From Data Fusion to Situation Analysis

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Abstract - This paper proposes a new concept, Situation Analysis (SA), in an attempt to merge into a unifying synthesis the main notions put forward by well established data fusion and situation awareness models. In addition to clarifying the original concepts of these models, this synthesis expands on some of these ideas while achieving a fair depth in the level of details and the rigorousness of the resulting generic description. A particular care has been devoted to the selection of an appropriate unifying terminology to designate the fundamental elements of SA. The proposed model both defines the scope of the situation analysis process and establishes a comprehensive framework that could facilitate the dialogue between researchers, technologists, developers, and users of military command decision support systems.

Keywords: Awareness, Situation Awareness, Situation Analysis, Situation Assessment, Data Fusion

1 Introduction

Data fusion (DF) is a key enabler to meeting the demanding requirements of military command decision support systems (DSSs). In this regard, the data fusion model maintained by the Joint Directors of Laboratories’ Data Fusion Group (JDL DFG) is the most widely-used method for categorizing data fusion-related functions [1]. However, despite fairly widespread acceptance of the JDL model, the situation refinement process so essential to DSSs is generally not well understood and enjoys only mediocre consensus [2]. Formal definitions of situation and threat assessment (STA) available in the literature are only imprecise and somewhat disparate; most of the literature mixes the terms and processes of STA. This lack of a unifying terminology that crosses application-specific boundaries has been one of the barriers to advancements in STA.

Aside from data fusion, the term Situation Awareness (SAW) has also emerged as an important concept around dynamic human decision-making. Endsley [3-4] has proposed a general definition of SAW that has been found to be applicable across a wide variety of domains. There is no doubt that this model of SAW put forward by Endsley and the models of the JDL DFG [1] and Lambert [2, 56] for data fusion have great value. However, although each of these models contributes to the advancement of our comprehension of SAW and DF and provides a fair foundation on which one can build, the author considers that they all need to be reviewed and further expanded to a level of detail that could better guide the development of decision support tools by system designers and cognitive engineers. This paper is an attempt to go one more step forward towards an essential understanding of SAW and DF. The paper first recaps the essence of the models mentioned above. Then a new concept, situation analysis (SA), is introduced in an effort to merge into a unifying synthesis the main notions put forward by these prior models. This synthesis clarifies the original concepts proposed and expands on some of these ideas while achieving a fair depth in the level of details and the rigorousness of the resulting generic description. A particular care has been devoted to the selection of an appropriate unifying terminology to designate the fundamental elements of SA.

The paper thus presents a new model that both defines the scope of the SA process and establishes a comprehensive definitional, conceptual, and functional framework that could facilitate the dialogue between people developing DSSs. Although the elements of SAW may vary widely between domains, its nature and the mechanisms used for achieving it can be described generically, at an implementation-independent level of abstraction. In that sense, no algorithms and/or techniques to achieve SA are provided here; in line with Lambert in [5], we are more interested in knowing what SA is rather than how to do it. The resulting description can then be useful across multiple application areas.

2 Data fusion

The following concise definition of data fusion has been proposed by the JDL DFG [1]: Data fusion is the process of combining data to refine state estimates and predictions. Then, the JDL distinction among fusion “levels” provides a way of differentiating between data fusion processes that relate to the refinement of “objects”, “situations,” “threats” and “processes.” Note that the JDL differentiate the levels first on the basis of types of estimation process that typically relates to the type of entity for which state is estimated. If the process involves explicit association in performing state estimates (usually, but not necessarily the case), there is a corresponding distinction among types of association process. The definitions are as follows:

Level 0 – Sub-Object Data Assessment: Estimation and prediction of signal/object observable states on the basis of
Estimation and prediction of tactics

Organizations and operations [10]. As a result, the fusion in nature due to the inherent hierarchies built into defense applications, data fusion processing tends to be hierarchical of the JDL model in [1]). It reflects that in most defense missions, data fusion processing tends to be hierarchical of the JDL model in [1]). It reflects that in most defense applications, data fusion processing tends to be hierarchical of the JDL model in [1]). It reflects that in most defense applications, data fusion processing tends to be hierarchical of the JDL model in [1]). It reflects that in most defense applications, data fusion processing tends to be hierarchical of the JDL model in [1]). It reflects that in most defense applications, data fusion processing tends to be hierarchical of the JDL model in [1]). It reflects that in most defense applications, data fusion processing tends to be hierarchical of the JDL model in [1]). 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As a result, the fusion process also progresses through a hierarchical series of inferences at varying levels of abstraction.

