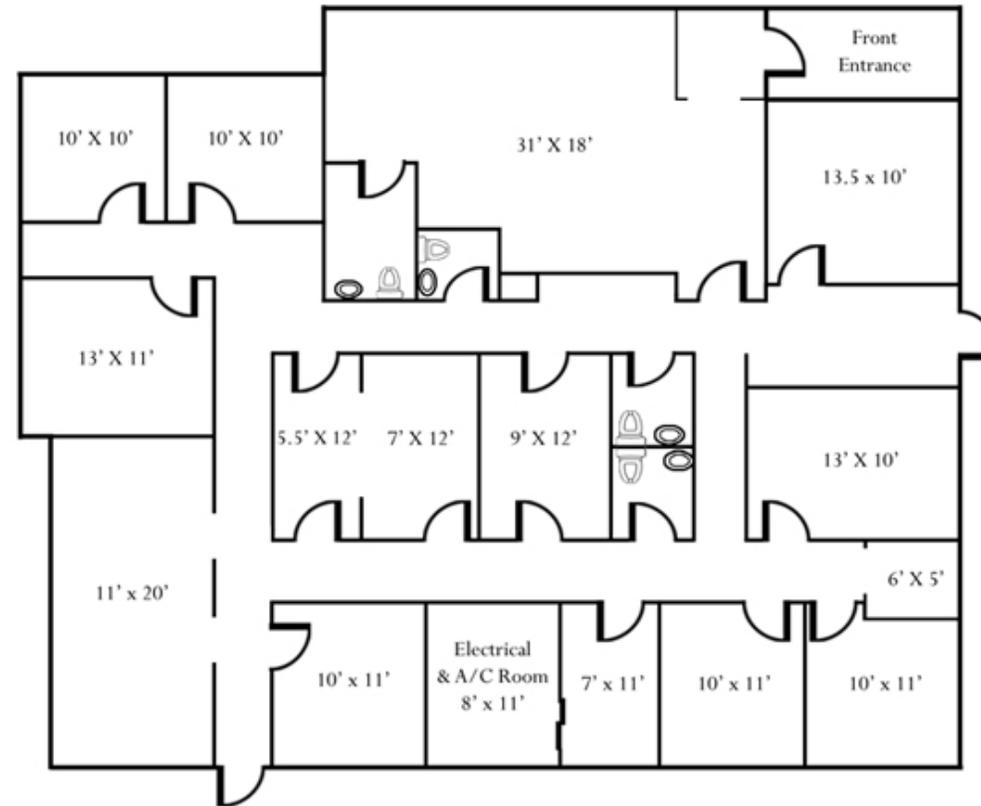
Real World Conditions



Search Methodology



Real World Conditions



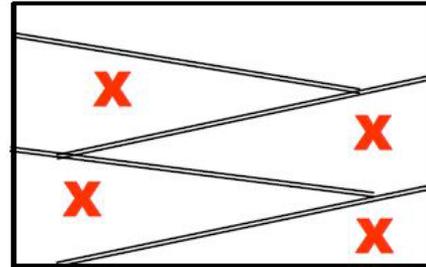
Search Methodology



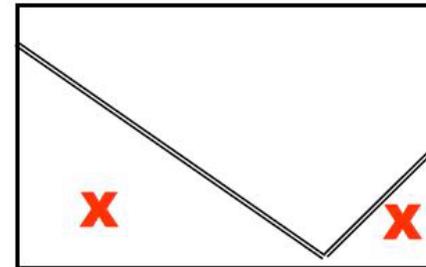
Real World Conditions



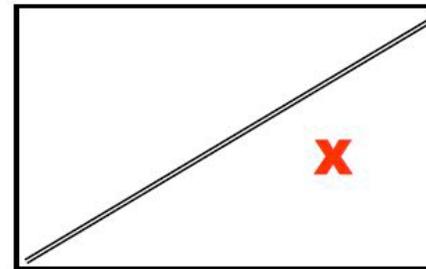
Structural Voids



Pancake Void



'V' Void



Lean-to Void

X = Voids

If you see collapsed floors or walls, **GET OUT!**

PM 7-14

Individual Voids



Survivors may seek protection in various places

- Inside bathtubs
- Underneath desks
- Inside cabinets
- Under/next to beds
- Inside closets

