

The EOC manager must determine the number of people he or she wants to fill each of the 5 major operating sections within the EOC (Command, Intelligence and Plans, Operations, Logistics, and Finance). Within an EOC it is always a challenge to know the correct number of people required to perform the duties of each section within the hectic, undetermined timeframe created by the nature of an emergency. With the standardized list of tasks per section a schedule could be developed to determine the best number of people to accomplish the tasks for each section. However, the EOC manager (the decision maker) would still have to decide if that recommendation would actually achieve the results he or she needs based on the current assessment of the emergency at that time. It is here that the interaction between the DM and the analyst may traditionally take place. However, research has shown [– need to prove] that interaction between the analyst and DM at the input and output stages results in fewer changes, better alternative development and more accurately reflects the true needs of the DM all in less total processing time. Therefore, the purpose of this research is to create a framework to support interaction between a scheduling analyst and a decision maker within an EOC.

There are two major players in this interaction: the EOC manager, who is the decision maker, and the analyst or scheduler, who is outside the scope of the EOC, more like an external consultant to the EOC manager. The EOC manager is within the operating sphere of the EOC. He or she is responsible for major decisions regarding operations and is responsible for delegating tasks to five subordinate section chiefs. It is within the subordinate sections that the majority of the tasks will be executed. However, the EOC manager is the person with the capability of accessing and training additional workers for each section if necessary, therefore, he is the decision maker (DM) regarding personnel allocation. As an outside observer, the scheduler or analyst can recommend to the DM alternatives for optimal performance within the

EOC. The coordination between the DM and the analyst is critical to ensure that the DM's criteria and objectives are correctly conveyed to the analyst so the optimal solution for the problem can be determined. Below is a diagram of a general EOC organization. It is clear that the EOC manager (DM) is within the scope of the EOC, but the analyst is completely outside the scope of the EOC.

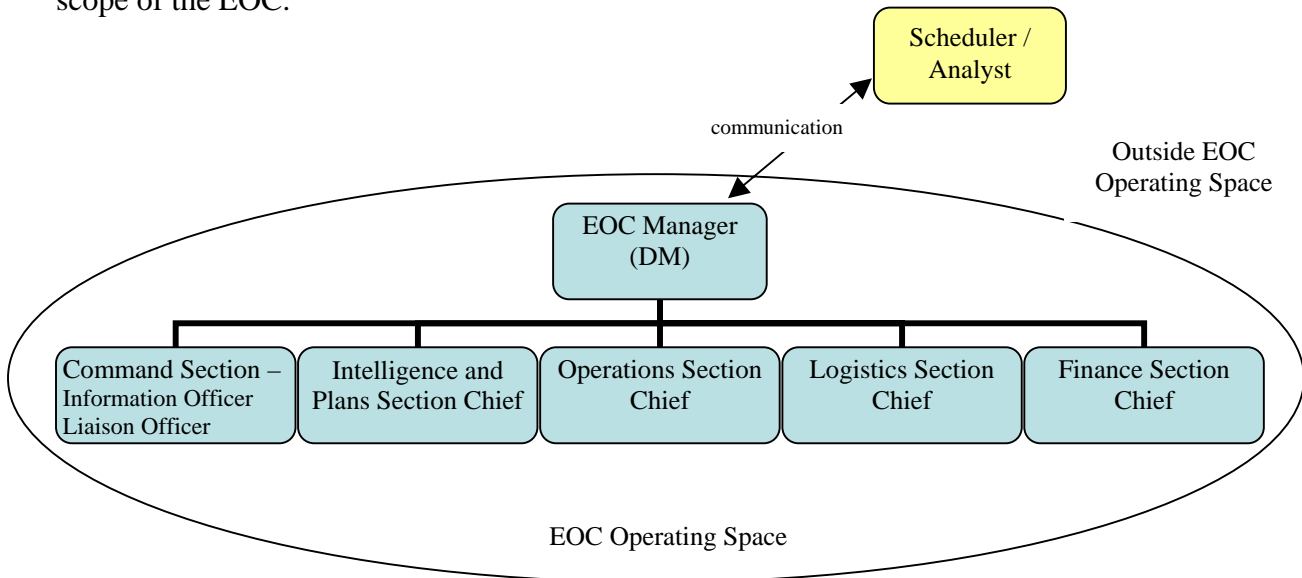
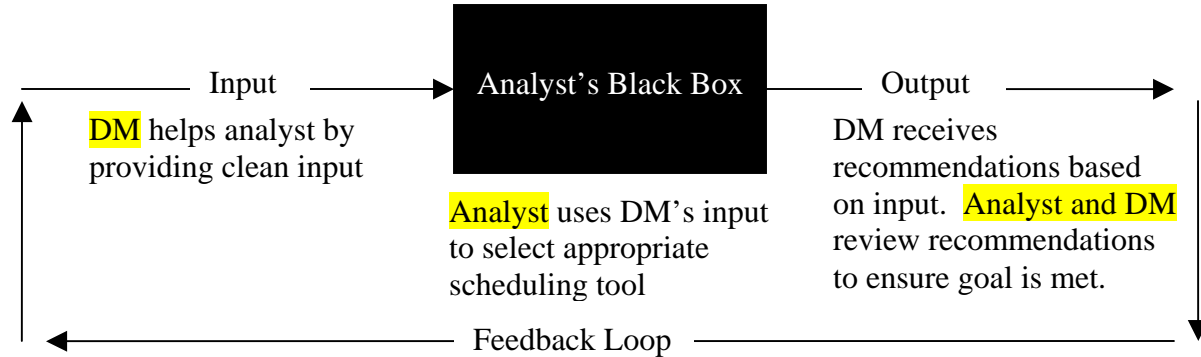


