rest periods may prove desirable. Under moderately hot conditions, 5-minute rest periods with 25 minutes of training in the sun may be desirable. Under severe conditions, the duration of rest periods should be increased.

When the temperature is excessively high, training should be curtailed or, under severe conditions, suspended entirely. Exposure to high temperatures at night as well as during the day should be avoided if possible, as it decreases the amount of training that can be performed effectively.

It should be noted here that heat injuries have been observed at WBGT temperatures of 75°F (24°C) and lower. Overexertion can cause heat injury at even lower temperatures, especially if the soldiers must wear personal protective equipment (gas masks, butyl rubber or charcoal impregnated suits) in their training.

REDUCING EFFECTS

There are several ways of reducing the direct effect of heat upon soldiers. Clothing and equipment, for example, should be worn in a manner that permits the free circulation of air between clothing and the body surface. Wearing shirt collars, shirt cuffs, and trouser bottoms open will aid in ventilation. (This practice may not be advisable, of course, in those areas where loose fitting or open style clothing presents a safety hazard.)

In the presence of full sunlight or a high radiant heat source (a furnace or generator, for example), keeping the body covered with permeable clothing reduces its radiant heat load. When heat exposures do not include much radiant heat, removing outer clothing helps reduce body temperature.

Impermeable clothing should be avoided unless it is required for protection against toxic agents. If such clothing is necessary, precautions must be taken to avoid the resulting rapid buildup of body heat, since heat illnesses may show up within minutes. (Personal protective equipment that alleviates heat stress is available for certain situations.)

A cool rest area allows body heat to reduce to average preexposure levels during alternate training-rest schedules and during breaks. A rest area temperature of about 75°F (24°C) is best. Water supplies should be located at or near rest areas.

Ventilation for heat control in buildings such as motor pools can be either local or general. General exhaust ventilation requires large quantities of cool make-up air and is frequently less cost effective than local ventilation. Besides, increased ventilation cools the skin only if the air temperature is less than 95°-100°F. The best supply air temperature for providing practical heat relief is 80°F. Portable floor fans can be used in maintenance areas to increase air velocity; they can be moved to direct the air supply on the workers and can be adapted to daily and seasonal changes in heat exposure and air supply.

A hot environment and the way troops perform in it can be dealt with in a manner that benefits physical and psychological readiness as well as productivity. A knowledgeable, well thought-out approach to activities in the heat not only improves performance but also produces acclimatized troops who have learned how to function at their best in such environments.

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Emergency FDC Techniques

STAFF SERGEANT JOHN E. FOLEY

It can happen. Your M577 Fire Direction Center (FDC) is mistaken for a T-62 and hit by 10 or 12 TOWs, or the enemy scores a direct hit on the FDC bunker. And no one thought to bring the spare plotting board.

This should be no reason for the mortar section to take a break and wait until the S-4 can find and deliver a new graphic firing fan, M-16 plotting board, or mortar ballistic computer. The guys out front still need fire support.

But for a mortar computer or any other mortarman to continue to provide accurate fire without his conventional devices, he has to have a considerable amount of skill, imagination, and confidence. If this ever happens to you, will you have that skill, imagination, and confidence? You

will — but only if you plan for it now.

There are several improvised procedures you can use on the battlefield to make this task easier. They aren't as accurate, of course, but they'll allow you to place fire on a target and continue your mission, even under the most adverse conditions.

The techniques that come immediately to mind in these instances are the direct lay and the direct alignment methods of fire. These methods — normally used in emergencies only and then with only one gun — are covered in depth in FMs 23-90, 23-92, and 7-11C1. But you can carry them a step further when necessary and use them for an entire platoon.

The direct lay method is the least desirable, because you're exposed to the enemy. It is the fastest method of engagement, though, and you should try it. Here is how you do it.

First, have your section align on the target and use your base gun to range in (initial deflection 3200). Have your other guns follow along with the deflection the base gun uses. As the gunner moves his sight onto the burst, then re-lays his mortars on the target, he can call out the deflection, and the other gunners can place that deflection onto their sight units and also lay on the target. (This method will work best if all the guns have been properly boresighted, preferably by the same man.) The other guns will also follow along with the charge and elevation of the adjusting gun.

The next step is to fire for effect and then leave fast! This method is rapid and provides the maximum amount of fire on a target with the least number of adjusting rounds.

When the terrain and situation permit the use of the direct alignment method, here is what you do:

Once the base gun is aligned on its stake and is preparing to fire the first round, the section sergeant shoots an azimuth across the gun to determine its direction of fire. Then, he positions and lays in the other guns, using the technique of laying the mortar for direction with the M-2 compass.

Once this is done, have all the guns place out aiming stakes and slip the scales so that they all read 3200 (or the same deflection).

Finally, the section sergeant writes down the corrections that the base gun squad leader (or whoever is acting as the forward observer) calls out, using the LARS rule for deflection (left, add; right, subtract) and a firing table, and translates the corrections into deflections, charges, and elevations.

As long as the observer stays within 100 meters of the gun-target line, this method is quick and accurate. The target hit data can be recorded on DA Form 2188-R (Data Sheet), if one is available, or in your notebook. With this data, fires can be rapidly placed back onto the targets with only minimum adjustment or the data can be used for shift missions. If someone outside the platoon should call for a mission and is more than 100 meters from the gun-target line, the missions can still be fired, but accuracy will fall off since all corrections are being made from the gun-target line and not the observer-target line. This means more rounds will be needed to adjust.