PM 7-14

Search Methodology



Stop frequently to listen for:

- Tapping
- Movement
- Voices
- Building structure noises
- Gas hissing or electrical arcing

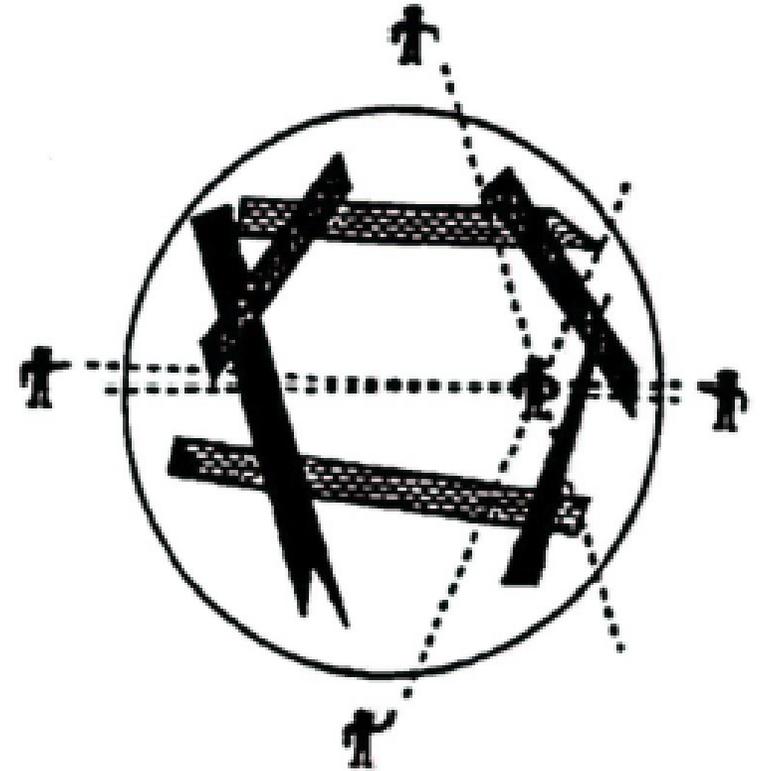


PM 7-15

Search Methodology



Triangulation allows rescuers to view a location from several perspectives

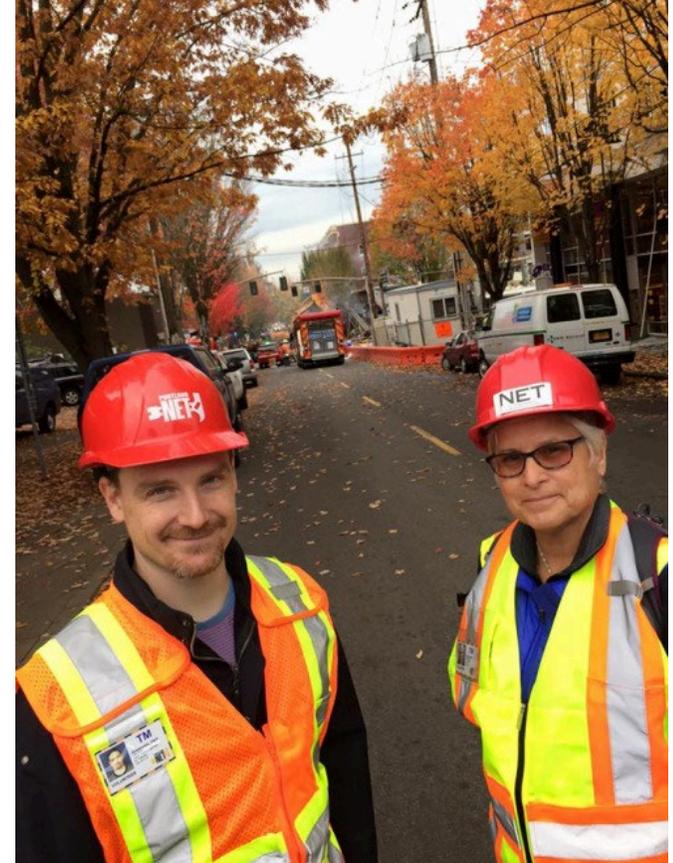


PM 7-15

Specific Safety Considerations



- Emphasize rescuer safety
- Use the buddy system
- Check your equipment
- Be alert for hazards
- Have an exit strategy
- Use your emergency whistle if needed
