

# SITUATION AWARENESS REQUIREMENTS FOR THE FUTURE OBJECTIVE FORCE

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## ABSTRACT

*This paper demonstrates how a Goal Directed Task Analysis (GDTA) can be used to provide insight into potential allocations of staff functions within the Objective Force Units of Action. The GDTA is a methodology that delineates the goals, decisions, and SA requirements essential for achieving a particular objective. In evaluating the responsibilities assigned to different components of a proposed command structure, the GDTA can provide support for three types of assessments: (1) an assessment of essential information requirements, (2) an assessment of likely cognitive workload associated with the proposed structure, and (3) an assessment of potential problems and/or benefits associated with a particular allocation of responsibilities. This type of assessment will highlight areas where soldiers' information needs are not being adequately met, where particular staff function allocations are overly demanding on the soldiers' cognitive resources, and where particular combinations of responsibilities within and across cells can create unexpected consequences that negatively impact the soldiers ability to successfully complete their mission.*

## INTRODUCTION

As the nature of modern day conflicts diverge from those of previous conflicts, the Army is seeking to restructure operations to effectively and efficiently meet the new challenges. Although changes in technology have allowed and even necessitated a change in the way the Army carries out its mission, the mission itself has not changed. Consequently, decisions must be made as to how to most effectively redefine roles and reallocate personnel to

maximize Army resources. Many of the existing goals, decisions, and information requirements essential to mission success will continue to exist within the Army's new force structure. For example, with the implementation of the command structure for Objective Force Units of Action (UA) and Units of Employment (UE), the main difference will reside in who is tasked to accomplish a given goal (and how many people are available to support attainment of each goal) rather than in a change in the mission itself. This fact provides an avenue for determining the SA needs for the future Objective Force – one based on goals, which do not change, rather than physical tasks, which will change dramatically with new force structures, new processes and new technologies.

The objective of this paper is to demonstrate how an analysis of the SA requirements for Army C4ISR operations can shed light on the efficacy of different options that are being considered for the command structure of the future Objective Force. To this end, a form of cognitive task analysis, a goal-directed task analysis (GDTA), was conducted for Brigade staff positions. The GDTA focuses on the goals relevant to successful mission completion for a given position, the decisions that must be made in order to achieve these goals, and the information requirements that are needed in order to make each decision (See Figure 1). Goal-directed task analyses have been conducted for several positions within the current brigade command and control staff. Officers with brigade staff experience as Operations officers (S3), Intelligence officers (S2), Logistics officers (S4), Fire Support officers (FSO), and Engineers were interviewed to define the goals, decisions, and information requirements relevant to successful mission completion with respect to their specific position. These GDTAs can provide insight into proposed force structures by providing support for three types of assessments: 1) an assessment of essential information requirements – that is, their SA requirements, 2) an assessment of likely cognitive

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workload associated with positions of responsibility within a proposed command structure, and 3) an assessment of potential problems and/or benefits associated with a proposed command structure.

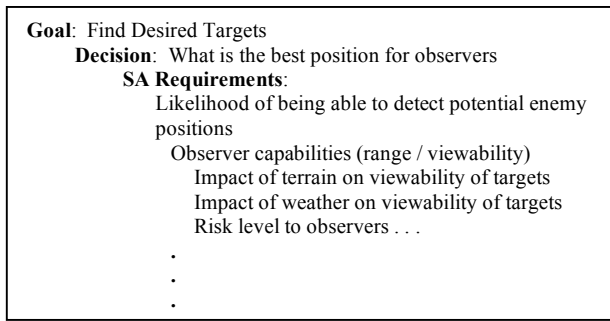


Figure 1: Example subset of FSO GDTA

### ASSESSING INFORMATION REQUIREMENTS

The goals defined by the GDTAs developed for brigade staff positions can be mapped to descriptions of the new roles and goals assigned to officers in the proposed Objective Force structure (TRADOC PAM 525-3-90 O&O) to provide an assessment of the information needs associated with particular aspects of a proposed force structure. For example, according to TRADOC Pamphlet 525-3-0.1, the overall goal of the Fires and Effects Cell is “to plan and coordinate the production of effects resulting from the application of lethal and non-lethal capabilities that support the commander’s intent for mission success” (p. 43). This overall goal is quite similar to that of the FSO, which is to “plan and integrate lethal and non-lethal fires into scheme of maneuver”. Thus, all the goals associated with the brigade FSO position (Figure 2) are also relevant for the Fires and Effects Cell.

