Madison Arm Fire Entrapment
Facilitated Learning Analysis Report

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Review Team:

Eric Johnston
Acting Deputy Director, Fire, Aviation and Air
Forest Service Northern Region

Charlie Webster
Fire Management Officer
Kootenai National Forest

Karl Nikoleyczik
Engine Supervisor
Lolo National Forest, Missoula Ranger District

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Introduction:

What follows is a facilitated learning analysis (FLA) report regarding an entrapment and burnover situation on the Madison Arm Fire, on June 27, 2007. Resources that were entrapped and burned over include two Forest Service engines and a chase rig, as well as a contractor owned heavy pickup truck, trailer and dozer. Eight Forest Service employees (two engine supervisors and their crews) and the contractor were entrapped. This was a serious, life-threatening event that thankfully ended without injury or fatality.

To conduct the FLA, a team was assembled and traveled on June 28, 2007, to the unit where the event occurred. An FLA has been described as "an After Action Review on steroids." Its intent is to improve future performance by capitalizing on the shared experience of participants. The team's intent in conducting this analysis was to understand the thoughts and actions of persons involved and avoid fault finding, blame placing, or judging. The involved unit was familiar with the "learning" approach that is the foundation of a facilitated learning analysis. Given the understanding and acceptance that we need to learn from near misses, the unit was very open and responsive to the team while describing the events, what their thinking was at the time, and how the story along with lessons learned might be helpful to others in the future. Over the course of a day and a half, the team interviewed and dialogued with participants in a variety of settings including at the entrapment site itself.

This report contains a synopsis of the conditions in which the event occurred, the location of the fire, a summary of the event, lessons learned that were identified by the participants, and several emphasis items the team highlighted based on their observations. Also included is a list of discussion questions relating to this event that are intended to stimulate further discussion and learning among fire leaders and fire fighters who use this situation in sand table exercises or other learning environments.

Conditions during the event:

The entrapment event occurred during extended attack with a Type 3 organization on a very complex fire. Complexity issues include:

- Human safety – civilians, dozer operator
- Homes, a resort, a campground, and a major route into Yellowstone National Park
- Flat terrain making fire difficult to observe from the ground
- Rapidly changing fire environment
- Extreme fire behavior

The crews involved in the entrapment describe changing wind directions and a storm cell to the north that was driving the wind changes. Local weather at West Yellowstone (southeast of the fire) indicates steady light winds. The Madison Arm Fire appeared to be one that was fuel driven, creating it's own weather, which was quite severe at the head of the fire (see attached photos number 1-5 that illustrate the escalation of severe fire behavior through the course of the afternoon).

Location of the fire:

A map showing the location of the fire and pertinent features associated with the incident is attached. The map also shows the locations where photos of the fire were taken at various times on June 27th.

The fire was first detected around 1300 on June 27, 2007, approximately 2.5 miles northwest of the town of West Yellowstone. It spread in a northeasterly direction through lodgepole pine forest toward the Madison Arm of Hebgen Lake. The entrapment occurred on the Madison Arm Road that runs along the southern side of the lake (Madison Arm). The Madison Arm Road joins state Route 191, a major roadway into Yellowstone National Park.

Event Summary:

Early on the afternoon of June 27, 2007, the fire had been scouted and sized up at less than 5 acres. When the fire grew in size, a Type 3 Incident Commander assumed command. Around 1700, resources were directed to the Madison Arm Resort for a briefing where they received operational and command position assignments and fire status. Both of the engines (A and B) that were eventually entrapped were at this briefing. The majority of the resources at the briefing were directed to the heel of the fire to begin direct attack. Engine A was not one of those resources. Engine A's assignment, as they understood it, was to patrol the Madison Arm Road and give updates on the fire as it progressed north to the Madison Arm Road. Engine B's assignment, as they understood it, was to stage at the Madison Arm Resort.

Fire behavior continued to change rapidly, and while the resources were enroute to the heel of the fire to implement the plan for direct attack, new orders were given. Those orders were for resources to regroup at the Route 191/Madison Arm Road junction (191 Junction). The orders to regroup at the 191 Junction included Engine B. The operations chief thought Engine B would follow the rest of the resources around the heel of the fire, to the 191 Junction, and thought he had told them to do so.