3 Refinement of the JDL model

Lambert [2, 5-6] states that, in its current form, the JDL model provides only a weak framework in which its components enjoy varying degrees of conceptual and theoretical maturity. He then seeks to sketch a more mature, strategic foundation for understanding data fusion based around the JDL model, and provides the following revision of the JDL definitions:

Data fusion is the process of utilizing one or more data sources over time to assemble a representation of aspects of interest in an environment.
Object fusion is the process of utilizing one or more data sources over time to assemble a representation of objects of interest in an environment. An object assessment is a stored representation of objects obtained through object fusion.

Situation fusion is the process of utilizing one or more data sources over time to assemble a representation of relations of interest between objects of interest in an environment. A situation assessment is a stored representation of relations between objects obtained through situation fusion.

Impact fusion is the process of utilizing one or more data sources over time to assemble a representation of effects of situations in an environment, relative to our intentions. An impact assessment is a stored representation of effects of situations obtained through impact fusion.

According to Lambert [5-6], object fusion exists because in our interaction with the world, we are inclined to associate bundles of near-coincident observable properties with objects, and to associate the persistence of those objects with the observed existence of those properties under periodic review. Object assessments allegedly document persistent objects having properties, and in an engineering context, these properties are usually measurable. The conceptualization of a world of objects with properties is a fundamental characteristic of every object assessment. However, Lambert does not stop there. He further discusses the emergence of relations as a conception over and above properties, leading to the notion of a world of facts as the fundamental substrate, where facts are subsequently understood as the application of relations to objects. Hence, thus far, object assessments assess a world of objects, while situation assessments assess a world of facts.

But the conceptualization is not complete yet. When engaging the world, we rarely attend to individual facts in isolation. Typically we form mental snapshot pictures of the world over some limited time frame and region, and in assessing this picture we are naturally inclined to represent it as a collection of facts. Lambert terms these collections of facts, events. We are also inclined to associate collections of these events when comprehending the world. These collections of events Lambert terms scenarios. The term situation is applied to mean an event or a scenario. He finally concludes that situations are essentially collections of related spatio-temporal facts, where facts consist of relations between objects. Here the world is a world of situations, and assessing the world involves individuating situations. Situation assessment involves assessing situations, not facts or objects per se.

With respect to level 3 fusion, Lambert states that it is about how our beliefs derived from level 2 fusion impact upon our will, i.e., the effect of situations on our intentions, and thus, level 3 interprets the world in terms of opportunities and threats, with a view toward maintaining the satisfaction of our intent. Our will determines what is of interest to us. Assessing how predicted situations will impact upon our intentions requires self awareness of our own intentions and an understanding of how our beliefs and other mental states influence our intentions.

4 Situation awareness

The term Situation Awareness (SAW) has emerged as an important concept in dynamic human decision-making. Endsley [3-4] has proposed a general definition of SAW. She describes SAW as “the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future.”

The perception of cues is fundamental. Without a basic perception of important information, the odds of forming an incorrect picture of the situation increase dramatically [3]. Endsley also states that SAW as a construct goes beyond mere perception. It also encompasses how people combine, interpret, store, and retain information. Thus, it includes more than perceiving or attending to information; it includes the integration of multiple pieces of information and a determination of their relevance to the person’s goals. Such a comprehension of a situation demands that the problem of meaning be tackled head-on. Meaning must be considered both in the sense of subjective interpretation and in the sense of objective significance or importance. A person with situation comprehension has been able to derive operationally relevant meaning and significance from the data perceived. At the highest level of SAW, the ability to forecast future situation events and dynamics marks decision makers who have the highest level of understanding of the situation. This ability to project from current events and dynamics to anticipate future events (and their implications) allows for timely decision making.

5 Situation analysis

In her model, Endsley presents SAW as a stage separate from decision making and action. SAW is described as the decision maker’s internal model of the state of the environment. Based on that representation, the decision maker can decide what to do about the situation and carry out any necessary actions. SAW therefore is represented as the main precursor to decision making. This is illustrated in Figure 3, built around Boyd’s OODA loop.

