OPTIMIZED MANNING FOR THE 21ST CENTURY

Yvonne R. Masakowski

Office of Naval Research International Field Office, London

ABSTRACT

Mission's changes of the 21st century will shape the allocation of functionality among humans, computers, expert systems, equipment, and systems designed to support interoperability and optimum performance. A key component of these changes aimed at supporting netcentric warfare is the development of technologies for optimized manning. Namely, optimized manning in a combat, command and control center mandates that human-centered design focuses on the allocation of functions and tasks between humans and systems in combination with consideration for both individual and team performance. Implicit in the design and development of new technologies is the need to address new approaches to training for multi-national missions.

This presentation will provide an overview of the US/UK Science and Technology efforts related to the Technology for Optimized Manning initiative. This discussion will be organized according to three main topics:

US/UK TOM program,
Human-Centered Design systems, and
training for changing missions of the future.

Introduction/Background

In the 21st century, there are two significant forces that will alter the ways in which the US Navy will man its ships and submarines. First, reductions in funding have directly influenced the ways in which we will recruit, train and maintain a Navy. Second, advances in technology will shape the Navy of the future and its platforms. These two factors, funding and technology, will require individuals with higher levels of skills and knowledge to understand and operate complex systems. The question is how do we know which technologies to develop when we are faced with constraints in funding? Thus, it becomes imperative for nations to identify and prioritize those technologies that will support the individual, the platform and netcentric warfare system of the future.

Optimized manning dictates that all personnel and systems perform within a shipboard combat, command or control center in an accurate and timely manner that will secure a successful mission. The allocation of functionality among humans, computer programs, and equipment may be complemented or hindered by the efficiency of the Human and/or the Human-Computer System design. In addition, attention must be paid to the level of workload within a complex environment in which systems no longer consist of isolated units but rather consist of a network of systems that may or may not present a coherent or consistent representation of events in real time. Knowledge and tactics remain essential components of a successful mission, however human-centered systems that incorporate the allocation of functions and tasks between humans, hardware and software ensure optimal decision-making and operational superiority.

Central to all of these units is the allocation of functionality. Namely, the integration of systems, humans, computer programs, and equipment may be complemented or hindered by the efficiency of the Human and/or the Human-Computer System. In addition, attention must be paid to the level of workload within a complex environment in which systems no longer consist of isolated units but rather consist of a network of systems that may or may not present a coherent or consistent representation of events in real time. Knowledge and tactics remain essential components of a successful mission, however human-centered designed systems that incorporate the allocation of functions and tasks between humans, hardware and software ensure optimal decision-making and operational superiority.

Program Goals

This presentation provides an overview of an ongoing Science and Technology (S&T) program sponsored by the Office of Naval Research, US Navy and the UK Royal Navy known as "Technology for Optimized Manning" (TOM). This collaborative effort, initiated by RADM Gaffney (US Navy) and RADM Phillips (UK Royal Navy), aims to improve our bilateral science and technology collaborations. Moreover, this program is focusing on those areas of technology development that will optimize the allocation of functions to people and machines that will enhance both system and warfighting performance at an affordable cost. This program is designed to lay the groundwork for science and technology and provide technology insertion into the UK Future Surface Combatant and the US DD 21, as well as future platforms.

A first step toward achieving these goals was to sponsor a series of four workshops, two in each country, to identify and refine details for the way ahead. The four themes of the workshops are: 1) Future Battlespace and Technology, 2) Personnel and Future Systems, 3) Human Systems Integration and Technology and 4) Whole Ship Integration. While the overall goal is to provide the fleet and force personnel the technology they require to optimize manning, participation of acquisition and requirements personnel is critical to ensure that the technology is relevant.

US/UK Technology Program

Our first task was to bring together a group of people from a variety of disciplines from the US and the UK who could discuss these issues within a workshop setting. We established

four themes to these workshops: 1) Future Battlespace and Technology, 2) Personnel and Future Systems, 3) Human Systems Integration and Technology and, 4) Whole Ship Integration.