After the briefing at the Madison Arm Resort, Engine A traveled east toward the 191 Junction where they observed the fire burning about a mile south of them. Shortly afterward they heard a radio transmission from an agency firefighting aircraft indicating that the head of the fire was going to bump the road hard in 15 minutes where a green Forest Service engine was parked. Engine A assumed that engine to be them. Engine A was aware of the orders for other resources to travel to the 191 Junction. They also noted that the public was still driving on the Madison Arm Road. They assumed that the public, along with other fire fighting resources they saw on the road were evacuating the area. They requested further direction and were told to continue to monitor the fire.

Engine A then proceeded approximately a half mile more to the east, where they encountered a dozer operator and his equipment as well as a deputy sheriff's vehicle. They progressed past them to the location where the fire had bumped the road and contacted their division supervisor and requested to implement a burnout operation to

hold the road. They received approval from the IC to light where needed. They requested assistance to implement that assignment, and soon observed and communicated that the fire had already crossed the road and a burnout operation was no longer an option. They were then informed that they were to try and catch the spots across the road. They requested additional assistance to do so. Engine Supervisor A began working on the spots, but ordered his crew to remain in the engine, based on his growing concern over safety.

When the orders to regroup at the 191 Junction were given, Engine B and a chase vehicle began making their way to the 191 Junction via the Madison Arm Road (not the southerly route around the heel of the fire which the other resources were taking). Approximately 2 miles from Highway 191 they observed the Madison Arm Road to be impassable to the east. At that point they encountered the dozer operator and his equipment and observed Engine A further down the road spraying water. Engine B made contact with Engine A. They collectively decided the spot fires were too well established, their escape route to the east was unusable, and they were in an unsafe situation. They called their task force leader and informed him there was nothing they could do. Their task force leader concurred with their decision to disengage and asked them to pull out to the west on the Madison Arm Road together with Engine B. They waited for the dozer to load and began traveling west with the rest of the vehicles which included the dozer transport, two engines and a chase truck.

After traveling a short distance west on the Madison Arm Road they discovered that their remaining escape route was compromised. Engine B contacted the IC and informed him that they were entrapped. Having local knowledge of the Madison Arm Road, Engine B's supervisor directed the others in the entrapment situation to turn around and go to an open area with light fuels. This site was the only break in the timber in the area. Upon arrival at the site, they were instructed to immediately implement a burnout operation to remove fuels between them and the oncoming fire front. The fire the crews lit was sucked toward the fire front. Approximately 2-3 minutes after implementing a burnout, Engine B's supervisor ordered the crews to retreat to the vehicles. There were high winds, extensive heat and very dense smoke that made it difficult for crew members to locate the vehicles. Visibility was so bad that one crew member from Engine A recalls having to follow their engine supervisor's shouts to find the engine.

During the burnover, the vehicles were positioned along the north side of the Madison Arm Road, facing east. Once inside the vehicles, crew members recall intense heat, and very heavy smoke, making breathing very difficult. They recall embers flying past the windshield and large chunks of debris raining down around them. While inside the vehicles, Engine Supervisor B obtained radio clearance so that the entrapped firefighters could communicate with each other. Once the fire front had passed, they repositioned the vehicles to the south side of the road, away from vegetation that was now burning on the north (or lake) side of the road. A short time after the crews had determined they had survived the entrapment, Engine Supervisor B requested that someone come to the site and escort them to the 191 Junction. He reasoned that the crews had just survived a traumatic life threatening event, he didn't know the conditions between the entrapment site and the 191 Junction, and didn't want them to face any more hazards such as fallen

trees or snags on the road. The division supervisor recalls traveling to the site to meet up with them.

After the event, crew members from both engines recall being in a survival mode and trusting completely in the instincts and direction of their engine supervisors. Both engine supervisors maintained complete control of their crews, and also recalled trusting without question that their crews would carry out their orders. Photos number 6-9 were taken at the entrapment site the day after the burnover occurred.