- Remember survivor etiquette
- Rotate teams



Search Methodology



The 2 greatest causes of rescuer deaths are:

- Secondary collapse
- Rescuer disorientation

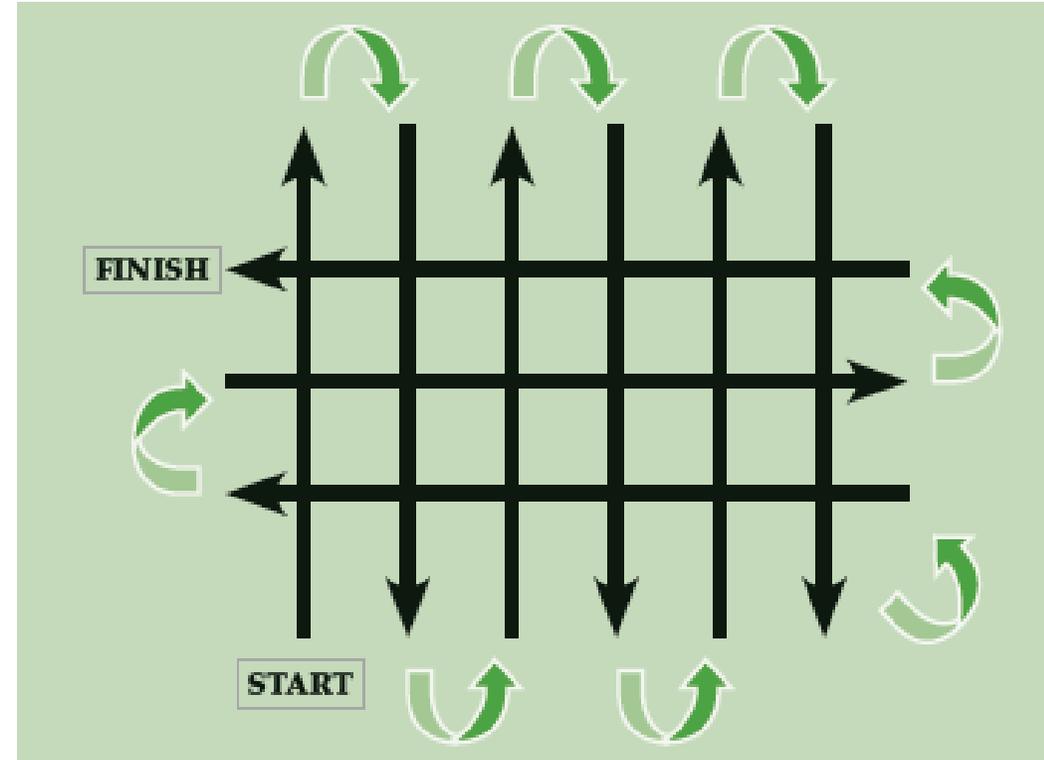
Exterior Search



These searches will always be coordinated with just-in-time-training from professionals.

The concept is to set up a grid search:

- Set distance between searchers according to visibility and debris
- Overlap patterns for full coverage
- Search in as straight a line as possible
- Mark areas that have been searched



PM 7-15

Wrap-up and Q&A

