DECISION-MAKING SUPPORT APPLICATION REDUCING THE MILITARY AIR TRAFFIC CONTROLLER`S ERRORS WHEN DEALING WITH THE AIR THREAT

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Abstract: *For military air traffic controllers is time always the biggest enemy when solving an extraordinary or threat situation. People need enough time to analyse, decide and to spread important information to another site. The decision process always suffers from lack of time and obviously brings human errors which can lead to accidents or even fatalities. This article deals about human factor and points out that software decision-making support aids are necessary for military controllers and authorities responsible for weighty decisions.*

Keywords: *error, threat, attribute, decision-making process, military air traffic controller.*

1. HUMAN ERROR

While the number of aviation accidents attributable solely to mechanical failure has decreased markedly over the past decades, those attributable at least in part to human error have declined at a much slower rate. Given such findings, it would appear that interventions aimed at reducing the occurrence or consequences of human error have not been as effective as those directed at mechanical failures. Clearly, more emphasis must be placed on the genesis of human error as it relates to accident causation.

The human-factors programme is a long-term and never ending effort, with the aim of improving safety to higher levels. It is the primary and permanent goal both for civil and military aviation. Human error is a causal or contributing factor in the majority of aviation occurences. All personnel commit errors, although there is no doubt they did not plan to have an accident. Errors must be accepted as a normal component of any system where humans and technology interact. They are a natural bi-product of virtually all human endeavours. Errors may occur at the planning stage or during the execution of the plan. Errors lead to mistakes – either the person follows an inappropriate procedure for dealing with a routine problem or builds a plan for an inapproriate course of action to cope with a new situation. Even when the planned action is appropriate, errors may occur in the execution of the plan. On the understanding that errors are normal in human behaviour, the total elimination of human error would be an unrealistic goal. The challenge then is not merely to prevent errors but to learn to safely manage the inevitable errors.

One of the more common error forms, decision errors, represents conscious, goal-intended behavior that proceeds as designed; yet, the plan proves inadequate or inappropriate for the situation. Often referred to as "honest mistakes," these unsafe acts typically manifest as poorly executed procedures, improper choices, or simply the misinterpretation or misuse of relevant information. In contrast to decision errors, the second error form, skill-based errors, occurs with little or no conscious thought. The difficulty with these highly practiced and seemingly automatic behaviors is that they are particularly susceptible to attention and/or memory failures. As a result, skill-based errors such as the breakdown in visual scan patterns, inadvertent activation/deactivation of fundamental application, forgotten intentions, and omitted items in checklists often appear. Even the manner (or skill) can affect safety.

2. THE NEED FOR DECISION SUPPORT TOOLS

The performance of the human element cannot be specified as precisely. We should also take into account the fact that incidents rarely, if ever have a single cause. They usually occur as part of a sequence of events in a complex situational context. Even if not altogether avoidable, human errors are manageable through the application of improved technology, relevant training and appropriate regulations and procedures.

Air defence decision making process has severe (possibly catastrophic) consequences for errors. It is a complex task accomplished by a team of highly skilled personnel. It requires mental integration of data from many sources. Air defence personnel is responsible for all aircraft in their surveillance area and must maintain awareness of available resources, monitor audio and verbal messages and prepare situation reports. Although almost all of the control centres has a high tech equipment, critical data are still manually recorded on a desk, whiteboard or notepad. In this environment, it can be difficult to for Air defence team members to notice or identify key pieces of information that may enable them to better understand the tactical situation. Air defence personnel in real-world are working under conditions which comprise dynamic, fluid situation; time pressure; high-risk multiple decision makers; shifting and competing goals; action feedback loops and situations with uncertain and incomplete data.

3. DECISION-MAKING SUPPORT APPLICATION

A Decision-making support application (DMSA) is a computer-based software application for military air traffic controllers (MATC) that supports and speed-up decision-making activities especially concerning the threat situation. DMSAs can serve on every MATC positions and help to take necessary steps against the menace, which may be rapidly changing and not easily specified in advance. The goal of this support tool is to

present decision support information in a format that minimises any mismatches between the cognitive characteristics of the human decision maker and the desing and response characteristics of the decision support system. DMSA creates as an outputs transformed data generated by algorithm based on user criteria. DMSA offers focusing attention on high priority contacts (and alerts), as well as on missing data and enabling the decision maker to use more data than are typically used in common systems (compared to normal values). Common systems used by MATC require the user to retain previous contact data in memory to compare with the most recent values for critical parameters. These systems also require the user to rely on recall of vast amount of information from training and experience. Presenting all known data on a contact in a synthesized way should reduce working memory requirements and facilitate recognition. Additional features offered by DMSA include displaying the complete kinematic contact history, presenting graphic displays of location an its prediction, highlighting missing data, providing alerts and providing assessments of current contact identity that go beyond what existing systems now present.

The systems like DMSA are widely used in civilian air transport but in military are missing and desperately necessary. The DMSA should be flexible, easy to operate and with real time dissemination of info. Each MATC position as Tower, Radar, CRC and National authorities should have their own setup focusing on the specific cues.