One of the factors that the engine crews identified as integral to the entrapment was the presence of the dozer operator and his equipment. Engine Supervisor A indicated that when he first saw the dozer operator, he assumed that it might be the additional resources he had requested, delaying his eventual decision to disengage. Engine Supervisor B indicated that he didn't feel that the entrapment would have occurred had they not encountered the dozer operator. He mentioned that valuable time was lost loading and turning around the equipment while attempting to disengage and escape from an unsafe situation. He also recalled poor visibility due to smoke and how painfully slow their travel behind the truck and trailer was when attempting to use their escape route to the west. With respect to where the dozer was actually supposed to be, the dozer operator indicated that he felt he had been asked to report to Madison Arm Resort. The dozer boss felt she had asked him to report to the staging area at the 191 Junction. The IC also had given instructions and expected the dozer to be at the 191 Junction.

Throughout the incident, communication was difficult due to heavy radio traffic, radio equipment failures and rapidly changing conditions on the ground. For various reasons the sense of urgency and seriousness felt by the crews during the entrapment was not fully recognized by overhead. Overhead felt that there was not a sense of urgency communicated to them during radio communications. They recall asking the crews if they were safe, and receiving affirmative responses that indeed they were. Also, they felt the tone of the communications they were receiving did not convey the danger the crews were in.

Lessons Learned (identified by those involved in the event):

1) Don't ignore your gut feeling: Engine Supervisor A recalled feeling a great sense of unease when he was communicating with overhead relative to his request to hold the road at the head of the fire, and while attempting to carry out instructions such as fighting the spot fires across the road. He indicated that he had experienced feelings of unease in the past and that overhead had assured him that he was in a safe location. And in the past that had indeed turned out to be the case. Following this event, he indicated he would more readily act upon any feelings of unease and more readily disengage.

2) Crew cohesion is important. Keep making efforts to allow for opportunities that foster building strong relationships. The individuals involved in the entrapment have a mixture of experience ranging from first year firefighter to firefighters with more than 10 years experience. Crew members expressed that they felt the

outcome (no injuries/fatalities) was directly related to crew cohesion. They mentioned the synchronicity of their actions under duress. Through the course of their discussions with the FLA team they mentioned activities and retreats where they were able to get to know each other before the incident occurred.

3) Follow your leader if you are unsure. Trust and confidence in the leaders at the entrapment site was essential to the outcome. While it's understood that everyone is ultimately responsible for their own safety, crew members indicated that their willingness to follow their leader implicitly and with complete trust was instrumental in their surviving the entrapment. This includes the location selected to park the vehicles once they realized they were entrapped, the burnout operation, and the direction to retreat to the vehicles as the fire front approached.

4) Past training, that included previous accident reviews, helped guide actions during "survival mode". One of the engine supervisors and other crewmembers recalled previous knowledge and awareness indicating that using vehicles as a refuge was an option. As he fell into "survival" mode, his knowledge of those events guided his decisions and actions. Note: Discussion about the effectiveness of vehicles in burnover situations continues to be a topic of debate within the fire community. In this case, using vehicles as a refuge worked, but is not appropriate in all situations.

5) Ask more questions and never make assumptions. Ensure that all those under your supervision provide specific updates on changes in the fire environment. The IC during this event indicated that he wished he had made fewer assumptions and asked more questions. Many people on this incident made many assumptions as this rapidly changing incident progressed. Examples of assumptions that participants in this incident made include:
    - The operations chief indicated that he assumed that all resources directed to the 191 Junction at the Madison Arm Briefing would travel to that location via the south route around the heal of the fire.
    - Based on discussion with the dozer boss and the IC, neither expected the dozer to engage the fire before receiving a briefing from a fire line supervisor.
    - Crews on the ground assumed that resources they encountered on the Madison Arm Road (specifically the dozer) were there to assist them with their instructions.