Figure 1: EOC operational organization chart depicting interaction between EOC Manager and Scheduler/ Analyst. Adapted from the Emergency Management Institute, National Emergency Training Center, Independent Study Course-100 “Introduction to the Incident Command System.”

The interaction between DM and analyst can be broken down into four main elements: 1) input from the decision maker; 2) the ‘black box’ which executes the analyst’s course of action (model or algorithm appropriate for the decision maker’s needs); 3) the output or recommendations to the decision maker; and 4) the feedback from results which become the DM’s future input. Both the DM and analyst (whether person or computer) participate in their respective areas of responsibility (DM – input, analyst – black box) and then come together to review the results.



The EOC manager contributes the input to the analyst. It is that input that directly affects the tools the analyst will use and indirectly affects the results of the analysis. Some examples of the input are: 1) the decision maker's goals; 2) event specific additional tasks; and, 3) the scope of the event. The input can be categorized into two distinct types: decision criteria and situational variables. The decision criteria are those that are based solely on the decision behavior of the EOC manager. Situational variables are those that are dictated by the situation itself. The EOC manager will have to make a judgment about the situation variables; however these should be viewed as separate from decision making input because they are primarily driven by external, uncontrollable forces. The decision variables are those that are under complete control of the decision maker and reflect his or her personal choices rather than uncontrollable events.

The criteria for the input is...

The decision maker may have many different goals for EOC operations that will contribute to determining how many people to allocate to each section. The EOC manager may decide that his main goal is to simply accomplish all tasks for which the EOC is responsible; or, she may need to accomplish all the EOC tasks within a specified amount of time; or, he may need to do as many tasks as possible within a specified time, but not need to complete all the tasks (credit may or may not be given for partially completed tasks). These goals, as described

here will become the optimization criteria for the schedule. Therefore, an algorithm will be selected that will optimize the allocation of resources based on the defined goal of the EOC manager. The EOC manager will need to decide which goal is most appropriate for the situation.

There are a couple of situational elements implied by the nature of an EOC and the way operations flow. First, it is implied that the available people are used to their maximum capacity for working in the assigned section. EOC operations are usually for a short period of time in a critical situation, so it is common for workers to sustain great energy expenditure throughout the duration of the event. Of course the workers will have shift changes, but while they are working it is logical that they will be operating close to their individual maximum capacity. Second, an allowance for shift change-over must be incorporated into the schedule. This means that workers will have less total time to accomplish the specified tasks. For example, it is common to have a 12 hour shift. Shift change may consume a total of 1 hour of that total available working time (30 minutes before and after the shift). During shift change, it is not common that tasks are worked on. Normally, shift change is reserved for an exchange of information about what has transpired over the last shift and what is expected for the next shift. Therefore, the shift change period must be removed from the total time available for execution of tasks.