However, the goals of the FSO are not sufficient to describe the goals of the Fires and Effects cell, as this cell is also responsible for achieving the desired effects by “shaping operations in the vertical and cyber dimensions, counterstrike, precision strike, mobile strike, joint effects integration, suppression of enemy air defense, interdiction, airspace management and coordination, theater air and missile defense, computer network attack, PSYOPS, and electronic attack” (TRADOC Pamphlet 525-3-0.1, p. 43). By including elements not traditionally the responsibility of the FSO, the goals of the Fires and Effect Cell surpass that of the traditional FSO and includes responsibility for “staff functions traditionally represented by field artillery, army aviation, air and missile defense, USAF liaison, electronic warfare, information operations, PSYOPS, and SJA (Rules of Engagement)” (TRADOC Pamphlet 525-3-0.1, p. 43). Thus, once GDTAs have been completed for these positions, the relevant goals can be combined with those already delineated by the FSO GDTA to provide a

comprehensive picture of the goals, decisions, and SA requirements of the proposed Fires and Effects Cell.

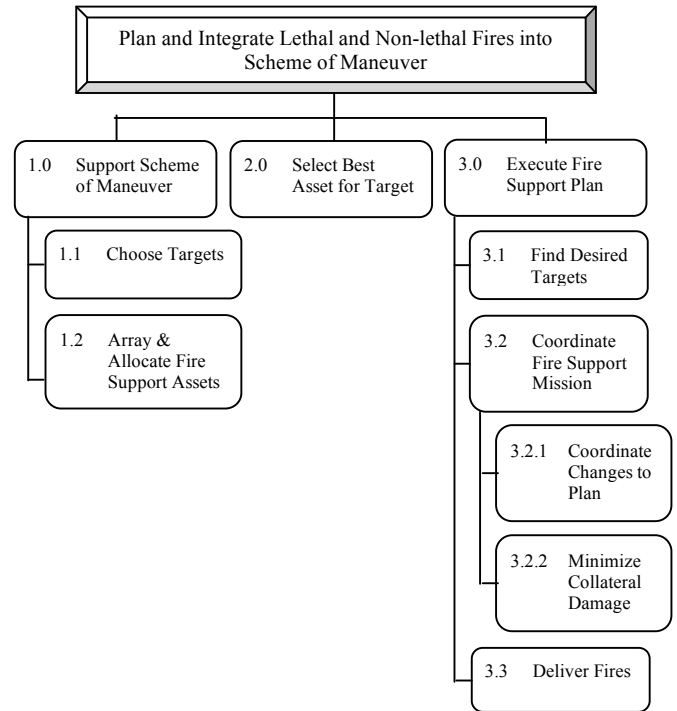


Figure 2: FSO Goal Hierarchy

### EFFECT ON COGNITIVE WORKLOAD

In addition to providing an assessment of the information needs associated with each new position, the GDTA can also be used to provide an assessment of how much workload might be associated with attaining a high level of SA with respect to a particular component of the command and control structure. Because the GDTA focuses on the specific manner in which information is needed to support a goal, it allows for an assessment of how the information needs for different goals either compete with or compliment each other. If successful completion of more than one goal relies on information requirements that are complimentary, the increased demand of having to complete these multiple goals may be minimal. On the other hand, if the information requirements are conflicting in that the type of information required is dissimilar across goals, the cognitive demand on the officer is increased.

For example, the Command Integration Cell’s (CIC) primary focus is “facilitating the commander’s leadership and decision making functions by integrating and synchronizing the efforts of the multi-functional cells” (TRADOC Pamphlet 525-3-0.1, p. 42). The CIC incorporates a variety of goals that stretch across a number of Legacy Force brigade staff positions, including the Commanding officer, the Executive officer, the Operations officer, the Intelligence officer, and the Logistics officer.

