MESSAGE FROM THE CHAIR
By Chairman Tom Malone
tbmalone@carlow.com

When I worked to initially organize and establish the Systems Development Technical Group in the HFES, becoming its first Chairman, I was motivated by the conviction that getting human requirements addressed in complex systems was one of the more important, and challenging activities of the human factors specialist. My thinking on this hasn’t changed in my 37 years of involvement in human factors. I’d like to share my vision for what is involved in applying human factors in the context of a system development effort, and what we can expect as benefits of human factors.

Let me begin by affirming that human factors, as a discipline, includes the methods, models, hardware, software, firmware, courseware, information management techniques, tools, procedures, documentation, system design features, standards and data for fully integrating the human into a complex system. The primary overriding objective of human factors in system development is to influence design. The way in which this is accomplished involves several initiatives including: getting human factors issues and concerns addressed early in system acquisition; defining the roles of humans in system operations and maintenance early in system development; identifying deficiencies and lessons learned in existing, comparison systems; applying simulation and prototyping early in the process; applying human-centered design throughout the process; and applying human-centered test and evaluation.

Primary overriding objectives of Human Factors in System Design is to inform System Designers

Given the activities assigned to human performance, and the demands that individual tasks and task sequences make on personnel, it remains a requirement to optimize the design of system equipment, software, procedures, information, environments, as well as system manning and training.

At the human interface level within the system, human factors is too often applying only to the physical interfaces, the human-machine interfaces. Human factors should also be concerned with requirements associated with several categories of human interfaces, such as: (a) functional interfaces including roles of humans versus automation in system operation, control, maintenance and management; human functions and tasks; and roles of system personnel in automated processes (e.g., monitoring, management, supervision, intervention, etc.); (b) informational interfaces including information needed by a human to complete a function or task, required characteristics of the information (source, accuracy, currency, quantity), and protocols and dialogues for information access, entry, update, verification, dissemination and storage; (c) environmental interfaces concerned with the system physical environment (illumination, noise, temperature, vibration, ship motion, weather effects, etc.), workspace arrangement, facility layout and arrangement, and environmental controls; (d) operational interfaces which include operating, maintenance, and emergency procedures; workloads; personnel skill requirements;

(Continued on page 6)
As many of you know, The SDTG has decided to join the web world and is developing a site to provide information to our members. The first step in developing a web site is to know the user group and the needs of the people who will use our site. To achieve this, the SDTG web committee sent an email survey to the membership. The survey consisted of the single question “Do you want any of the following?” followed by a list of possible options:

- Summary of SDTG mission
- Charter
- Explanation of eligibility, how to join, email contact
- TG officials names and email
- TG committees and/or projects
- List of past projects
- Meeting schedule SDTG, or HFES, other conferences
- SDTG Newsletters
- Bulletin board questions & answers to/from members
- Job postings
- Links - URLs of members personal and/or organization
- Links useful sites: academic programs or technical documents/info or lab facilities or standards/guides, etc.
- Articles from members full text
- Synopses of member articles, technical reports, etc. and where to get the full document
- List of members, email, and their area of expertise
- Notices to members (an ever-changing page) e.g., calls for papers, standards review needs, etc.
- Surveys or input forms for current TG projects
- Papers from the HFES Annual Meeting Systems Development track if allowed by HFES
- Upcoming TG meeting time and agenda
- Success stories/lessons learned
- Human factors cartoons and jokes

Of the 145 members who have provided email addresses during TG registration, 23 members responded. The SDTG web committee decided that options receiving a two-thirds or greater “yes” vote should be implemented barring any major considerations such as privacy, legal issues, etc. Options receiving a majority “yes” vote, but not the two-thirds, would be strongly considered but possibly not implemented on the initial web site. Options not receiving a majority “yes” vote should be discussed and thought through with the likely outcome of not incorporating the option.

This result of the questionnaire shown in Table 1 is to serve as the initial steps in the process of SDTG web site design. The column “Web Enabled” indicates those items that will be implemented in the initial web site. Survey respondents supported most of the options. Only full text articles received less than 50% “yes” vote.

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<td>List of members, email, and their area of expertise</td>
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Helping to inform existing members; and 2) interest others in joining. HFES allows each technical group site to “do their own thing” with these HFES requirements: 1) must have either the Society’s name or logo on the TG site; 2) must link back to the HFES site; and 3) must clearly state that the TG is associated with HFES.

The web site was demo-ed at the SDTG meeting in July. Reviewers had these comments:
- Change “News Flash” to “What’s New” since this box includes more than news.
- Change “About SDTG” to “About Us”.

