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Recent Human Factors Contributions to Improve Military Operations

By Dee Andrews, Franklin Moses, Harold Hawkins, Michael Dunaway, Robert Matthews, & Tim Singer

Recent world events have again highlighted the necessity for the United States military and its coalition allies to be prepared for all manner of military operations. These operations run the full gamut from large-scale, theater-wide combat, as witnessed in Operation Iraqi Freedom, to small-scale operations against terrorists, to operations-other-than-war that include peacekeeping and humanitarian aid. Here, we briefly describe recent Air Force, Army, and Navy human factors efforts to improve the preparation of military personnel.

Distributed Mission Operations (Air Force)

Air Force personnel are being sent to foreign theaters much more frequently than was the case during the Cold War. Time away from home station has reduced the time they have to acquire and sustain necessary skills and knowledge.

The Air Force Research Laboratory's Warfighter Training Research Division (Human Effectiveness Directorate) has developed a concept called Distributed Mission Training (DMT) to address this challenge. DMT combines live (i.e., aircraft flying on a range), virtual (human-in-the-loop), and constructive (computer models) assets to form a synthetic battlespace. These battlespaces can be used for a variety of purposes, such as training, test and evaluation, and mission preparation. Human factors issues and solutions lie at the heart of the DMT concept. The lab has made human factors improvement a major goal of any DMT activities. These human factors considerations include learning acquisition and retention, performance measurement, visual perception for simulator visual displays, brief and debrief capabilities, team interactions, mission rehearsal requirements, and advanced distributed learning.

Air Force Chief of Staff General John P. Jumper has embraced the DMT concept and wants to use the technologies and methods for training and functions other than training. He has coined the term "Distributed Mission Operations" (DMO) to connote this broader view.

Under the DMO concept, a Distributed Mission Operations Center at Kirtland Air Force Base, New Mexico, will serve as a command control that connects various DMO nodes around the world. These nodes will consist of human-in-the-loop, high-fidelity simulators; constructive models; and a variety of weapon systems. These networked assets can be used for stand-alone training, small-scale mission drills, and large-scale exercises. The DMO

network will provide wartime decision support training during peacetime. It will also allow full-scale mission rehearsal.

A key challenge for human factors and training researchers has been to develop a training strategy for DMO that will provide instructors, trainees, and warfighters with the training methods to take full advantage of the DMO capabilities. Science and technology work for DMO continues.

Multifaceted Soldier Support (Army)

The U.S. Army's soldiers are regularly deployed for extended periods to multiple theaters and different types of conflicts throughout the world. The approach taken by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is therefore multifaceted. Examples of ARI's work show how research has assisted soldiers to gain the adaptability, flexibility, and readiness they need.

Deployment preparedness. The Army wanted to better understand the stresses placed on soldiers and their families by frequent and extended overseas deployments in remote locations. Two projects illustrate ARI's response: (1) studying the steps that can be taken to reduce the family stresses, and (2) helping soldiers to understand foreign cultures prior to operations.

In research about families, ARI collected 10 years of lessons learned and identified changing support needs over four phases of deployment: predeployment, deployment, rest and recuperation, and reunion. ARI developed a practical guide for both families and family service providers with common problems and advice such as how, while deployed, to handle family problems and related issues such as the inability to sleep.

ARI's approach to helping soldiers understand a culture different from their own was to develop a generic template that lists the specific aspects of a culture that can be used as an aid to understanding. That template includes content areas such as religious customs, language, laws, politics, housing, and humor, providing a framework for observing and learning about other cultures.

Leader development. Leaders need to understand how to make decisions and solve problems for a variety of deployments. The Army has a major initiative to improve decision making whereby leaders learn to (a) use what they already know, (b) recognize what they don't know, and (c) explore possibilities of gaining new knowledge. Decision-making guidelines resulted from a course for leaders that ARI helped develop at the Command and General

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Recent HF Contributions to Improve Military Operations

(continued from page 1)

Staff College, Fort Leavenworth, Kansas. The guidelines include how to take multiple perspectives, how to adapt to a situation, how to find hidden assumptions, and how to enhance practical reasoning and integrative thinking.