4. PROCESS

The environment is permanently scanned for attributes relevant to the active template. All data are collected from primary and secondary surveillance radars, intelligence info and other units contributing to system. The set of available attributes to be evaluated are then selected from the input. Finally, the perceived data are compared to the expected data (e.g. deviance from flight plan).

According to foreign studies and empirical domestic research there were identified up to 15 attributes, but not all of them are described as critical. The list of major of them is following (order is not fixed and can be varied depending on MATC position and location): Country of origin; Intel report; IFF mode; Deviation of Flight Plan; Altitude; Speed; Civilian/Military; Supicious behaviour of aircraft crew; Radar signature (where primary radar info is available); Number and type of aircraft, ordnance; Maneuverability of aircraft.

Beside these attributes the tool should offer various alert signalisations depending on the unit designation and geographical position and many options concerning safety lines and ranges setting. The most applicable are: Short Term Conflict Alert (STCA); Minimum Sector Altitude Warning (MSAW); (Predicted) Horizontal and vertical violation of prohibited areas; Deviation of flight route / flight plan.

During the DMSA evaluation was observed that:

1. The attributes were weighted differentially depending on each position and evaluator`s skills and experiences.
2. Air defence personnel did not rely on all data and was influenced by conflicting data in specific attributes rather than the overall pattern of data.

Overall threat level was not related to the number of attributes that were evaluated during threat assessment, but was related to the degree of fit of observed data to expected data ranges in the evaluator`s active template.

5. GRAPHIC INTERFACE

The display is designed to present the relevant data necessary for a commander to evaluate all likely explanations for what a potential target might be and what it might be doing. There are various display modes of DMSA – graphical, numerical, or combination of both. Experiences show that graphical mode was prefered on every tested position, because number could implied a false sense of accuracy. Its main advantage is that a large amount of parametric data should be portrayed graphically for rapid assimilation by the user. The user can see, at a glance, a synthesized picture of the contact`s behaviour. Graphic presentation should reduce the amount of mental computation required to perform tasks and allow users to spend less time searching for needed information. Graphic also allow users to omit steps that are otherwise necessary when performing a task without a graphic. An example of this advantage is that to determine whether the aircraft is within the range to reach the airport, there is no need to recall the specific range values and then compare them with the aircraft`s current range. Instead, the user can determine if the aircraft is within its launch range by a quick glance at the display. Generally, graphics help users save time when searching for needed information when several related dimensions of information are encoded in a single graphical object.

6. INTERFACE GUIDELINE SUGGESTIONS

The window should contain an indication of threat rating, threat prediction and history and a comprehensive list of attributes. Users could drag the window anywhere on the screen, but normally it will be hooked close to the track. Each threat evaluator can accomodate the number of displayed attributes, add or remove them according to own discretion. However, the main (critical) attributes will be displayed permanently. Threat ratings should be displayed with verbal descriptors (e.g. high, medium, low) rather the numbers of percentages. The utility showing threat ratinghistory is giving feedback on a proposed threat assessment interface and enables better sense of track history.

Threat assessment window have to provide a list of all relevant attributes. A comprehensive list avoids several biases and is consistent with user preferences regarding verification and confidence. In addition, the full list should help avoid over-reliance on only a few attributes. For some of them, the corresponding data values (e.g. speed, altitude, distances) should also be displayed. Each attribute should have a graphic frequency indicator that shows how far the data value deviates from the attribute`s expected value. This method of display would help avoid familiarity biases, over-reliance on a subset of cues. Displaying attributes in order of preferred use would not overcome user`s reliance on the first few ones, or the influence of a change to one of the high-weighted.

7. CONCLUSION

Perhaps because air threats are rare events only few organizations are prepared when one occurs. The situation in the Army, respectively the Air Forces is not an exception. Many organizations, airliners and airports do not have effective plans in place to manage events during or following an emergency or crisis. Managing of a crisis situation depends on succesfull handling the first few minutes. So errors occured right in the beginning of the decision making process are then very hard to eliminate and could lead to fatal consequences.

Human is the last, most important, but also generally the weakest element in decision-making process. According to all available and relevant information he must make the final statement and, of course, bear the consequences. Due to the multi-tasking, tempo, integration demands and short term memory requirements, the task of the Air defence decision maker can be characterized as challenging between normal and extreme conditions. That is the reason why automated help tools like the DMSA are now becoming indispensable (neoceniteľnými) in modern air traffic management. The intension is to aid the decision maker by providing information in a way that will minimize the need to maintain information in working memory, reduce information processing demands, help focus attentional resources on the highest priority contacts, help make decisions under stress and support higher levels of situation awareness.

This article discussed about human errors as an irremovable part of air traffic management and the development of guidelines for displaying threat information to decision makers. The DMSA is set to conform to the expectations of so-called primary decision makers responsible for the first steps of threat recognition and to carry out adequate measures and also for the final (strategic) decision makers (national authorities) to take weighty decisions. It displays the data that they need, in order in which they use it, thereby contributing to their rapid assimilation of the information. All the features of DMSA should help users avoid common decision-making biases and reduce the likelihood of misses and false alarm errors.

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