Our goal is to identify those national programs that support optimized manning and conduct a joint technology gap analysis. The result of this in depth analysis would, in turn, lay the foundation for the Science and Technology programs to be developed.

Our approach was to use the theme of each workshop as a template that is placed over each group of technologies currently under development in an attempt to characterize relevant US/UK programs and determine the scope and boundary conditions for joint research efforts.

To achieve this goal, we invited representatives from each country to attend each workshop.

Our database included information representing all platforms, including DD21. Our aim was to identify shortfalls in technology, as well as those technologies that will be developed for the "Post DD21" period.

Among our challenges, we recognize the need to address technologies that support a "Vision of the Future" in terms of joint, allied inter-operability issues, as well as distributed collaborative efforts. We have invited speakers to present their view of future platforms and opened the discussion regarding the technologies that might be required to support that effort.
Our plans are ambitious. We recognize that it is necessary to plan for the technologies of the future. However, in order to determine what kind of sailor will be needed, we believe that it is important to identify the gaps in our technology. It is only then that we can begin to direct the development of research and development (R&D) programs that forge the development of advanced technologies that will facilitate optimized manning.

Platforms for the 21st century

As we move forward in the 21st century, the US Navy is planning profound changes in technology and manning. We are aware of the plan to reduce the number of personnel for DD21 and the concern about automated systems managing damage control. While more attention has focused on the issue of whether this is possible, the real question is, "How will advances in technology and automated systems impact the ways in which we recruit, train and operate during battle?"

Our daily life is currently being shaped by advances in technology. They will continue to do so regardless of whether we welcome the intrusion of technology or choose to ignore it. Our ignorance will not last for technology changes are pervasive and alter our perception of ourselves, our workplace, our home and our battlefield. They change the way that we conduct business and the way that we conduct military operations. For those of you who have any doubt, I suggest you try doing your job without access to your computer, email, fax, voicemail, etc. There are no longer secretaries but word processors and website designers. We may not always like the intrusion of technology but we have come to rely on it. Isn't it better to take control of it and direct the ways in which it develops?

During the next 20 years, there will be significant changes in technology, equipment, systems and manning levels. Perhaps one of the most critical components of platforms of the future will be the way that they integrate human-centered system design.

Human- Centered System Design

Human-centered system design mandates that system design begin with an emphasis on human system integration (HSI). This means that the systems engineer shifts his focus from the hardware to the human in the system. Specifically, human-centered system designs account for human abilities and consider the cost of trade-offs incurred in functional allocation to the human or the machine.

At our next workshop in November, we will focus on issues relating to human-centered system design and its relationshiop to personnel issues such as recruitment, training and retention. We recognize an important link between the design of systems, advances in technology, and the training of individuals to use these complex systems in an effective way.

We will begin to explore the relationship between crew requirements, functional allocation, training and system design during our next meeting. This process assigns functions to automated systems or to humans. The result of our November workshop will provide a view at those technologies that support a more integrated and coordinated system that supports both personnel and system requirements.

Summary

As we move into the 21st century, we see the impact of rapidly changing technology that impacts the knowledge base of the civilian and military personnel. The crew of the 21st century will be faced with complex systems and situations. Automated systems and crew reductions will place additional responsibilities on those who design systems, train operators and conduct combat operations. The effect of technology will be realized differently across platforms, however, there are common issues that emerge regardless the nation, the military division or the funding available for technology development. The human decision-maker should always be considered in system design and provided with the most effective tools to facilitate those decisions. The future combatant will be more educated , more specialized and faced with the most complex environment ever presented in a combat situation. Ultimately, it will be the human who oversees the automated command and control systems, as well as the one who will use his/her knowledge to provide context to the situation and make the critical decisions.

We believe that our TOM effort is a significant step toward developing technologies that will support the systems designer and the decision-maker of the future.