Reserve mobilization. Mobilization in an all-volunteer Army increasingly depends on the call-up of Reserve soldiers and on their capacity for relearning skills that may have grown rusty. ARI's research found no significant difference in what reservists had forgotten either six months or three years since last performing their military duties. Therefore, rapid relearning succeeds well for a much longer period than expected. Overall, skill reacquisition during rapid training is easier for soldiers with a higher aptitude for learning, for those whose prior active duty was longer, and for those whose civilian occupations were similar to their Army jobs. For such soldiers, short videotape presentations of their Army tasks were sufficient to prompt recall of many procedures.

The ARI products described here, along with others developed in response to soldiers' needs, are available now for direct application, including handbooks, tools, guidelines, and recommendations on what to do and how to do it.

Virtual At-Sea Training (Navy)

In early 2001, the Secretary of the Navy announced that the Navy would vacate its live-fire training range on the island of

Vieques, Puerto Rico, by mid-2003. The impact of this decision on training and combat readiness was significant: For 30 years, Vieques had provided a unique spectrum of combat training capabilities, including naval surface fire support, strike aviation, under-sea warfare, Marine Corps amphibious assault, and combined arms operations.

In the spring of 2001, the Chief of Naval Research formed a team to explore technological alternatives to the Vieques range. Drawing on decades of research and development on modeling and simulation, human-system interface design, training technology, and systems engineering, the Office of Naval Research was able to demonstrate a modeling and simulation-based system for naval surface fire support training and qualification within a few months. This system, Virtual At-Sea Training (VAST), has been well received and now is in use as an effective and affordable method to train and qualify ships for combat operations in naval surface fire support.

VAST generates a 3-D environment in cyberspace and locates the ship within that space. The ship's sensors and weapons systems are stimulated by an embedded training system called the Battle Force Tactical Trainer to display target and navigational information that conforms exactly to the synthetic battlespace in which the ship is operating. The ship then deploys an array of floating buoys – centered on the synthetic target area – each of which has a hydrophone suspended beneath the water's surface, a Global Positioning System receiver, and a radio transmitter. VAST calculates the projectile's trajectory according to ballistic flight models and determines where a shell would have struck the computer-generated target area in the synthetic battlespace, taking into account target elevation or height above sea level on the 3-D landmass.

VAST then creates a realistic visual scene of the target as it would appear to a spotter ashore or from an aircraft or uninhabited air vehicle overhead. That display appears on the video monitor of the forward observer, who sees the rounds hit the target area as would occur when directing a real surface fire mission.

Under current development through ONR support is an entire family of VAST capabilities, including systems that provide training and mission rehearsal for coordinated antisubmarine warfare, strike aviation, Marine Corps long-range artillery fire control, and, in partnership with the Defense Modeling and Simulation Office, joint operations in urban synthetic terrain. All these capabilities are planned for use in the Navy and Marine Corps within the next two to three years.

The speed with which these systems will be developed, their effectiveness, and their affordability are directly attributable to investments made by the Department of the Navy and Department of Defense over the past 50 years in basic and applied research on human factors, modeling and simulation, and training technologies.

Dee Andrews is a senior scientist with the Air Force Research Laboratory's Human Effectiveness Directorate (Warfighter Training Research Division), Mesa, AZ. Franklin Moses is a senior research psychologist with the U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA. Harold Hawkins is a senior scientist, and Michael Dunaway, Robert Matthews, and Tim Singer are scientists with the Human Systems Science & Technology Department, Office of Naval Research, Arlington, VA.

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Executive Council Meeting Report

The annual meeting of the HFES Executive Council took place at the Adam's Mark Hotel in Denver, Colorado, on October 11–12, 2003. Following is a report of the discussions and actions taken at that meeting.