Conclusion
The survey has provided valuable insights into the desires of the SDTG membership for the web site of the SDTG and will be used in the creation of the SDTG web site. If there are any additional comments that you feel need to be considered, please contact:

Larry Avery: (919) 481-0565 x 206
lavery@humancentrictech.com

Teresa Alley: (619) 545-7384
talley@dticam.dtic.mil

The entire survey results including all comments will be posted on the SDTG web site. This web site is an iterative development process. The Web Committee would welcome further input!

By: Teresa Alley

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**Table 1. Results of the Web Site Survey**

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<td></td>
<td>Human factors cartoons and jokes</td>
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<td>4</td>
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</tbody>
</table>

1) helping to inform existing members; and 2) interest others in joining.
HFES allows each technical group site to “do their own thing” with these HFES requirements: 1) must have either the Society’s name or logo on the TG site; 2) must link back to the HFES site; and 3) must clearly state that the TG is associated with HFES.

The survey also enabled respondents to input questions that need to be considered in the site development process. Questions included: What is the intent of the site? What are our users’ behaviors? Is the site a controlled presentation of information or an open discussion environment? Is this site separate from the larger effort of HFES.org?

In answer to some of these questions:

Chair Larry Avery set preliminary goals of:
Critical System Methodology

By Brian Gore

In the September newsletter, Tom Malone challenged the SDTG to tailor the principles, processes, methods and data of human factors to the reduction of errors in hospitals and health care systems. I would like to suggest one methodology from the aviation domain that exists for studying both human behaviors and human-system interactive behaviors. From Tom’s article, the human factors principles that should be applied to the reduction in human error in this arena included:

- the human (patient and practitioner) being viewed as an integral element of the system;
- system design must address the interfaces between the human and other elements of the system (hardware, software, information, environments, organizations, procedures, protocols, treatment pathways, and other humans);
- human factors must influence system design and development to ensure that human interfaces are designed in terms of the requirements, limitations, capabilities, and expectations of the human;
- human factors will reduce the potential for error by modeling human tasks and associated requirements, and ensuring that task performance requirements are in line with human capabilities, limitations and expectations;
- Where errors cannot be prevented, human factors analyses will ensure that the system is error tolerant; that errors, once occurred, will be detected and corrected in time, or that their impact if uncorrected will be minimal;
- The majority of errors in a complex system are due to situational and design factors rather than personnel factors;
- medical systems must be designed to facilitate and encourage the accurate and timely reporting of actual errors and near misses.

A number of methods exist for studying human performance in systems, and consequently human error in systems. We are able to examine the performance of individuals in high-fidelity simulations as the human operates in the complex system. The use of full mission or high fidelity simulation has been proposed as a methodology for examining human-systems performance in a safe and controlled environment in the surface transportation and aviation communities. This technique has proven to be successful in accomplishing the goal of safely and realistically evaluating human behavior in systems but have the disadvantage of being very costly, often times prohibiting their use (Lee, 1998).

Modeling is an alternative methodology to these expensive simulators in that modeling can be used at an earlier process in the development of a product, system or technology. Many different forms of modeling exist - these can range from static paper models of human performance through to more complex dynamic representations of human performance within an operating environment. These latter techniques include integrated human performance models. Human performance modeling tools avoid the dangers associated with incorporating new technologies by examining human behavior using empirical data from past human performance (Laughery & Corker, 1997). Human performance modeling is a computer-based simulation process where human characteristics taken from years worth of research from respective fields are embedded within a computer software structure to represent the human operator interacting with computer generated representations of the human’s operating environment (Gore, 2000; Gore & Corker, 2000b; Gore & Corker, 2000a). This representation is a little more complex than is the representation of many of the static models as the static modeling tools do not represent the human and the environment as an interactive package, rather they examine the human performer in relative isolation of a dynamic environment. The human characteristics that are contained within the computer-generated representation of the human operator in many of the integrated human performance modeling tools include visual and auditory perceptual and attentional systems, anthropometric characteristics, and the environment (including workstations as well as the outside environment). Since the human operator responsible for interacting in these systems is not present in the actual system evaluation, the risks to the human operator and the costs associated with system experimentation are greatly reduced: no experimenters, no subjects and no testing time.

