# Planning and Computing FASCAM

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There's some confusion among field units about the procedures to plan and compute family of scatterable mines (FASCAM) minefields. Although not difficult, planning FASCAM minefields is time-consuming; and the firing data must be computed manually.

This article addresses the tactical considerations for employing FASCAM and the procedures to compute FASCAM firing data. When planning a FASCAM minefield, the fire support officer (FSO) must be able to advise the maneuver commander about FASCAM concepts. If he advises the commander incorrectly, the FSO may not be able to fire the minefield in the density or size desired or in the time allotted. After the FSO's initial planning, the battalion fire direction officer (FDO) plans the minefield in detail followed by the battery FDO's computation of FASCAM technical firing data.

**FSO Planning.** Before the commander decides to employ FASCAM, the FSO provides guidance on the availability of FA munitions and delivery units. The planning starts with the Minefield Planning Sheet, DA Form 5032-R (*FM 6-40 Tactics, Techniques and Procedures for Manual Cannon Gunnery*, Figure 13-27 on Page 13-63).

At this point, the FSO must be aware of not only the tactical considerations in employing FASCAM, but also the technical computations required. The FSO and battalion FDO must be aware of the considerations outlined in Figure 1.

The FSO and battalion FDO have a tool to help them plan FASCAM missions–the initial fire support automated system (IFSAS). In the planning mode, IFSAS can segment the proposed minefield, determine the required number of aim points for a minefield and allocate the appropriate resources to fire the mission. (The IFSAS operator must select the commander's Mod File for target segmentation.) IFSAS conducts this planning via a software package based on the Mine Employment Tables in Chapter 13 of FM 6-40.

**Battalion FDO Planning.** If the FASCAM mission is preplanned, the battalion FDO receives the minefield coordinates on the Minefield Planning Sheet (Section A, Lines 4, 5 and 6). If the mission is a target of opportunity initiated by a forward observer (FO) or fire support team (FIST), the grid coordinate given or target location determined becomes the minefield center.

In a nutshell, here's the process the battalion FDO uses to plan FASCAM. When he receives the mission to fire FASCAM, he plots the target and determines the minefield center and the num-

- **Width of the FASCAM Minefield. This varies according to the mine type and angle of fire.**
- **Angle of Fire (High- or Low-Angle).**
- **Desired Density (Low, Medium or High).**
- **Duration of the Minefield (Short or Long).**
- **Timing of When the Minefield must be in Place.**
- **Artillery Support Available to Fire the Minefield.**
- **Time for the Artillery to Fire the Minefield.**
- **Number of Artillery Rounds Available to Emplace the Minefield. This includes the logistics of getting more rounds in time, as necessary.**

Figure 1: FASCAM Considerations. The FSO and FDO must consider these factors in FASCAM planning.

| Entry | Employment Table 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Transfer or Met + VE | X | X | X | X | | | | |
| Observer Adjust | | | | | X | X | X | X |
| M718/741 (RAAMS) Low-Angle | X | X | | | X | X | | |
| M718/741 (RAAMS) High-Angle | | | X | X | | | X | X |
| M692/731 (ADAM) Low- or High-Angle | | | X | X | | | X | X |
| BMA ≤ 800 mils | X | | X | | X | | X | |
| BMA > 800 mils | | X | | X | | X | | X |

***Legend:*** **ADAM** = Area Denial Artillery Mission **BMA** = Battery Minefield Angle **RAAMS** = Remote Anti-Armor Mine

Figure 2: Mine Employment Matrix (FM 6-40, Page 13-49). Following the example in the article, the one table that all three answers have in common is Table 1 (as highlighted in this figure).

| Delivery Technique: Transfer or Met + VE | | | | | | Trajectory: Low Angle | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Shell: M718/741 (RAAMS) | | | | | | BMA: Equal to or less than 800 mils | | | | |
| Range Meters | Desired Minefield Length (Meters) | | | | | | | | | |
| | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | 1,000 |
| 4,000 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 |
| 6,000 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 |
| 8,000 | 2 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 |
| 10,000 | 3 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 |
| 12,000 | 3 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 |
| 14,000 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 |
| 16,000 | 4 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 |
| 17,500 | 4 | 5 | 5 | 6 | 6 | 7 | 7 | 8 | 8 | 9 |

Figure 3: Mine Employment Table 1 (FM 6-40, Page 13-50)

ber of aim points required. Then he passes the information to the battery FDO who computes the firing data.

To begin planning, the FDO plots the target to determine the chart range and battery minefield angle (BMA). The BMA is defined as the smaller interior angle formed by the intersection of the minefield center line with a line drawn from the battery center to the center point of the minefield. The minefield center line traverses the minefield *width* through its center point. The FDO puts a target grid on the minefield center point and orients the target grid to reflect the attitude (direction) of the minefield. He uses the range-deflection protractor (RDP) to determine the BMA from the battery or platoon center to the minefield center.