2003 Revised Budget

The revised 2003 budget was approved. Estimated income and expenses for 2003 are as follows:

Estimated Income

Membership	\$ 635,875
Membership Services	42,750
Communications/Pubs	392,145
Annual Meeting	197,369
HFES Institute	24,140
Miscellaneous	4,300
Total estimated income	\$.1,296,579

Estimated Expense

Member Services	\$ 69,139
Publications	338,600
Administrative	639,179
HFES Institute	35,205
Committees & Officers	44,325
Annual Meeting	82,259
Interorganizational	12,636
Total estimated expenses	\$.1,221,343
Estimated surplus	\$ 75,236

2004 Budget

Council approved the following budget for 2004:

Estimated Income

Membership	\$ 655,290
Member Services	45,250
Communications/Pubs	444,250
Annual Meeting	172,000
HFES Institute	18,250
Miscellaneous	5,000
Total estimated income	\$.1,340,040

Estimated Expenses

Member Services	\$ 95,750
Publications	304,903
Administrative	632,523
HFES Institute	41,200
Committees & Officers	53,425
Annual Meeting	67,000
Interorganizational	12,350
Total estimated expenses	\$.1,207,151
Estimated surplus	\$ 132,889

Awards

Based on recommendations from the Awards Task Force, chaired by Richard Pew, Council approved changes in the materials required to nominate members and nonmembers for HFES

awards. These requirements will be described in detail in the call for awards nominations, which will be published in the January issue of the *HFES Bulletin*.

Chapters

A new student chapter has been approved at the University of Miami. The president is Tracy R. Delgado, and Shihab Asfour is the new chapter's faculty adviser.

Communications and Publications

Council endorsed the recommendation of the Communications and Publications Subcouncil to appoint Melody Carswell as editor of *Ergonomics in Design*. Her term will begin on January 1, 2004.

A budget was approved for redesigning the HFES Web site. Work is expected to begin in early 2004.

Approval was given for a new feature at the HFES Web site: a collection of past presidential addresses, which has been compiled by Peter Hancock with assistance from students at the University of Central Florida. Watch the *HFES Bulletin* for an announcement of its availability. Pending study by a task force, future presidential and keynote addresses may be videotaped for archiving, sale, and/or use at the HFES Web site.

A task force will be formed to make recommendations for a member salary survey in 2004. The task force will consider details such as the questions to include, which portion of the membership to survey, and sale of the final results.

Diversity

The HFES Diversity Committee, under the leadership of V. Grayson Cuglock-Knopp, will staff an HFES exhibit at one minority society conference during 2004 to promote interest in the field and HFES.

Fellows Selection

An Operating Rule change was endorsed that will make it possible for any HFES Full Member to apply for Fellow status directly without waiting for another member to submit a nomination on his or her behalf. This change will take effect with the 2005 cycle, and applications for that year will be available in October 2004.

Two administrative changes were made: the Fellows Selection Committee will now be composed of nine rather than six members, and approval of new Fellows will require a 2/3 majority of the Fellows Selection Committee.

Interorganizational

Pending execution of a final agreement, HFES will cosponsor the 2004 Institute of Industrial Engineers Applied Ergonomics Conference. The Society will assist with marketing the AEC to members, and HFES membership will be promoted at the meeting.

Membership

Changes to the requirements for membership as proposed by the Member Category Task Force were endorsed by Council but will require approval of a Bylaws change by the membership before taking effect. First, the endorser requirement for new member

continued on next page

applications would be eliminated. Second, a bachelor's degree would no longer be required for Associates, though it would remain a requirement for those applying for Full Membership. It would be necessary for applicants for the Associate category to demonstrate at least two years of relevant full-time experience in the field.

The following Operating Rules change was approved by Council and has taken effect. Associate members who wish to upgrade to the Full Member category will be asked to submit an application for upgrade; automatic upgrades no longer apply.

New members and changes of membership were approved as follows: 17 new Full Members, 15 Associates, 24 Affiliates, and 57 Student Affiliates; 5 Associates to Full Member, 1 Associate to Spousal Associate, 2 Transitional Associates to Full Member, 2 Transitional Associates to Associate, 2 Affiliates to Associate, 3 Affiliates to Full Member, 1 Full Member to Student, 1 Full Member to Spousal Member, 1 Student Associate to Associate, 4 Students to Transitional Associate, 1 Student Affiliate to Full Member, and 1 Student Associate to Spousal Student.

Professionalism

A proposal from the Education and Training Committee for establishing a national benchmarking database for university programs in human factors/ergonomics was approved. A task force will be formed to investigate the costs and benefits of creating such a database.

A task force will be established to develop criteria by which undergraduate human factors/ergonomics programs could be eval-

uated for potential HFES accreditation or other form of Society recognition.