For example, among the functional responsibilities necessary to successfully achieve the CIC's mission statement is the responsibility to "orchestrate and supervise all friendly (BLUE) operations" (TRADOC PAM 525-3-90 O&O, p. D-3). Accomplishing this task requires the combining of goals currently spread across various brigade staff positions. Figures 3, 4, and 5 provide examples of positions from which goals relevant to accomplishing this objective are drawn. Figure 3 shows a subset of the Intelligence officer GDTA involving the use of assets to collect needed intelligence information. As this goal is a friendly operation, it falls under the umbrella of the above stated responsibility. Figure 4 shows a subset of the operations officer GDTA. Again, much of what the operations officer does involves orchestrating blue forces, so almost all of the goals from the Operations officer GDTA will be relevant for the CIC. Figure 5 provides an example of goals relevant to the blue forces from the Logistics Officer GDTA that will also need to be accounted for within the CIC.

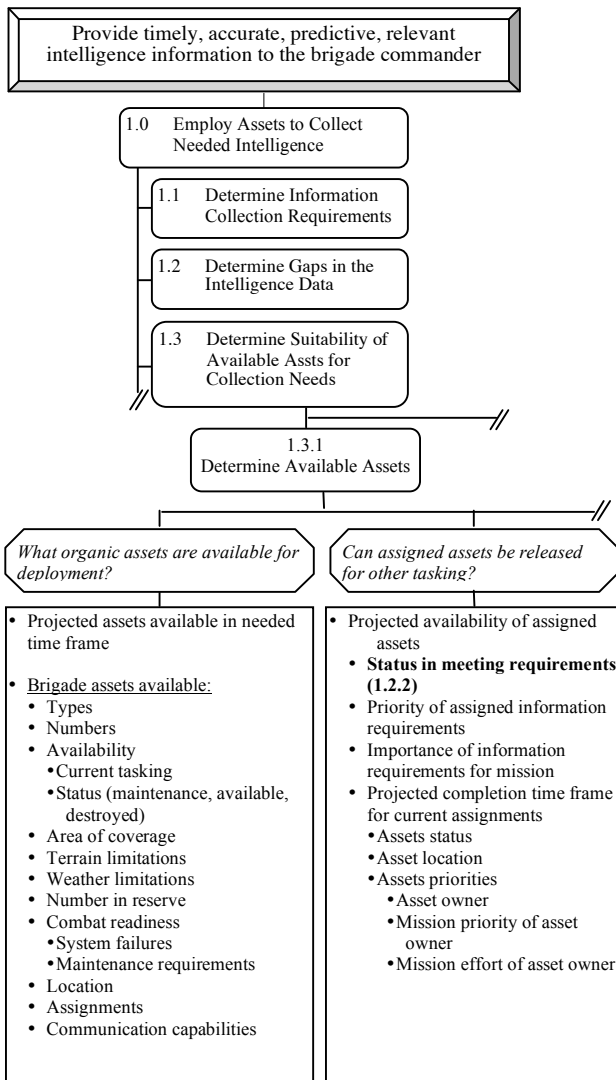


Figure 3: Subset of Intelligence Officer GDTA

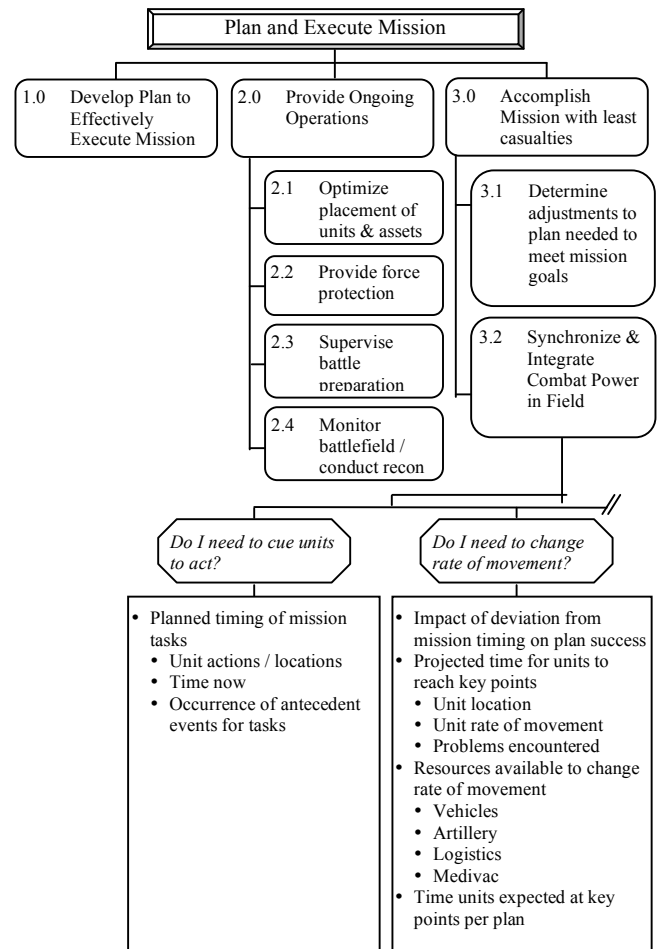


Figure 4: Operations Officer Goal Hierarchy with subset

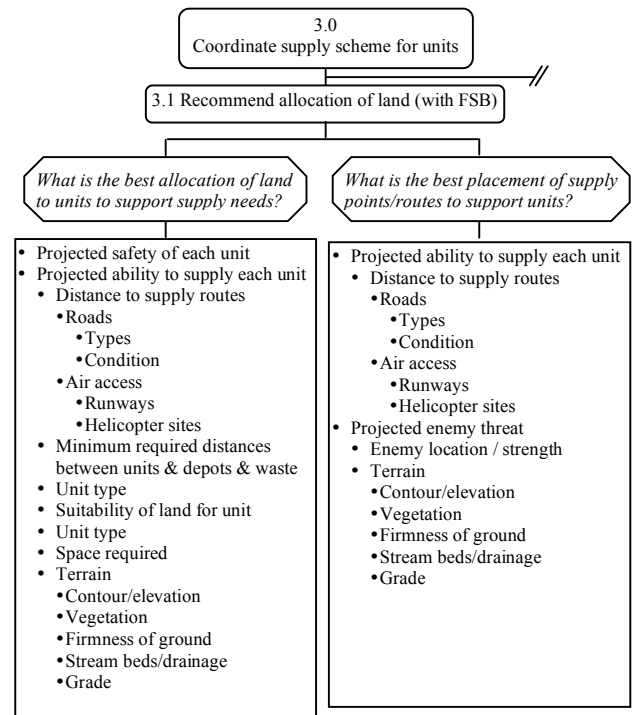


Figure 5: Subset of Logistics Officer GDTA

By comparing the SA requirements essential to each of the goals relevant to the CIC an understanding can be gained regarding the amount of information the CIC must maintain an awareness of in order to achieve a high level of SA. Although a full analysis is beyond the scope of this paper, and the three figures above provide example analysis. First, the relevant goals for each position are evaluated to determine the extent of their similarity or difference. In this case, the goals are each unique and thus they must all be added to the GDTA for the CIC (Figure 6).

- Coordinate Supply Scheme for Units
- Determine Available Assets
- Synchronize & Integrate Combat Power

Figure 6: Combined goals for Figures 3 - 5

Next, the decisions associated with the relevant goals are subjected to the same scrutiny to assess their similarity or difference. Again, in this case all the questions are unique and so they must be retained in their entirety (Figure 7). At times, two goals may share a similar decision point, in which case only a single unique decision will be added to the new GDTA.

- What organic assets are available for deployment?
- Can assigned assets be released for other tasking?
- Do I need to cue units to act?
- Do I need to change the rate of movement?
- What is the best allocation of land to units to support supply needs?
- What is the best placement of supply points/routes to support units?