The FDO also can calculate the BMA mathematically by subtracting the average unit direction of fire from the minefield attitude, which always will be less than 1,600 mils (BMA = Attitude - Direction of Fire).

The FDO then determines which Mine Employment Table in FM 6-40 to use. To determine the appropriate table, he uses the Mine Employment Matrix from Page 13-49 of FM 6-40 (Figure 2) based on the answers to three questions:

(1) What is the delivery technique–transfer or meteorology (Met) plus velocity error (VE) or observer adjust?

(2) What is the shell and trajectory–remote anti-armor mine system (RAAMS) or aerial denial artillery munition (ADAM) at high or low angle?

(3) What is the BMA–less than/equal to 800 mils or more than 800 mils?

To illustrate the process, say the FDO answered the questions as "Met + VE using RAAMS at low angle and the BMA will be less than or equal to 800 mils." Referring to the Mine Employment Matrix in Figure 2, he looks down the "Entry" column to find each answer and then across the "Employment Table" rows to find "Xs" indicating the numbers of the Mine Employment Tables he can use for that answer.

Using the sample answers to the questions, the matrix says that for the Met + VE technique, the FDO can use any one of Tables 1 through 4; firing RAAMS at low angle allows him to use Tables 1, 2, 5 or 6; and a BMA of less than or equal to 800 mils calls for Tables 1, 3, 5 or 7. The one table that all three answers have in common is Table 1. This is the table the FDO must use to determine the number of aim points required for the example minefield. The heading of Table 1 in FM 6-40 restates the answers to all three questions (see Figure 3).

The FDO now addresses the minefield module concept. A RAAMS minefield module for planning is 200 x 200 meters for low-angle firing and 400 x 400 meters for high-angle. The planning module for ADAM is 400 x 400 meters, regardless of the trajectory.

The FDO must remember the rule that *the width of a planning module cannot change; only the length of the module can change.* For example, if the FDO plans a battalion-sized low-angle RAAMS minefield of 800 x 800 meters, he segments the minefield by modules. Knowing that the planning module for low-angle RAAMS is 200 x 200 meters and that the width cannot vary, the FDO determines that it takes four 200 x 800-meter modules to cover the 800 x 800-meter minefield (Figure 4).

Using Mine Employment Table 1 (Figure 3), the FDO determines the number of aim points *per module*. In this example, the FDO has four modules of 200 x 800 meters each. If the range from the battalion center to the center of the 800 x 800-meter minefield is, say, 10,500 meters, the FDO uses a range of 10,000 meters and a minefield length of 800 meters to enter Table 1 and determine the number of aim points per module–in this case, six. Given the example, each planning module will use six aim points and, with four modules, the FDO needs 24 aim points for the 800 x 800-meter minefield.

The FDO then determines where to emplace the aim points. He segments the minefield into 200 x 800-meter modules and establishes a center line for each module. FM 6-40, Pages 13-53 and 13-54, provides guidance for emplacing the aim points based on the standard planning module size, type of round being fired and either an even or odd number of aim points. According to FM 6-40, for an even number of aim points, the initial aim points are placed

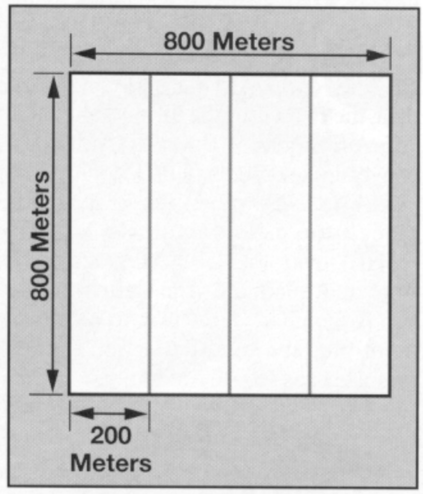


Figure 4: Sample Minefield Segmentation

100 meters left and 100 meters right of the center point along the center line of the module (see Figure 5). The remaining aim points are placed at 200-meter intervals from the initial aim points until all are emplaced. Figure 5 illustrates the concept using the example six aim points

After establishing the 24 aim points, the FDO determines the grid coordinates for each. In the absence of IFSAS in the planning mode, he can determine the grid coordinates using a firing chart and target grid or an M17 plotting board.

The next step is for the FDO to determine the number of rounds to be fired at each aim point, based on the density of the minefield (low, medium or high). For the example, the commander needs a medium-density minefield. The FDO refers to the Desired Density Rounds Per Aim Point Table listed in the FM 6-40 (Table 13-21, Page 13-55). The table states that for a low-angle, medium-density RAAMS minefield, 12 rounds must be fired per aim point. Therefore, 288 rounds must be fired to emplace the 800 x 800-meter minefield.