Figure 3: Situation analysis and decision making

In this perspective, we define situation analysis as: a process, the examination of a situation, its elements, and their relations, to provide and maintain a product, i.e., a state of SAW, for the decision maker. As shown in Figure 3, the SA process thus encapsulates that part of the overall
of the situation through data/information collection with various sensors and other sources. Situation comprehension is about further developing one's knowledge of the situation with respect to both its nature, i.e., the inherent character or basic constitution of the situation, and its significance or meaning, i.e., the importance, the impact and/or the implication of the situation. This sub-process must be able to grasp the nature of the situation, and to derive operationally relevant meaning and significance from the results of situation perception. Situation projection must produce an estimate of future possibilities for situation elements, based on current trends. Finally, situation monitoring has to do with watching, observing, or checking the evolution of the situation in order to ultimately keep track of, regulate or control the operation of the SA process.

Figure 5 is a detailed functional description of the SA process. From a data-driven perspective, it entails integrating and interpreting the whole spectrum of source data and information, ranging from radar returns to political factors. The SA process thus encompasses a vast range of activities, from the detailed signal processing associated with target acquisition and tracking, to intelligence interpretation. Simply put, the process must provide answers to a great number of questions: What? Who? How many? How big? Where? What structure? When? What is it doing? Why? Build up? What could it do? How soon? What is outstanding? What has changed? Delta from expectations? What is going wrong? and many others. The SA process thus consists of numerous dependent and independent sub-processes, or capabilities, at multiple levels of abstraction. Every sub-process can itself be further decomposed hierarchically into multiple sub-processes.

These SA capabilities must be integrated and interleaved into an overall processing flow. Regarding this issue, one should note that there are no arrows on the diagram of Figure 5. Moreover, although SA is clearly a multiple level-of-abstraction activity, there are no explicit references to the JDL data fusion "levels" in the model. According to [1], the data fusion levels are intended only as a convenient categorization of data fusion functions. They were never intended to be, nor should they be taken as a prescription for designing systems: do level 0 fusion first, then level 1, then level 2, etc. The SA capabilities should rather be regarded as agents having some degree of autonomy, each one interacting with its own changing environment that could be the external physical world, or the other agents. Hence, there is a requirement that the SA capabilities must, at a minimum, communicate with one another or, ideally, cooperate with one another. Any capability can communicate to any capability. This is in line with the data fusion notion of process refinement. SA capability results (or states) are generally correlated with each other, so that good estimation of certain states is likely to yield good estimates of other states, provided the SA process is cognizant of the underlying correlations [7]. The capabilities at the higher levels of abstraction build on the results produced by the lower levels, and they also feed
back conclusions to these lower levels in order to fill in unknowns. For example [9], entities perceived near a river (context) might be characteristic of elements of an engineer battalion (identification) and, because of their presence near a river and on the opposite side from the friendly forces (context), a bridge-building mission might be inferred (intent, situation classification/recognition).

Given the inherent data-driven bias of traditional data fusion practitioners, there is a natural tendency to look at Figure 5 through a "clockwise rotation" perspective, i.e., starting with acquisition/collection, and then going sequentially through structured description (integration/abstraction), classification/recognition, assessment, projection, impact, and monitoring. But it doesn’t have to be like that. On one hand, the SA process may start anywhere; there are multiple asynchronous entry points. On the second hand, human information processing in operating complex systems is seen as alternating between data-driven (bottom-up) and goal-driven (top-down) processing. This alternation is viewed as critical in the formation of SAW. In goal-driven processing, attention is directed across the environment in accordance with active goals [3]. The decision maker actively seeks information needed for goal attainment and the goals simultaneously act as a filter in interpreting the information that is perceived. In data-driven (or stimulus-driven, reactive) processing, perceived environmental cues are processed to form SAW and may indicate new goals that need to be active. Dynamic switching between these two processing modes is one of the most important mechanisms underlying SAW.

Although the discussion so far has a slight "technology flavor", no particular a priori human-machine allocation is presumed for the proposed model of SA. At least in principle, each capability in Figure 5 could be performed by humans and/or computers. Clearly, the current technology alone is not sufficient to fully implement the SA process in computers. There is thus an optimal mix of human and technology that can be defined for SA, but this issue is out of the scope of this paper. However, one could say that the proposed model should enable human factors specialists and knowledge engineers to model the tasks as well as the knowledge and data structures that are key ingredients in the SA process.