Human performance modeling tools have been proposed by many human factors researchers as a method of upholding the guiding human factors and ergonomics principles of early input into the design process. The computer-generated human performance representation possesses many advantages to studying Human-in-the-Loop (HITL) performance especially when dealing with advanced, complex systems (Gore & Corker, 2000b). One of the advantages is the ability to model critical events that can not be studied fully with HITL subjects due to safety concerns and subsequent costs. Current research efforts in the National Airspace System (NAS) have been focused on creating dynamic models of human error. Perhaps the medical community can look at the efforts from the aviation research community...
to generate research ideas on solid theories of human error with advancing technologies and the Aviation Safety Reporting System (ASRS) or a newer, less voluntary reporting system known as Aviation Safety Action Program (ASAP). The ASAP is viewed as an important adjunct to, but not a replacement for, ASRS. While some airlines may establish ASAPs with a provision for automatically submitting copies of ASAP reports to ASRS, flight crew members should continue to file ASRS reports themselves, partly to ensure their eligibility for the limited relief from enforcement action.

This article is suggesting three main ideas. The first is that these two methodologies, the HITL simulations and the human-out-of-the-loop (HOOTL) simulations need to be used in a cooperative manner as opposed to a competitive manner. The iterative design process with early and constant input from the human factors researcher allows for more usable products and concepts. This means that the lessons that are learned from the human performance modeling domain need to be augmented and validated with the use of the HITL simulations and that the HITL simulation domain needs to listen to the findings from the predictions being generated from the modeling domain.

The second idea is that the efforts from the aviation community in the development and application of human error methodologies and in the concept of an ASRS-like strategy may assist in identifying parts of a complex system where vulnerabilities for human error exists. Once these vulnerabilities are identified then corrective actions may be elicited from the operators or from the designs of the complex systems being used. The ASRS system in the aviation community has been useful in identifying likely areas of system vulnerability in an anonymous fashion across a wide range of users, namely the commercial aviation and the general aviation communities.

The third idea is that the reporting system that is designed for the medical field be used in a manner somewhat consistent with that from the aviation field. Besides loosely keeping track of the users of the aviation system, the ASRS data is often used as a starting point to identify likely areas of system vulnerabilities that can then be simulated in human-out-of-the-loop (human performance modeling) and HITL simulations. These simulations are created as a means of identifying potential problem areas for the system. Once these vulnerable areas have been simulated, a modification can be made to the procedures or technologies within the system to examine the impact of the human performer and hence on the safety of the system performance. The newer reporting system known as ASAP may allow better data to be used in attempting to better understand human error in complex systems and may provide some insight to the medical field of reporting mechanisms that can be used to assist in creating HOOTL or HITL simulations.

The methodology outlined in this article therefore serves as an example of one way of measuring the system effects of implementing advanced technologies in a relatively cost effective manner while maintaining some degree of safety for the user population. The lessons learned from the aviation domain may assist in the considerations of the medical system when attempting to find suitable processes for the examination of system effects within such a complex system as the medical one. I now challenge another field to outline some principles, processes, methods and data of human factors to the reduction of errors in hospitals and health care systems.

References


By Brian Gore
personnel manning levels; and system response time constraints; (e) organizational interfaces including the factors impacting the organization of system management functions, policies and practices, personnel jobs, and data; (f) cooperative interfaces primarily concerned with communication, collaboration, and team performance; (g) cognitive interfaces including decision rules, information integration, problem solving, instructional materials and systems, short term memory aids, cognitive maps, and situational awareness; (h) physical interfaces which include the physical, structural, and workstation elements with which the human interacts in performing assigned system tasks. The benefits of applying human factors can be expressed at the system level and at the human interface level. At the interface level the results of applying human factors in system design are:

- displays which are meaningful, readable, integrated, accurate, current, complete, clear, directive, transparent, readily associated with control actions, and responsive to information requirements;
- controls which are reachable, identifiable, operable, consistent, compatible with expectations and conventions, and simple to use;
- consoles and panels which include the required control and display functions which are arranged in terms of functions, sequence of operations, and priorities;
- software command modes which are transparent to the user who is always aware of where he or she is in a program;
- on-line help which is available and responsive;
- procedures which are logical, consistent, straightforward, and provide feedback;
- communications which are standardized, consistent, intelligible, clear, concise, identifiable, prioritized, and available; and
- environments which are within performance, comfort and safety limits, designed in terms of task requirements, and consider long term as well as short term exposure.

At the system level, the primary benefit of applying human factors in system development is a significant reduction in the cost to acquire the system, resulting from reductions in manning requirements, incidence of human errors and accidents, system maintenance, and training requirements.