An M109A5/A6 or M198 howitzer firing at the maximum rate of fire for the first three minutes followed by the sustained rate thereafter requires a six-gun battery to fire for 42 minutes to emplace the minefield. The battalion FDO would fire this mission as a battalion due to the size of the target and assign each firing battery one or two modules to execute.

Once the battalion FDO determines the number and location of the aim points, the battery FDO computes the technical firing data.

**Battery FDO Computations.** The battery FDO has all the information he needs to calculate the technical firing data. He determines the technical fire direction by using dual-purpose improved conventional munition (DPICM) graze burst data and then converts it to RAAMS or ADAM data. To convert the data, the FDO uses the Firing Table (FT) 155-Addendum-N-1 for RAAMS data conversion and Addendum L-l for ADAM.

*RAAMS Data Conversion.* the FDO places the manufacturer's hairline (MHL) over the DPICM graze burst time and quadrant. The deflection-to-fire is the chart deflection to each aim point plus the total deflection correction. He uses FT Addendum N-l in conjunction with Tabular Firing Table (TFT) AN-l/AN-2 to determine firing data for shell RAAMS and Table A, Column 1 of the N-1 Addendum to determine the correction-to-quadrant.

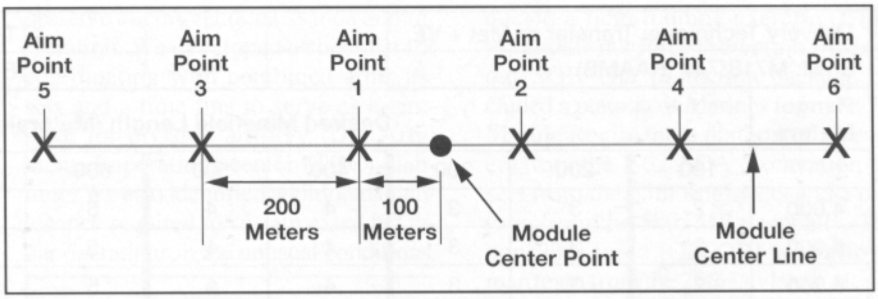

Figure 5: Aim Point Emplacement

The entry argument is the DPICM graze burst quadrant elevation (QE). The FDO finds the correction-to-quadrant in Column 2 and adds it to the graze burst data.

The FDO also determines the fuze setting. He uses Table B of the N-1 Addendum for fuze corrections. The entry argument is the DPICM graze burst fuze setting listed in Column 1. The correction to the fuze setting is found in Column 2 and is added to the graze burst fuze setting. Subsequent corrections for quadrant are determined from Table A, Columns 3 and 4 and Table B for fuze corrections, Columns 3 and 4.

*ADAM Data Conversion.* The computation for ADAM rounds are slightly more complicated. Because low-level winds can blow ADAM away from the intended aim point, the FDO must modify or correct the aim points. The FDO offsets the aim points in meters.

ADAM has a 600-meter height of burst that corresponds to Line 02 of a meteorological (Met) message. The FDO uses Line 02 to determine the wind speed and direction to help offset the ADAM aim points.

FT 155 Addendum-L-l, Table A, provides correction factors for low-level winds. The entry argument to Column 1 is the DPICM graze burst quadrant from the firing unit to the center point grid. The correction factor is extracted from Column 5 for a one-knot wind speed. The FDO multiplies the correction factor by the wind speed indicated on Line 02 of the Met message to compute the total correction. This procedure determines the number of meters (expressed to the nearest 10 meters) needed to offset each aim point.

Then the FDO places the target grid over the module center point and plots the offset aim point into the direction of the wind. He reorients the target grid over the new offset point, resets the minefield attitude and determines the new module center line. He uses the new chart range and deflection to determine the new offset aim point. But he uses the original aim point to calculate the vertical interval and site. The battery FDO follows these correction procedures for each aim point.

He then determines the DPICM graze burst times, deflections, elevations and quadrant elevations for the offset aim points and computes the data using the same procedures as for RAAMS.

*BCS Firing Data Computations.* The battery computer system (BCS) can determine technical firing data for RAAMS and ADAM. But the BCS can only compute data for each individual aim point. Firing units assigned multiple aim points must execute each as if it were an individual mission. In the BCS autonomous mode, the battery FDO performs the steps outlined for the battalion FDO to segment the minefield and identify the aim point as well as compute the technical firing data.

Chapter 13 of FM 6-40 outlines the steps to execute a FASCAM mission. Although the steps take time and can appear complicated, in fact, they are not difficult. Fire supporters must master the procedures to ensure FASCAM minefields are emplaced when and where their maneuver commanders need them.

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