### 5.1 Situation model

The main purpose of the SA process is to assemble a representation of aspects of interest in an environment. This is in line with the ideas of Lambert [2, 5-6]. The SA process thus incorporates and develops an internal situation model of itself and the environment in which the process operate. This situational model, that the SA process endeavors to keep up to date, captures not only the representation of the various elements of the situation, but also a representation of how they relate to create a meaningful synthesis, i.e., a comprehension of the situation. There is one real world, and the situation model is an abstraction of it [2]. Among other things, it is abstract in the sense of being incomplete (as our attention to the world is selective) [5].

### 5.2 Situation element acquisition

A number of sources provide data/information to the SA process at a variety of levels ranging from sensor data, to a priori information from databases, to human input [8]. Hence multiple types of dynamic and static data/information are made available to the SA process. Source examples include sensors, prisoners, local populace, HUMINT, other Blue staff, reference information, etc. The sources provide only limited observables, coverage, resolution, and accuracy [10]. In the "acquisition" of the situation, various separate and distinct entities, events,
and/or activities are perceived. It is also worth noting that some evidence comes in group form, for example a raid report, or the information has to be dealt with as a group because of sensor resolution limitations. With respect to the environment perception sub-process, terrain and weather analysis is focused on their effects on friendly and enemy capabilities to move, shoot, and communicate [7]. Given weather and terrain conditions, execution doctrine determines how the enemy will fight.

5.3 Data alignment and association

As discussed above, data/information related to an entity, a battlefield event, a group, etc., will often be reported independently via a multiplicity of sensors/sources, each differing in coverage area, spectrum, resolution, response time, and observable sensed [7]. Common referencing is the processing of input reports to achieve a common time base and a common spatial reference [8]. Data alignment must remove any positional or sensing geometry and timing effects from the data/information [7]. The sub-process also transforms source data into a consistent set of units and coordinates for further processing [8]. Data association (i.e., data origin uncertainty management) is a basic data fusion process necessary to determine which input data elements associate to which situation element in the field of view (for example, whether entity data, which have been reported by different sources, represent the same entity or different entities).

5.4 Situation element perception refinement

In the presence of uncertainty for a complex environment, where an unknown number of entities are entering the volume of interest at any time, while some others are leaving this same volume or are destroyed (we also include here the random false alarms and the clutter), there is an evident requirement for an existence analysis sub-process. Referring to the target tracking terminology, once tracks are formed and confirmed (so that background and other false targets are reduced) and low quality tracks have been deleted, the number of targets can be estimated. Note that the number of groups, and their size, is also of interest. Situation abstraction [10], that includes both situation generalization and situation specialization, is an interesting concept with respect to existence analysis. Situation generalization allows bottom-up abstraction of entities, events, or groups that are either not directly measurable or not perceived, to be inferred [10]. Situation specialization is a form of top-down reasoning where subordinate elements are deduced or inferred. Situation abstraction attempts to fill in missing information and to develop a more complete and integrated situation representation than is possible using reasoning based strictly on direct observables. The kinematics analysis sub-process assembles a representation of the kinematic properties of the situation elements maintained in the situation model. Identity analysis is the sub-process by which some level of identity of a situation element is established, either as a member of a class, a type within a class, or a specific unit within a type [8].

5.5 Situation element contextual analysis

One crucial aspect of successful SA is understanding that the various assessments optimally derive from examining the data/information from multiple contextual viewpoints [7]. The context is the interrelated conditions in which something exists (entity) or occurs (event). Hence, as we progress through it, we desire the SA process to represent more than just measurable properties of situation elements; relationships among them are also a key aspect of interest [1-2, 5-6]. The contextual analysis capability thus develops a description of all sorts of relationships among situation elements: physical (is composed of), spatial, proximity, temporal, structural, organizational, perceptual, functional (involves/requires/providers), functional (e.g., supply, communications), process (performs the process of), causal, informational source/recipient, influence source/recipient, sequential dependency (occurs conditional upon), temporal dependency (occurs when), etc. Clearly however, we are talking here about relationships of interest between situation elements of interest. Given these relationships, group formation and refinement is made possible. By forming individual situation elements into groups, further inferences on attributes, identity, allegiance, function and mission may be possible. Groups also form a fundamental component of SA for inferring what tactics the total set of enemy entities are employing.