    A collection of assumptions led overhead to the conclusion that the crews on the ground were not in the serious danger that they were in. For example, they perceived no outward sense of urgency in the radio transmissions from the crews in the early stages of the entrapment. Some of the confusion surrounding these assumptions is related to the challenges and difficulties of radio communication in a rapidly escalating wildland urban interface fire.

6) Even when there are no outward signs of panic and no injuries, a crew involved in a "burn over" or entrapment needs attention, support, and time to recover. Following the burnover, Engine Supervisor B took positive steps to ensure that individuals involved in the entrapment were not exposed to additional hazards

and were removed from the fire. He called for an escort from the entrapment site to the staging area at the 191 Junction and requested that those involved in the burnover be allowed to stand down.

7) Better use of tactical frequency(s) is essential during complex extended attack situations. Again, this was an extremely complex Type 3 incident. Almost all involved on this incident recall the tremendous volume of radio traffic and the difficulty communicating effectively.

8) Operations resources that have not been briefed by their fireline supervisor, must be directed and report to the designated staging area. If you think your instructions are vague, then they probably are. As mentioned in the event summary, the presence of the dozer on the Madison Arm Road and his decision to engage the fire was one of the factors that was integral to this entrapment. Following the incident, the dozer boss indicated that instructions given to the dozer operator may have been vague and that it would have been better to accompany the dozer to his assigned briefing location.

Overarching FLA Team Emphasis Items:

- It's a "new world" and we should anticipate fire behavior in places and at times that are out of character with what we have experienced in the past. An "expect the unexpected" mindset for fire behavior, along with the growing complexity of our work (values at risk, abundant urban interface, etc.) should set the context for all involved with planning and implementation of strategy and tactics, when giving and accepting assignments, and assessing whether adequate LCES safety precautions are in place. Extreme fire behavior is unforgiving and shortens the time available to make escape decisions. In this event, individuals performed well when they found themselves in a life threatening situation. However, they should never have been in that situation.

- Even though there's a lot of chaos that often occurs in extended initial attack situations (when command and control is forming and people are transitioning from their day jobs to assume fire responsibilities), it's extremely important to gain and maintain situational awareness with a clear focus on safety first. This includes control of resources that are assigned to you and ensuring that they are also thinking safety first. Let suppression plans emerge from LCES mitigations.

- During fires in transition, situational awareness has a tendency to break down as the fire environment goes through rapid changes. Some checklists become invaluable tools to help ensure we stay focused on the priority of safety. The LCES Checklist (page 6 of the IRPG) is one of those tools that can help ensure that the fine lines between doing things right and tragedy are never blurred. This checklist takes less than 90 seconds to review. Fires will burn and homes will be lost. However, every firefighter has a responsibility to reassess LCES as conditions change to help ensure that the error of a moment never becomes the sorrow of a lifetime.

- Changes occur in seconds on transitioning fires. The ability of an individual to recognize critical changes is affected by these rapid transitions that can occur on wildland fires. Fire leaders can readily observe incremental changes and still lose sight of the big picture. Therefore, it is everyone's responsibility to speak up when something doesn't seem to make sense. Organizationally, we must possess the determination and the will to ensure for safety first with no exceptions, even in the presence of internal (personal) or external (social, economic, political) pressures to do otherwise.

- The focus of a Facilitated Lessons Learned approach should not lie in getting every fact exact or in answering every question with the perfect clarity afforded by hindsight. The focus should be to get the story out and ask fire managers/firefighters to review it, discuss the incident from their perspectives, and practice scenarios that help prevent a similar event. These learning opportunities may help to prevent an accident. We shouldn't wait months or even weeks to provide learning opportunities for our firefighters.