Preliminary considerations that will affect the number of people initially assigned to the EOC. Several other situational variables contribute to the number of human resources needed per EOC section. These variables are relatively static per situation and will be considered through the scheduler's input to the system. FEMA has created a standardized list of basic tasks that must be accomplished with each EOC operation. This is a set list of tasks and is a minimal requirement for every operation. Additional tasks will be included based on the event itself and may or may not be known before EOC operations begin. In this case, the EOC manager may

have to use judgment to determine the likelihood and volume of certain types of tasks. But, the basic tasks offer a stable input to the system for baseline operations. It is known that the tasks will not be fewer than those prescribed, therefore any changes to the task list will only be additions based on the situation.

The scope and type of the event will affect the number of people working in the EOC. Generally, an event with a broad reaching scope and commonly effects the populous will drive more outside agencies to provide representation to the EOC. This could add any number of people per section and will affect the total number of people (resources) working in each section, independent of the recommendations of the scheduler. The need for coordination with external agencies will also affect the number of people needed in the EOC. However, this aspect will be considered under the general definition of scope and type of event. Again, the larger the scope and more far reaching the type of event the greater the need for external coordination will be. It is important to note that this has been considered, however because the external coordination is a key aspect of EOC operations. This presents some interesting influences to the system because the EOC manager will have to consider the number of people already assigned to each section once the scheduler recommends an optimal number based on the input for the situation. The DM will have to decide if more is better or if people need to be moved between sections to match the recommendations of the scheduler. Either way, this will be the sole decision of the EOC manager. That decision could be used as feedback to the scheduler to re-input into the system to be analyzed if necessary.

The overall duration of the event could be seen as affecting the optimal resource allocation, but it does not. The optimal number of people working in each section is not changed by the duration of the event. The schedule will determine the optimal number of resources and it

is up to the EOC manager to plan for shift changes, replacement rotations, and keeping the people continuously prepared for operations throughout the duration of the event regardless if it is a 15 hour operation or a 3 week operation. Therefore, the scheduler will work with a 12 hour shift period of continuing operations with predetermined change over times to analyze the data.

The environment in which the EOC manager operates is also an important factor. In general, it is an environment where a “series of multiple, interdependent decisions are made in real time in a continuously changing autonomous environment.”<sup>1</sup> This defines a situation where dynamic decision making is applied. The DM must continuously process incoming information: updates to the incident, changes in personnel, increased numbers of tasks, and unforeseen events, yet make a decision within a time frame that allows the EOC as a whole to react in a timely manner. Another characteristic of the EOC environment is that the decision maker will have multiple objectives she is trying to achieve. For example, she would have to contain the event itself, manage the public information flow, schedule and allocate the material resources as necessary, and perhaps support evacuation operations. Given the number and variety of objectives of the EOC manager, it is clear that she would have to optimize the accomplishment of all of those tasks. In this situation, it is not acceptable to fail to perform any of the objectives, and some objectives absolutely must be accomplished before a deadline. If a fire (the incident) requires the evacuation of a populated area, that objective absolutely must be met by the time the fire affects that area or the result could be loss of life. This type of urgency forces the system to respond differently than if it were acceptable to complete this objective after the deadline. As such, this will be one of the most critical aspects addressed in the “black box” of the scheduler to ensure that those time restrictive tasks are completed before their due dates.

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<sup>1</sup> Gonzales, C. (2004). “Learning to Make Decisions in Dynamic Environments: Effects of Time Constraints and Cognitive Abilities.” Human Factors 46(3). pp. 449-460.