Figure 7: Combined decisions for Figures 3 - 5

The next level of analysis involves the individual SA requirements. When the exact same SA requirement is needed to make more than one decision, this requirement may be listed once on the SA requirements analysis. This situation indicates that the SA requirement can be met by a single source or display element. At other times, SA requirements may be similar but their required format different, thereby necessitating separate representations in the analysis and on the display. When different decisions draw on the same SA requirements, the decisions are complimentary in that the soldier will experience less of an increase in workload in order to track the essential information than if the SA requirements were the different. The higher order cognitive processes may still differ, however, so an increase in workload is experienced as the soldier must use this information to accomplish different goals. For example, the SA requirements associated with the example questions for the Logistics officer in Figure 5 contain significant overlap (Figure 8). Thus, the basic elements about which the soldier must maintain an

awareness do not increase drastically when responsibility for these two decisions are combined; the basic information requirements are complimentary and do not pose a significant amount of added cognitive workload. However, since the SA requirements must be used to answer different questions, an increase in workload is still experienced.

When goals possess little overlap in their respective SA requirements, combining responsibility for these goals produces a greater increase in cognitive workload. For example, when responsibility for the goal “Determine Available Assets” (previously a goal of the S2, Figure 3), with “Synchronize & Integrate Combat Power in Field” (previously a goal of the S3, Figure 4), the cognitive workload increases significantly since the SA requirements that support these two goals have very little overlap (Figure 9). Thus, combining the goals in this example results in an increase in the overall SA requirements with which the soldiers within the CIC must contend.

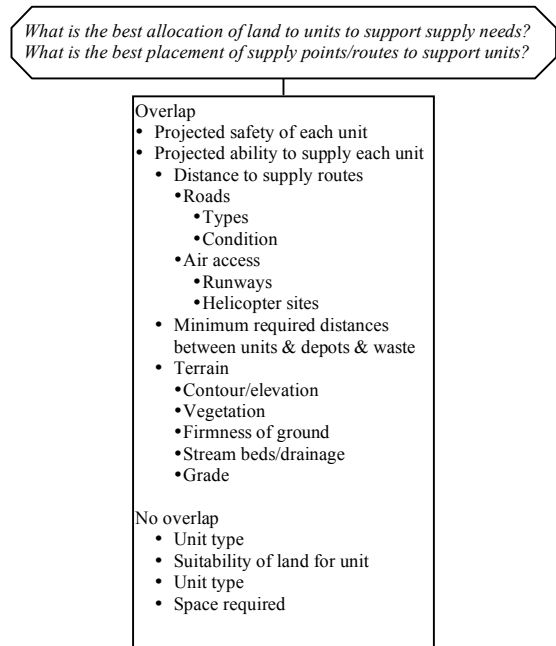


Figure 8: Combined SA requirements for S4 Example

As can be seen by the extensive list of SA requirements shown in the example of Figure 8, combining goals from multiple positions into one cell may require soldiers to maintain an awareness of a large amount of often disparate pieces of information. Further, since the Units of Action within the Objective Force are comprised of a relatively small number of soldiers, coping with large amounts of information within a single cell may be overwhelmingly burdensome. The combining of a large number of goals with different SA requirements creates the potential for increased cognitive load that pushes the human’s cognitive resources to the maximum if not beyond. Keeping the

cognitive demands within the realm of feasibility requires careful consideration be given to the design of the systems used to support these personnel.