Standards

Pending development of a budget proposal, Council agreed in principle to invite International Standards Organization committees working on human factors/ergonomics-related standards to conduct their meetings at HFES annual meetings. This will help to increase meeting attendance and provide a convenient venue for HFES members who wish to participate in ISO groups.

Volunteerism

Council approved the development of a Web-based tool for soliciting volunteers for Society committees and activities. ☒

ANNUAL REVIEW

New HFES Book Series

By Raymond Nickerson

The Human Factors and Ergonomics Society has decided to establish a new publication series, *Annual Review of Human Factors and Ergonomics*. Plans for the first few volumes are being developed by the HFES Institute's subcommittee on the Annual Review of Human Factors and Ergonomics.

Each volume will contain chapters reviewing recent research in several areas of interest to human factors researchers and practitioners. The emphasis will be on research findings that have practical significance, and authors will be asked to make the practical implications clear. The topics for Volume 1 include

- Anthropometrics and biomechanical modeling
- Cognition augmentation
- Human-automation interaction
- Technology and aging
- Making highway transportation safer and more efficient
- Enhancing human performance in extreme environments
- Reducing and mitigating human error in medicine
- Improving safety and convenience in the home

The subcommittee welcomes suggestions of topics and/or potential authors for subsequent volumes. Suggestions may be sent to any member of the subcommittee: Chair Raymond Nickerson (r.nickerson@tufts.edu), Deborah Boehm-Davis (dbdavis@gmu.edu), William Howell (whowell@imap4.asu.edu), Thomas Landauer (landauer@psych.colorado.edu), Richard Pew (pew@bbn.com), Christopher Wickens (cwickens@psych.uiuc.edu), and Robert Williges (williges@vt.edu).

The long-range objective is to provide a primary resource for researchers, practitioners, and other potential users of human factors and ergonomics research findings. As the volumes accumulate, we hope the series will become the first place one thinks to look for extensive reviews of the various areas of HF/E work. The target date for the first volume, which I am editing, is 2005. ☒

2003 HFES Fellows and Award Winners

At this year's Annual Meeting in Denver, the Society recognized the 2003 award winners and honored this year's newly elected Fellow. Jack Stuster, chair of the Awards Committee, organized the award nomination and selection process.

Philip J. Smith, a codirector of the Institute for Ergonomics and professor in the Industrial and Systems Engineering program at Ohio State University, was elected the newest HFES Fellow.

The **Arnold Small President's Distinguished Service Award** for 2003 was presented to Douglas H. Harris, chair and chief scientist at Anacapa Sciences, Inc. Harris is an HFES Fellow and past president of the Society, and his career-long contributions have brought honor and distinction to the HF/E field.

The winners of the **Jerome H. Ely Human Factors Article Award** were John D. Lee, Daniel V. McGehee, Timothy L. Brown, and Michelle L. Reyes for the article "Collision Warning Timing, Driver Distraction, and Driver Response to Imminent Rear-End Collisions in a High-Fidelity Driving Simulator." The authors used two well-planned simulator experiments to demonstrate and quantify the efficacy of a rear-end collision avoidance system and constructed an analytic model to extrapolate their findings.

The 2003 **Best Ergonomics in Design Article Award** went to Douglas H. Harris for his timely paper entitled "How to *Really* Improve Airport Security." His coverage of a nationally important issue provided a compelling case for a stronger application of human factors to the sensitive topic of airport security.

Julie M. Stark was the winner of the 2003 **Alphonse Chapanis Best Student Paper Award** for "Investigating Display Integration in Candidate Synthetic Vision System Displays." Her paper examined ways to avoid low-visibility aviation accidents using displays augmented with synthetic vision system technologies.

Sebastiano Bagnara of Politecnico di Milano, Milan, Italy, was the recipient of the **Distinguished International Colleague Award** for 2003. He was honored for outstanding research in cognitive ergonomics and human aspects of information technology, as well as his sustained leadership in the human factors field.

Mica R. Endsley was honored with the 2003 **Jack A. Kraft Innovator Award**. Her contributions to the development, theory, and application of situational awareness have helped clarify the term for many researchers. One of the most frequently cited writers and practitioners in the field, Endsley has continually demonstrated creative and thorough work, broadening the understanding of situation awareness and its measurement.