EOC operations generally fall under three major categories that govern the levels of staffing necessary and authorized for each event.<sup>2</sup> Level one, with decentralized coordination and direction, is considered a relatively minor local event where the EOC may or may not be activated. Level two, with centralized coordination and decentralized direction, is an event where a state of emergency may be called and local resources are not adequate to deal with the situation. In this case, it is recommended that the EOC be activated. Level three, centralized coordination and direction, is the most severe case of event, the EOC is activated, and local and regional resources are overwhelmed and state or federal resources may be needed. In the first two levels, not all sections of the EOC may be required. Therefore, the level three will provide the main focus for this research. Defining the event as a level three event ensures that all sections of the EOC will participate in the event and will have to fulfill all major requirements as they are defined.

The EOC manager must determine the best number of people to have working in each section. In doing this he or she will have some specific decision variables that will affect the decision of how many people to allocate per section. These decision variables are based on internal characteristics of the decision maker, written guidance regarding the activation level of the EOC based on event characteristics, as described above, and the general characteristics of the people who will be the resources within the EOC. First, the decision maker must know her decision making characteristics, specifically risk aversion, etc. Second, the scope of the event will determine the extent to which the EOC is operational. Finally, the EOC manager must define the level of confidence she has in the resources (EOC staff) to operate at full capacity. And, if the people cannot operate at full capacity (because of lack of training, inexperience in

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<sup>2</sup> Ventura County SEMS Multihazard Functional Response Plan – 2002, “MNMGT2002,” page 35.

real events, or other factors) he must be able to define at what level he will expect the group to be operating.

The sections of the EOC are standardized through the SEMS program of California and the recent national NIMS program. There are five sections: management, operations, planning/intelligence, logistics, and finance. Within the management section, there are several officers who perform specific functions that require attention and acknowledgement because their functions are critical and often require specific training or experience in those areas. For example, the Public Information Officer is assigned to the Management section of EOC operations. However, the PIO has an individual list of tasks separate from those of the Management section. In other sections, for example Operations, the list of tasks can be accomplished by anyone in the section – there is no specialized list of tasks separate from the main Operations tasks.

While the scheduling of the EOC staff may be considered in light of known practices of scheduling staff members, traditional elements of staff scheduling miss the needs of EOC staff planning. Staff scheduling considers characteristics of the staff members, for example: “limits on the number of consecutive shifts or weekly hours, special rules for night shifts and weekends, seniority rules, vacation periods, individual preferences...”<sup>3</sup> This research focuses on the characteristics of the tasks and the people necessary to accomplish those tasks.

“Staffing” seems to focus on finding the right people for the job... more of a human, personality/ competence driven focus.

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<sup>3</sup> [Beaulieu, Huguette](#) ; [Ferland, Jacques A.](#) ; [Gendron, Bernard](#) ; [Michelon, Philippe](#), “**A mathematical programming approach for scheduling physicians in the emergency room.**” *Health Care Management Science* 3, no. 3 (2000): 193-200 (8 pages). Kluwer Academic Publishers; 20000101.

## Appendix ZZZZ

# Ventura County SEMS Document Guidance Ventura County SEMS

Multihazard Functional Response Plan – 2002, “MNMGT2002,” page 35.

## LOCAL GOVERNMENT EOC STAFFING GUIDE

Event/Situation	Activation Level	Minimum Staffing
Unusual occurrences with severe potential impacts on the health and safety of the public and/or environment	One	EOC Director  Other Designees  Note: May be limited to Department Operations Center activation.
Severe Weather Issuance's (see <b>Part Three— Operations/NWS</b> )		
Significant incidents involving 2 or more departments		
Earthquake Advisory/Prediction Level One		
Earthquake with damage reported	Two	EOC Director  Section Coordinators, Branches and Units as appropriate to situation  Liaison/Agency representatives as appropriate
Earthquake Advisory/Prediction Level Two or Three		
Major wind or rain storm		
Two or more large incidents involving 2 or more departments		
Wildfire affecting developed area		
Major scheduled event		
Severe hazardous materials incident involving large-scale or possible large-scale evacuations		
Unusual occurrences with severe potential impacts on the health and safety of the public and/or environment		
Major county or regional emergency— multiple departments with heavy resource involvement	Three	All EOC positions
Earthquake with damage		
Unusual occurrences with severe potential impacts on the health and safety of the public and/or environment		