5.6 Situation element interpretation

Once an entity has been perceived, its kinematics have been determined and it has been identified, the decision maker typically wants to know what the object is doing, i.e., its behavior [11]. It is the particular manner in which something bears, conducts, or comports itself. It is highly linked to the notions of performance and action (i.e., activities). Behavior related to threat assessment can include elements of positional information: direction, speed, and maneuvers. It can also include operation of equipment: jamming, using radar or laser systems, opening weapon bay doors, and releasing weapons. Not all of these aspects of behavior are likely to be found at the same time, and the same combination of behavior elements may have different threat connotations depending on circumstances. Note that besides threat assessment, behavior can be a source of information for other SA capabilities such as kinematics and ID analyses.

The SA process also performs an analysis of the level of activity. For example, an increase in the level of communications may indicate movement of units. An increase in the level of use of active sensors may be an indication of an abnormal activity. In general, the monitoring of the level of activity may highlight a build up during the development of a crisis. Decision makers are often interested in having a description of the latest known enemy activities in an area. Lastly, note that the absence of activity is also of interest.

In military environments, account has to be taken of the intentions of the forces concerned [11]. The notion of intent
revolves around the ideas of aim, goal, target, objective, plan, and purpose. An intention is a determination to act in a certain way. Intent estimation has a lot to do with interpreting or explaining, i.e., give the "why", the reason for or cause of, the presence of entities or their behavior. Some part of intent analysis may be seen as a plan recognition activity. Some elements of a tactical plan may be identified that may be used to infer the missions of unknown units whose presence was previously unexplained. Ultimately, estimates must be made of the Red war plan that defines why, where, and when the enemy will enter into combat and with what force structures, schedules, and operations [7].

5.7 Situation classification and recognition

Situation classification is the systematic arrangement of situations in groups or categories according to established criteria. It has to do with the cataloging and sorting of situations. Multiple abstract models of situations may be available a priori. Associated with these models may be schemata of prototypical situations. Critical cues in the environment may be matched to such a priori schemata to indicate prototypical situations that provide instant situation classification and comprehension [3]. Situation recognition is the action of perceiving the situation to be something previously known. A very familiar situation, whatever the level of danger, may simplify decision making. Note however that such practice may lead to mental fixation, sometimes with deleterious or disastrous consequences (failing to foresee massive deception or a successful surprise attack, not anticipating enemy behavior on the battlefield, and the like) [7]. Unfamiliar situations may trigger various actions from the SA process (e.g., tasking the data collection sources to gather more information).

5.8 Situation assessment

To assess a situation is to determine the importance, size, or value of this situation. A situation assessment is thus a quantitative evaluation of the situation that has to do with the notions of judgment, appraisal, and relevance. While behavior analysis is about what entities are currently doing, the capability/capacity analysis sub-process is about what they could do. This includes various force evaluation functions that will determine what are the assets of the participants (own or enemy). Situation assessment also attempts to determine important intangibles for the forces: moral, psychological state, level of training, stability under stress, strength of will, etc. [7]. The salience of something is the striking point or feature of this thing. The perceptual salience of environmental cues is the degree to which they drew attention [3]. Salience analysis must evaluate what is outstanding in the current situation (e.g., an exceptional event, an entity that requires special attention, etc.).

5.9 Situation element projection

This SA capability is necessary because one is not only concerned with what is happening, but also with what events and/or activities are going to happen next. The decision maker can never influence the present, only the future. Hence, knowledge of the current world state is only of value as a contribution to understanding the future. Situation element projection must produce an estimate of future possibilities for situation elements, based on current trends and expectations. Ultimately, the predictive capability can include story building, simulation, war gaming, engagement modeling, etc.

5.10 Impact assessment

Impact means the force of impression of one thing on another; an impelling or compelling effect. There is the notion of influence: one thing influencing another. In that sense, impact assessment estimates the effects on situations of planned or estimated/predicted actions by the participants, including interactions between action plans of multiple players. It draws inferences about enemy threats, friendly and enemy strengths, vulnerabilities, and reinforcement capabilities, cost and utility implications of estimated situations, problems and opportunities for operations, etc. Accurate impact assessment requires applying the concept of "shifting perspectives" to the data/information to develop an optimum viewpoint of the situation [7]. This means examining the data from each of red, blue, and white viewpoints.