Arthur D. Fisk was given the 2003 **Paul M. Fitts Education Award**. A professor in the Department of Psychology at the Georgia Institute of Technology, Fisk was honored for his instrumental contributions to the education and training of human factors specialists.

The 2003 **A. R. Lauer Safety Award** was presented to Michael S. Wogalter for his research in safety communications and warnings and his work to develop national standards for warnings. Working at North Carolina State University as an associate professor

of psychology, Wogalter has spearheaded efforts for greater understanding of the requirements for the design and efficacy of warnings.

The 2003 **Alexander C. Williams, Jr. Design Award** was awarded to Alan Hedge for his contributions to the design of the Raymond Corporation's swing-reach forklift truck. Hedge is a professor in the Design and Environmental Analysis Department at Cornell University in Ithaca, New York. ☒

TECHNICAL GROUPS

User-Centered Consumer Product Design Award

The HFES Consumer Products Technical Group (CPTG) recently conducted its second product design competition for innovative and user-centered approaches to human factors and industrial design. The award committee (Dianne McMullin and Stan Caplan) received 12 outstanding nominations for a variety of product types. Seven judges evaluated the nominations on three design and three methodology criteria.

The award was presented at the HFES 2003 Annual Meeting in Denver to Microsoft Corporation for the Microsoft Office Keyboard.

Hugh McLoone, the Microsoft team leader for the project, accepted the award and presented a paper about the keyboard and its development at a well-attended CPTG session.

Design considerations were functional obviousness, ease of operation, and creativity. Research and methodological criteria considered how users were incorporated into concept development, design and evaluation phases of the design process. Thanks go to CPTG members Dave Aurelio, David Clarke, David Gilmore, Bill Lee, Jay Pollack, Nicole Prioux, and Rob Tannen, who evaluated the nominations.

The call for nominations for the award will be published in the February issue of the *HFES Bulletin*. In the interim, contact Dianne McMullin (dianne.l.mcmullin@boeing.com) or Stan Caplan (scaplan@usabilityassociates.com) for details. ☒

Mark your Calendar!

HFES invites you to attend the 48th Annual Meeting, to be held at the Sheraton New Orleans Hotel, New Orleans, Louisiana, September 20–24, 2004. Please go to <http://www.hfes.org/meetings/2004menu.html> for regular updates on the Annual Meeting.

2002 Financial Report

The Human Factors and Ergonomics Society's 2002 audited financial report, received by Secretary-Treasurer Mica J. Endsley in December 2002, was prepared by Castillo & Ebenhoch, an accountancy corporation. The firm audited the following statement of assets and liabilities – cash basis of Human Factors and Ergonomics Society, Inc. (a nonprofit organization) at December 31, 2002, and the related statements of revenues and expenses – cash basis and of changes in fund balance – cash basis for the twelve months then ended. These financial statements are the responsibility of the Human Factors and Ergonomics Society's management. The firm's responsibility is to express an opinion on these financial statements based on its audit.

In addition to the regular Society funds, the firm reviewed the A. Chapanis Award Funds. These funds had a balance of \$20,823 at January 1, 2002; at December 31, 2002 the balance was \$21,099.

The firm conducted its audit in accordance with generally accepted auditing standards. Those standards require that the firm plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statement. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. The firm believes that its audit provides a reasonable basis for its opinion.

As described in Note 1, these financial statements were prepared on the basis of cash receipts and disbursements, which is a comprehensive basis of accounting other than generally accepted accounting principles.

In the firm's opinion the financial statements referred to above present fairly, in all material respects, the assets, liabilities, and fund balances of Human Factors and Ergonomics Society, Inc. as of December 31, 2002, and its revenue, expenses, and the changes in its fund balances for the twelve months then ended, in conformity with the basis of accounting described in Note 1.