THIRD METHOD

These are emergency procedures only, of course. If you have the time and you stay in one area for an hour or more, you can use a third method of fire control and construct an improvised observed firing chart. In fact, whether you stay in the one position or displace, you can make an improvised observed firing chart out of materials on hand. What you will need is paper (or anything that can be written on — cardboard, a flat piece of steel, the shirt off somebody's back), a straight-edge, a map of the area, a protractor (GTA 5-2-10), and something to write with. Most of the materials can be found or scrounged quickly.

To construct an improvised observed chart, draw a grid system on your paper, taking care to make all the squares the same size. Scale is not as important as seeing that all the squares are the same size. The more accurately you draw your squares, the more accurate your fires will be. When you superimpose the grid system from your map onto the grid system you have drawn, you have made an observed firing chart. (You could have used your map itself, but this way you keep your map clean and will not have any intelligence on it.) Once you've made and numbered your grid system, you're ready to plot. By measuring the size of the grid squares, you can determine where to make your six- or eight-digit grid locations on the chart.

To use this system, this is what you do:

- Superimpose your map grid system onto the grid you've drawn.
- Plot your mortar location, forward observer location (if known), and target location.
- Using your straightedge, draw a straight line between the mortar position and the target location. Place your protractor over the mortar location and determine your azimuth.
- Determine the range on the basis of all the squares of your grid system being 1,000 meters across (horizontally and vertically) and 1,400 meters across diagonally.
- Convert the azimuth into a deflection using the RALS/LARS rules for azimuth and deflection. Thus, if the azimuth increases, the deflection decreases, and if the azimuth decreases, the deflection increases. Use whatever azimuth your guns are mounted on (mounting azimuth) as your start point for your deflection scale and have stakes placed out on the deflection that corresponds to the mounting azimuth. For example, if the mounting azimuth is 1600 mils, the referred deflection is 2800 mils, and the azimuth to the target is 1330 mils. This is a difference in deflection of 270 mils. Using the LARS rule, you would add this difference (270 mils) to the referred deflection of 2800 mils. This would give you a deflection to fire of 3070 mils. If you have the 107mm mortar, you would also add a drift of about 35 mils, which is the midpoint between the maximum and minimum drift for the cartridge, HE, M329A1. Since drift is a left correction, it is always added.

Now that your mortars are laid in the direction of fire, you need to know what charge and elevation to use for the range you determine. This is the time to look at your firing tables.

The 81mm and 60mm mortars adjust range by both charge and elevation adjustments. Because of the extremes of elevation and charges possible and the overlapping range characteristics of the ammunition, it is impossible to make an accurate estimate of the charge and elevation for these mortars. The best way to determine the charge and elevation for both, therefore, is to use a firing table. The second best method is to use the abridged firing table that comes packed with the ammunition. This is better by far than not having anything.

But even when you have no firing tables for a 60mm or an 81mm mortar, you still have an alternative. First, for both mortars being used in the ground mounted role, the maximum elevation is 1511 mils and the minimum elevation is 0800 mils. (In the M125A1 mortar carrier a maximum elevation of 1598 mils and a minimum elevation of 713 mils are possible. See page 8, FT 81-A1-3.) Using your experience, your familiarity with the firing tables, and luck, consider that you have a charge range of 0 to 9 with the 81mm mortar. At the minimum elevation (0800), the maximum range is as shown here for each charge.

You should try to memorize the maximum range for each charge for both the 60mm and 81mm mortar. Then, when faced with an emergency, you should be able to closely estimate the charge and elevation you will need to hit your target. (This is the least desirable method of determining charge and elevation, but it beats nothing. And with experience and practice, you should be able to make swift and accurate changes in range without the aid of a firing table.)

Charge	Maximum Range
0	401 meters
1	1,037 meters
2	1,508 meters
3	1,991 meters
4	2,466 meters
5	2,929 meters
6	3,374 meters
7	3,802 meters
8	4,209 meters
9	4,595 meters

With the 107mm mortar, there is a fixed elevation and a varying charge. In an emergency, therefore, when you need to fire and do not have either firing tables or a ballistic plate, you can use another improvised method to estimate the charge you need to hit a target. This method comes from a study of FT 4.2-H-2 and is based on a maximum range for HEM329A1 ammunition of 5,650 meters (elevation 0800 with extension) charge 41, and a minimum range of 920 meters (elevation 1065 without extension) charge 5. Using these two extremes, and what you remember from studying the firing tables, you should be able to determine the approximate charge needed.

I have found that for elevations 0800 and 0900 with or without extension, one-eighth of a charge will move the round 20 meters most of the time; at elevation 1065, it will move the round 10 meters.

With practice and common sense, this can be a very accurate way of getting your mortars onto a target. Remember that when you use it you will not have the normal FDC equipment; you will have only some guns, ammunition, men, and, hopefully, communication equipment. The whole idea is to keep putting fire on the target, no matter what.

The three techniques discussed here are for emergency use only — when there are no other means of fire control. Any one of them can be accurate and effective, but it takes a competent computer to determine the data to fire. Using data from missions you have fired successfully or from the team drills that are given to each Infantry mortar platoon course student at Fort Benning, you can train your computers and squad leaders to effectively control their fire even if they do not have FDC equipment.

Fire control is based on a direction and a distance from a gun to a target. If it seems you have lost everything, stay calm, use the techniques discussed here, and keep shooting.

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Mortars in the Desert

LIEUTENANT DOUGLAS W. McENIRY

The United States Army has not fought a major battle in the desert, let alone a war, since the North African campaign during World War II. Now, in the Army of the 1980s, attention is once again focused on the possibility of conducting desert operations. Several major field exercises, such as the annual Bright Star maneuvers and our continued use of the National Training Center at Fort Irwin, California, are helping to build our in-