Technical Evaluation Report

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1.0 INTRODUCTION

1.1 Background

The Critical Design Issues for Human-Machine Interface Symposium was planned to create an opportunity for HMI specialists to meet, discuss and present papers dealing with emerging technologies and future innovations in HMI. The people-technology intercept, is an important issue for system engineers, human factor experts, training specialist and operators. While HMI can be as simple as the grip on a hand tool, modern military platforms are complex and the human in the loop needs to be the central focus in the design. The human operator whether in a manned or unmanned platform can only perform a given amount of task in a given amount of time. Therefore, as specialist, we need to be certain that the task performed are optimized and user friendly in the systems designed and that these systems allow maximum human performance.

1.2 Purpose and Scope of the Symposium

Through the discipline of human factors, system engineering establishes the requirements needed to limit the amount of information that can be displayed and processed by a human operator. Besides the problem of information processing, a critical issue is how to best display this information to assure maximum human performance and thorough situational awareness.

The focus of the symposium was:

- Innovative HMI architectures

- Emerging and future HMI technologies

- Application of intelligence systems and decision aids

- Information processing prior to display

- Workload Management

- Distribution of workload authority between the operator and the system

- Self adaptive automation for rapidly evolving scenarios

1.3 Symposium Program

The symposium was held at the Masarykova Kolej from May 19–21, in Prague, Czech Republic. Dr. Nafiz Alemdaroglu, Chair of the SCI panel welcomed participants and introduced the program co-chairs, Dr. H. Barbara Sorensen and Maurizio Spinoni. The first keynote address was given by Dr. Yvonne Masakowski from the Naval Undersea Warfare Center. The second keynote speaker was Katharine Wykes, head of BAESystems Human Factors. Both keynote speakers stressed the need to look at the way information is conveyed and strive to develop systems based on innovative interfaces and sound

knowledge management. These systems would understand the decision maker's capabilities and limitations and provide information to achieve a successful level of performance and optimization of mission goals. Ms.Wykes noted a Boeing study[1] that highlighted the fact that as the complexity of aircraft systems has increased the human error ratio has increased. With first and second generation aircraft most failure was caused by the aircraft. Today 66% of accidents are attributed to human error. That is a high percentage and one which should be at the fore front of the minds' of most people working within the human integration domain. Both stressed the need for a user centered design process. The involvement of the user is crucial. Ms. Wykes stressed having as many users as possible, with varied backgrounds involved to avoid the risk of a biased personalized design.

The first two sessions of nine papers addressed Innovative and Emerging HMI Technologies for different platforms. The topics addressed in the papers ranged from HMI for aircraft cockpit design to advanced command and control for unmanned ground vehicles. The paper selected by the participants as noteworthy dealt with the man machine interface (MMI) for situational assessment and decision making in naval command and control. The MMI workstation has four displays that give the users a 3-dimensional presentation of the tactical environment, assessment support through graphic and alphanumeric representation s of important track parameters, a more traditional tactical 2-D picture (Bird's Eye View) and decision support consisting of tactical evaluation support and asset deployment planning. The initial results show that the concept is a modest step toward developing a workable design for future combat management systems.

On Tuesday there were four sessions. The first, Session II was Intelligent Systems and Decision Aids and consisted of four papers. "Understanding the Human-Computer Team" discussed understanding the process human operators use when deciding to rely on their own decision or those of an automated aid. By understanding this process design engineers may be better able to design systems and train military decision-makers on the appropriate use of automated aids.

Session III contained four papers and was entitled Information Processing and Situation Awareness. Most noteworthy was the discussion on how future armored vehicles will use advanced technology to increase the information available to the crew. By using on-board sensors, other sensor assets and other vehicles the crews situational awareness will be vastly increased. The soldier-machine interface will include a 360 degree representation of the outside world, thru head-mounted display which will include overlaid symbology for tactical, navigational and administrative information, including automated decision-aids and system management. The vehicle will have a 360 degree target detection and recognition and automated computer target engagement system. To validate the design, constructive models will be used for parametric assessment of technology performance and for validation of the overall virtual system and crew performance.