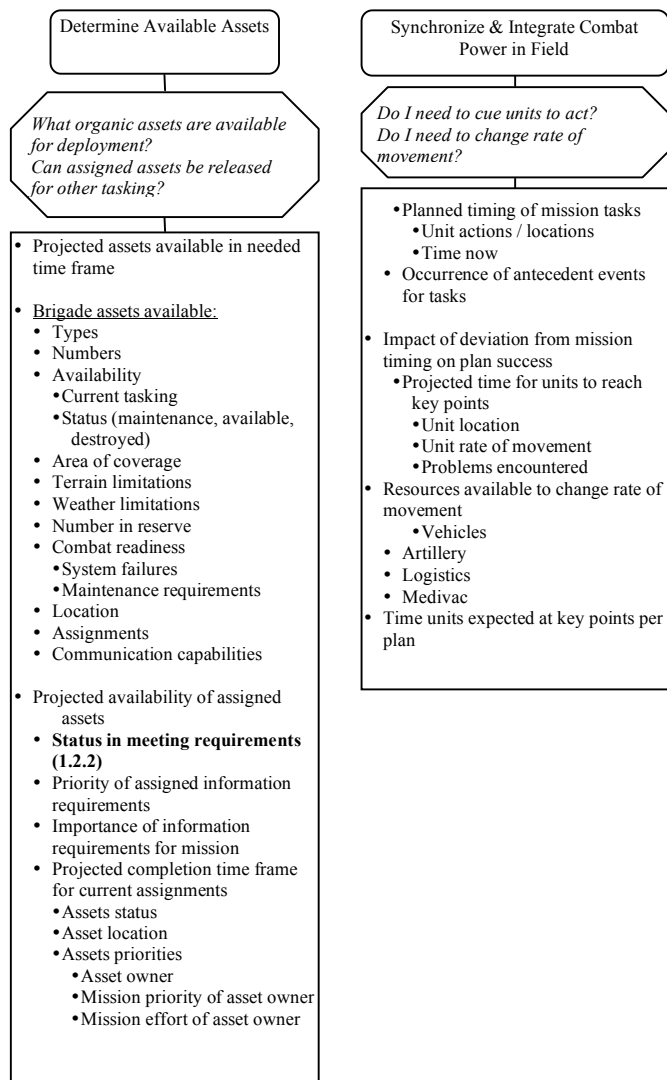


Figure 9: List of SA requirements for combined goals for subset of S2 and S3

## POTENTIAL ISSUES

The GDTA also provides information for assessing the problems and/or benefits resulting from the combination of different positions or different goals within a particular component or across components of the command structure. For example, divisions of goals or sub-goals across multiple positions can show areas where a high level of coordination will be required to meet goals. To illustrate this point, assume that the sub-goals associated with what is currently the Operations officer's goal to "provide ongoing operations" (Figure 4) were divided across different cells. Thus, different cells are responsible for (1) optimizing placement of units and assets, (2) providing force protection, (3) supervising battle

preparation, and (4) monitoring the battlefield and conducting reconnaissance efforts. Although this allocation may seem advantageous in that it spreads the cognitive workload among different cells, in actuality it creates an increased workload of another kind – coordination. Since all of these sub-goals are essential to the larger goal of "Providing Ongoing Operations", they must all be considered when addressing that goal. If various cells are responsible for accomplishing the associated sub-goals, then this information must be communicated to the cell responsible for achieving the higher-level goal. Further, if adjustments need to be made the higher-level goal, these adjustments must be communicated to all the other cells, further increasing the communication load. Finally, if circumstances require that major changes occur with respect to the major goal (in this case providing ongoing operations), the cell responsible for making the change may not have sufficient information regarding the status of lower level goals or the nature of their SA requirements (e.g., what assumptions were made, which information is definitive and which uncertain, how the lower level SA requirements were combined to form the higher level assessments) to make the best decision.

In these cases, communication between the cells responsible for the various sub-goals is required. This type of essential interaction may not be overly problematic if the individual cells are co-located, but if they are distributed, as is the intent of the Objective Force, this communication process becomes much more difficult. Numerous problems are created when these types of interactions must occur between distributed cells including increased demand on individuals and equipment necessary to relay the information to other cells. Consequently, high levels of overlap in goals and requirements are often better supported within a cell than between cells, as a higher degree of workload and bandwidth would be required to support the SA transmission needed for such overlaps across cells.

## CONCLUSION

As the Army looks to restructure operations to better meet its changing needs, maximizing resources to most effectively meet the needs of the soldiers responsible for facing emerging challenges is essential. The Goal Directed Task Analysis provides a tool for assessing the nature of proposed changes in force structure and to evaluate how well the newly defined force components supports or inhibits the soldier's ability to achieve mission goals. By providing for an assessment of the SA requirements associated with specific responsibilities and goals, this method can provide an indication of how well a soldier or group of soldiers will be able to handle the

amount of information about which they must maintain awareness. Further, this method allows for an analysis of potentially limiting side effects of different goal and responsibility combinations across as well as within cells. Finally, the GDTA helps identify areas where SA needs are not being met within the new force structure, thereby identifying requirements for supporting technologies.

#### REFERENCES

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#### NOTE

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