Madison Arm Fire

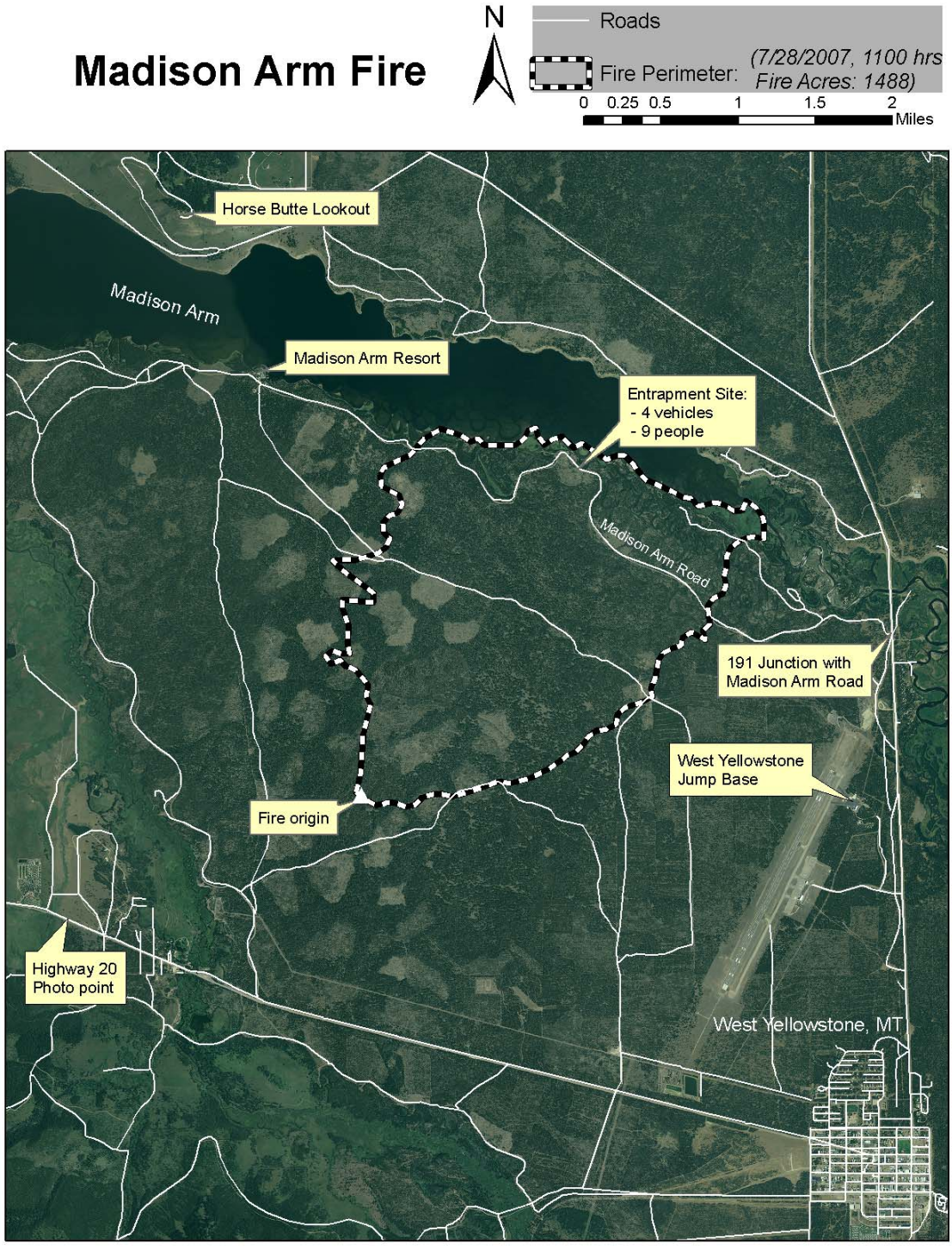

Photo 1: The Madison Arm fire as seen from the top of Horse Butte around 1400 hours.

Photo 2: The Madison Arm fire as seen from the base of Horse Butte around 1600 hours.

Photo 3: The Madison Arm fire as seen from Highway 20 around 1530 hours.

Photo 4: The Madison Arm fire as seen from the West Yellowstone jump base in mid afternoon.

Photo 5: The Madison Arm fire as seen from the West Yellowstone jump base in late afternoon.

Photo 6: General location of the entrapment site looking west towards Madison Arm Resort.

Photo 7: General location of the entrapment site looking south in the direction the fire came from.

Photo 8: General location of the entrapment site looking east towards Highway 191 Junction.