Session IV Workload Management consisted of four papers. One paper described an innovative approach applying a doctrine system for the situation-dependent conditioning of a ship. Supported by a doctrine control, the operator can define and test tactical courses of action while planning a military mission. Being prepared means functioning optimally in time-critical situations. Besides a user-friendly doctrine design the prototype allows interactive simulations for iteratively testing the interaction between creating and using doctrines and to evaluate the database before onboard operation.

On Wednesday Session V Training contained three papers and Session VI Lessons Learned had two papers. Training was emphasized through distributive learning technologies. TENOR is an intelligent adaptive

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[1] Statistical Summary of Commercial Jet Airplane Accidents: Worldwide Operations 1959 – 2001; Airplane Safety, Boeing Commercial Airplane, June 2002.

information processing and distribution system designed to increase the skill level, performance and critical thinking of the user. The training system supports multiple platforms and the material provided is easily tailored in real time to accommodate the capabilities of the individual trainee. It can accommodate all types of training material. The major architectural components of the system are the knowledge data base, the layout data base, the quiz data base and the administration data base. Tenor 1 is static but Tenor 2 will be a dynamic interactive training portal.

The lessons learned in the design of the Type 45 Destroyer Platform management system are a helpful review of elements to consider in the design of human machine interfaces. Potential benefits can only be achieved by considering what HMI facilities are required to support the operators. Careful attention should be given to how data can be filtered and presented to provide essential and effective information. The Type 45 facilities provide information to individual operators and also support co-operative performance by teams of inter-related operator roles.

The proceeding descriptions represent the diversity of the human systems integration discipline.

1.4   Symposium Arrangements & Assessment

Following are a compilation of the comments by the audience and participants.

- The overall assessment of the symposium was that it was very good and worthwhile. The majority of attendees felt that the symposium was well organized; however, many felt that the acoustics and audio could have been better.

- Some felt that the overlap of the panel meetings and frequent side meetings distracted from the presenters.

- Overall, the facilities, city, people and organization were commendable and they were very gracious host.

- The following are recommendations for speakers and presentations:
  - There needs to be a room/area for speakers to review presentations and test equipment.
  - Speakers need to be familiarized with the microphone.
  - Speakers need to distribute scripts to audience (same as given to translators).

- Presentations need to be arranged so that session chairs do not have their backs. to the screen and presenters are centered for the audience.

- All authors need to scrub acronyms from their presentations. All speakers should speak all words clearly and precisely throughout their presentations.

2.0   EVALUATION

2.1   General Comments

Today's warfighter has access to reams of data from multiple sources at a rapid rate. The operator must make critical decisions while performing his/her primary mission. It is our job to see that the systems designed enhance the operator's ability to make accurate decisions. The warfighter should be the central focus of the design. This assures that the technology meets the decision makers' requirements when performing critical missions.

Generally the presentations were good. The papers took many different approaches to deal with the human machine interface (HMI) but most dealt with the appropriate utilization of automation, situational awareness in conjunction with automation, turning data into usable information without overwhelming the operator, and command and control. Another focus was the use of decision aids to help the decision maker perform his/her task to meet mission objectives.

- Most attendees felt that the quality of the visual aids was good. However, the attendees felt that only half of the papers presented met the symposium Objectives and only half were relevant to the symposium theme.
- The theme was very appealing to the audience and they felt it should be continued.
- The general level of the papers was deemed satisfactory or better.
- While some papers dealt with critical issues many did not.
- It was suggested that the best papers be selected for technical publication for system concept integration.
- Only eight out of the nineteen member countries presented papers. Papers need to be recruited from the other countries.
- All presenters should find their session chair before their session to prevent time delays.
- Limit speaker introductions. All should be uniform.

3.0   CONCLUSIONS

One author said "as designers we have to get better at forgoing what we can have for the sake of what we can use."[2]

We have gaps in human systems integration:
- being able to predict and even measure some of our basic abilities
- understanding what the operators will be able to undertake under all conditions

Information and knowledge management are critical issues that must be integrated into the design interface.

4.0   RECOMMENDATIONS AND QUESTIONS

- An evaluation criterion for accepting papers needs to be established.
- Encourage papers from all participating nations (only 8 of the 19 member nations gave papers).
- Keep all breaks in conference room. It works very well.
- Set up round table discussions during breaks.
- Should the human component be brought inside systems integration?
- If we feel command and control and situational awareness are critical issues should that be our focus?
- How do we focus on the human component within the design and engineering process?

[2] Wykes, K.