Assessment of actual or potential threats is obviously useful. A threat is an expression of intention to inflict evil, injury, or damage. The focus of threat analysis is to assess the likelihood of truly hostile actions and, if they were to occur, projected possible outcomes [7]. Based on capability and intent (and to some degree, on opportunities as well), threat analysis generally attempts to compute some threat value for the situation elements that estimates the degree of severity with which engagement events will occur. This amounts to (1) quantitatively portraying the force capability, and (2) coupling this picture with an estimate of intent [7]. Once the hostile intent of an entity has been clearly established, then the significance of the threat is in proportion to the perceived capability of the enemy to carry out that threat.

5.11 Situation watch

As part of situation monitoring, the purpose of situation watch is to keep the evolution of the situation under close observation. It must pay attention to changes in various aspects of the situation and provide alerts to the significant ones. It must keep awake and vigilant to maintain a state of alert and continuous attention for the SA process in order to guard and protect it from missing important entities, events, or activities. For example, monitoring the outcome of an engagement (e.g., kill assessment) in real time is important. The diagnostic sub-process must estimate the difference between the current perceived situation and the projected one. For example, given predictions of enemy intentions, situation watch must identify areas of interest that should be monitored for verification of those predictions [7]. Subsequent observed cues can then either be bizarre, irrelevant, unexpected, or absent (i.e., absence of expected).
Discrepancies become the basis for requests, through the process refinement capability, for additional collection and for expanding the scope of the analytical evaluation [7]. In any case, the decision maker should be alerted to the inconsistent, unexpected absence of activity.

5.12 Process refinement

Process refinement seeks to optimize the overall SA process, with respect to the decision maker(s) dynamic goals and restrictions and the process requirements and constraints, by supporting global control of both the information collection and analysis process resources [9]. Goal management is clearly required for the SA process. At any given time, the decision makers have many tasks on their queue in various stages of completion [3]. The urgency associated with individual tasks changes with the passage of time or with the acquisition of new information. With constantly changing priorities, information needs are also constantly changing. The way the "attention" of the SA process is employed in a complex environment with multiple competing cues is essential in determining which aspects of the situation will be processed to form SAW. The object of attentional allocation is to maximize the information content gleaned from the sources [7]. When not controlled or guided by a global strategy, data/information sources act as "vacuum cleaners", collecting, along with vital information, totally redundant, unnecessary, and unwanted data/information. The analysis of massive amounts of irrelevant data can severely burden both manual and automated SA processes. Hence, based on recognized information deficiencies and potentially available collection assets, process refinement generates prioritized information requirements that are sent to the collection manager [9].

Process refinement also plays an important role in assessing the quality of the data to be analyzed. In this regard, some assessment of enemy countermeasure activity must be performed to better quantify the confidence the decision maker can have in the abstraction and assessment of the situation derived from the multi-source data/information. Attempts to disrupt SA (i.e., situation-estimating "countermeasures") involve concealment, cover, deception, i.e., CC&D, and creation of ambiguity [7]. The SA process is vulnerable to CC&D at each step. Finally, system awareness is especially important in complex, highly automated systems. Resource awareness is needed to keep track of the state of currently available resources, including both physical and human resources.

6 Conclusion

This paper proposed a new concept, situation analysis, in an attempt to merge into a unifying synthesis the main notions put forward by well established data fusion and situation awareness models. Situation analysis, as described in this paper, is a complex process, requiring deep knowledge of military operations and doctrine, military equipment characteristics, the effects of terrain and weather on operations and equipment, and a host of other factors including even such intangibles as a sense of the enemy's will to fight. It was a goal of this paper to provide a foundation for understanding situation analysis. In that sense, the SA model described here is generic, and is intended merely as a basis for common understanding and discussion among military researchers and developers for creating systems that support SA. The next step would be the development of a "theory" of situation analysis. The fact that such a theory does not exist makes it difficult to assess the suitability of various available processing methods [7]. The key point is that, in considering solutions to SA problems, we should avoid the lure of the technology push (the familiar "solution in search of a problem" syndrome), and assure ourselves that our solution approach is based on a requirements-driven analysis. Not having a theory of the SA process increases our vulnerability to possibly forcing a solution onto the problem.

References

[1] Steinberg, A. N., Bowman, C. L. and White, F. E., "Revision to the JDL data fusion model", Joint NATO/IRIS Conference, Quebec City, October 1998.