Photo 9: General location of the entrapment site looking north towards the Madison Arm at Hebgen Lake.

Discussion Questions Generated Through the Facilitated Learning Analysis for the Madison Arm Fire:

1) The following are the fuel and weather conditions recorded at a RAWS station near the fire:

Temp:	87	1 Hr	1
RH:	6%	10 Hr	2
Wind:	SW at 6mph w/ gusts to 13	100 Hr 1000 Hr	6 12
ERC:	64		
BI:	47		

What kind of fire behavior would you expect?

Looking at the pictures that depict the fire behavior that occurred, what month might you expect to see this kind of fire behavior in the Northern Rockies? How are changing fuel and climatic conditions changing our perceptions of fire behavior and how does that change your firefighting strategies and tactics?

2) What should the priorities for fighting this fire be?

3) Given the fuel and weather conditions, what actions would you take to help ensure for public safety?

4) At what point would you close/request closure of the Madison Arm Road?

5) What is Forest Service firefighter responsibility for contractors and their resources? What actions can be taken if a contractor will not leave equipment when a quick escape to a safety zone is essential?

6) What actions can you take to ensure that public and firefighter safety remains the highest priority during a rapidly transitioning fire? For a fire in the WUI? For a fire in a remote but popular backcountry destination?

7) The following Type 3 Organization was in place for this event
   Type 3 Incident Commander
   Operations Chief
   Division Supervisor
   Task Force Leader
   Dozer Boss

   Do you think this was an adequate amount of overhead to manage this quickly transitioning fire? What overhead structure or positions could have been dispatched to support the effort?

8) What are the implications for fighting a fire when all the resources needed to contain a fire are not available? How would that affect actions you do or don't take in managing and/or fighting a fire?

9) When does an IC need to re-evaluate strategy and tactics?

10) When can you attack the head of a fire?

11) How can you best keep control of arriving resources during a transitioning fire?

12) What steps can be taken to ensure that orders are clearly understood?

13) What have we learned from past entrapments, extreme fire behavior, and time for escape? What can be learned from this event?

14) What actions could have been taken to avoid entrapment on this fire?

15) If a lookout provided you with information that your current location would be overrun by fire in 15 minutes, what actions would you take?

16) Do you have identification on the top of your engines that is visible from the air?

17) What other actions might the firefighters have taken once they were entrapped?

18) Would the lake have provided an adequate safety zone?

19) Can a fire shelter be used in the water? How would you safely use a fire shelter in the water?

20) Using a vehicle is an option for refuge. What measures should you consider if you must seek refuge in a vehicle? When might you leave the vehicle?

21) What Standard Fire Fighting Orders were compromised during this entrapment?

22) Which Watch Out Situations were not mitigated?

23) Do you think resources on the Madison Arm Road had an adequate lookout? If not, at what point do you think the established LCES became inadequate? What would quality LCES look like for this fire?

24) What other resource(s) might have been used to monitor the fire as it approached the Madison Arm Road?

25) What steps can be taken to reduce radio traffic that hampers effective communication? What would a good communication system on this fire look like? What are the pros and cons of various communication systems that could be established?

26) Why is situational awareness so important to firefighters? How do you ensure that situational awareness is maintained?

27) Whose responsibility is it to ensure that all actions are based on current and expected behavior of the fire?

28) How can the use of trigger points help prevent entrapments? What could have been used as potential trigger points on this fire?

29) Could the use of similar words/phrases such as “Madison Arm Resort” and “Madison Arm Road” cause confusion? Are there methods designed to help avoid confusion with terminology?

30) Were the engine crews on Madison Arm doing a “burnout” or using a “backfire”? Are these terms interchangeable?

31) If you were in a command position how would a communication from ground crews using the words burnout or backfire shape your mental picture of what is occurring?

32) If you get a feeling in your gut that things are not quite right, would you take actions to address that feeling? If so, what kind of actions would you take to accomplish a “gut check”?

33) Have you reviewed the “6 Minutes for Safety” topic on “extended attack”? Have the militia who will be used as part of your Type 3 organization been included in this discussion topic?