By Tom Malone

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**Key Symposium:**

**Surface Transportation**

I thought it would be important to highlight certain upcoming conferences or symposia that deal with system-related issues. One such conference is a surface transportation related symposium entitled International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design. This will take place at Snowmass Village at Aspen, Colorado USA - August 14-17, 2001.

This symposium will provide an interdisciplinary forum for scientific exchange between experts and users in driving assessment tools, applications and technology. Attendees will include researchers and practitioners working on applications of driving assessment from the perspective of engineering, psychology, medicine, and public health. We encourage all interested parties to submit abstracts and papers for possible presentation and publication.

**Significant Dates:**

Abstracts Due: February 15, 2001
Draft Papers Due: April 1, 2001
Final Papers Due: July 1, 2001

For details visit: [http://www.driving-symposium.org](http://www.driving-symposium.org)

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**Reminder!**

The SDTG’s strength resides in its membership. It is with your support that we are able to produce such high quality newsletters and are able to sponsor HFES-related activities. As many of you know, membership dues will be coming up in January. I would like to encourage the current membership to renew their memberships and to add to your membership totals by telling your colleagues of the SDTG! Thank you for making Year 2000 a great success and for your 2001 support!
For any TG-related business, please use the emails listed below.

**TG Chair:**
Tom Malone
tbmalone@carlow.com

**Program Chair:**
Dan Wallace
dwalla@nswc.navy.mil

**Program Chair-elect:**
John Lee
jdlee@engineering.uiowa.edu

**Secretary-Treasurer:**
Melissa Dugger
melissa_dugger@teambci.com

**Newsletter Editor:**
Brian Gore
bgore@mail.arc.nasa.gov

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### Systems Development and Human Factors Reference List

As many of you are aware, HFES has requested that each TG put together a list of seminal readings in their particular domain of expertise. The following represents an initial list of references for system development and human factors. I want to thank David Meister and John Winters for initial suggestions for the list. The SDTG executive committee would appreciate your help in validating and extending this list before submitting it to HFES. Please contact me to add or discuss references that you feel make significant contributions towards the topic of human factors in system development. These references can be either books or articles. You can reach me by email at lavery@humancentrictech.com or voice mail at (919) 481-0565.

Regards,

Larry Avery

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### IEA/HFES 2000 Proceedings

(Continued from page 8)

- Tents, Author and Key Word Indexes
- The key volume for the SDTG-related information is volume #6: Product and System Design, Miscellaneous Topics.
- The prices for all proceedings ordering options are as follows. The member prices apply for members of IEA-affiliated societies (but not for TG members who are not members of HFES):
- Note: Special shipping/handling prices apply when ordering three or more books (write to Lois at 'lois@hfes.org' at HFES for details).

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<th>Volumes 1-7, books only</th>
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<td>Volumes 1-7, CD-ROM only</td>
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<tr>
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<tr>
<td>Volume 7, only</td>
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apply when ordering three or more books (write to Lois at 'lois@hfes.org' at HFES for details).

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The System Development Group fosters research and the exchange of information for integrating human factors into the development of systems.

IEA/HFES 2000 Proceedings

GOOD NEWS! The paper proceedings of the IEA 2000/HFES 2000 Congress are available from HFES - 5500 pages in 7 volumes. These volumes are arranged topically, which may make them more attractive to those members who wish to order the books (The CD-ROM is available for separate sale as well). The organization of the paper proceedings is as follows:

Volume 1: Cognitive Ergonomics, Computers and Communication
Volume 2: Organizational Design and Management, Environmental Design, Education and Training
Volume 3: Complex Systems and Performance
Volume 4: Safety and Health, Aging
Volume 5: Manual Work
Volume 6: Product and System Design, Miscellaneous Topics
Volume 7: Cumulative Table of Contents
(Continued on page 7)

Your SDTG Election Results

As I am sure you will all recall from the September newsletter, the SDTG membership was requested to vote for the positions of Program Chair Elect, Newsletter Editor Elect and Secretary/Treasurer Elect of your SDTG. We would like to thank all those SDTG members who responded. We had 34 ballots returned with 0% discarded. The results of the newsletter elections are as follows:

Program Chair Elect
John D. Lee: 34 Votes (100%)

Newsletter Editor Elect
Dennis White: 33 Votes (97%)
John Winters: 1 Vote (3%)

Secretary/Treasurer Elect
Melissa Dugger: 19 Votes (55%)
Yvonne Alvarez: 14 Votes (41%)
Missing: 1 Vote (4%)

Congratulations to all the new SDTG Officers!