**Statement of Assets and Liabilities – Cash Basis
December 31, 2002**

Assets	
Cash on deposit	
Bank of America Checking	\$268,256
PaineWebber Money Market and Certificates of Deposits (Note 5)	247
Total Cash on Deposit	\$268,503

Investments

Vanguard STAR Fund, at cost (Note 7)	6,959
Total assets	\$275,462

Liabilities and Fund Balance

Reserve for current payable (Note 3)	\$ 12,000
Total liabilities	\$ 12,000
Fund balance	263,462
Total liabilities and fund balance	\$275,462

**Statement of Changes in Fund Balance – Cash Basis
for the 12 Months Ended December 31, 2002**

Balance – January 1, 2002	\$164,904
Less: excess of expenses over revenues	(98,558)
Balance – December 31, 2002	\$263,462

**Statement of Revenues and Expenses – Cash Basis
for the 12 Months Ended December 31, 2002**

Revenues	
Individual memberships	\$565,150
Sustaining memberships	13,500
Publications	332,658
HFES Institute	41,597
Annual meeting	227,224
Placement	44,736
Miscellaneous	19,486
Total revenues	\$1,244,351

Expenses	
Publication expense	
Bulletin	\$39,922
Journal	116,052
Directory and yearbook	28,314
Ergonomics in Design	57,572
Books	21,757
Proceedings	2,356
Other publication expense	24,511
Total publication expense	\$290,484

Member Services:	
Mailings expenses	23,207
Placement service	39,225
Committee and other (Note 4)	66,132
Annual meeting	64,247
Member Services	39,364
Computer, web site, & related expenses	19,632
Interorganizational	20,437

Total General and Administrative Expense \$272,244

General and Administrative Expense:	
Salaries and Related Costs	457,452
Office Expense	114,887
Accounting and Legal	8,458
Income Taxes	2,268

Total General and Administrative Expense \$583,065

Total Expenses	\$1,145,793
Excess of revenues over expenses	\$98,558

Note 1 – Summary of Significant Accounting Policies

This summary of significant accounting policies of Human Factors and Ergonomics Society, Inc. (the organization) is presented to assist in understanding the organization's financial statements. The financial statements and notes are representations of the organization who is responsible for their integrity and objectivity.

Activity. The organization is a non-profit entity. The organization is an interdisciplinary organization of professional workers concerned with the role of humans in complex systems, the design of equipment and facilities for human use, and the development of environments

for comfort and safety. The membership is composed of psychologists, engineers, physiologists, and other scientists from the United States and around the world.

Human Factors and Ergonomics Society, Inc. promotes research and the application of human factors in the design, development, use, and evaluation of machines, systems, environments, and devices.

Basis of accounting. The organization's policy is to prepare its financial statements on the cash basis of accounting; consequently, certain revenues are recognized when received rather than when earned, and certain expenses and purchases of assets are recognized when cash is disbursed rather than when the obligation is incurred.

Note 2 – Property and Equipment

It is the organization's policy to expense all capital assets purchased throughout the year.

Note 3 – Reserve for Current Payable

This represents a segregation of surplus for bills due at December 31, 2002. This represents \$12,000 for miscellaneous payables.

Note 4 – Committee and Other

Awards	\$ 1,267
Chapter Affairs	1,241
Miscellaneous	18,264
HFES Institute	27,824
Technical Program	397
Executive Council	17,139
	\$66,132

Note 5 – Concentrations of Credit Risk

The organization maintains its cash balances at several financial institutions located in Santa Monica, California. Accounts at each institution are insured by the Federal Deposit Insurance Corporation up to \$100,000. At December 31, 2002, there were no uninsured cash balances at these financial institutions.

The organization also has an account at PaineWebber Incorporated, which is insured by the Security Investor Protection Corporation up to \$100,000 for cash balances and \$500,000 for the total account. At December 31, 2002, the organization's uninsured cash balance was \$168,256.

Note 6 – Pension Plan

The Organization has a Tax-Deferred Annuity Plan using Teachers Insurance and Annuity Association-College Retirement Equities Fund (TIAA-CREF) Annuities that meet the requirements of section 403(b)(1) of the Internal Revenue Code.

Benefits are provided by individually insured contracts issued by TIAA-CREF to each participant. The guaranteed rate basis for premiums applied to TIAA Retirement Annuity contracts is in accordance with the terms of the participant's individual annuity contract.

The plan is a defined contribution plan, which covers all full-time employees with two years of service. The plan calls for contributions of 10% of compensation for participants for the first three years in the plan and 12.5% of compensation thereafter.

Note 7 – Investments

The organization has the following mutual fund with the Vanguard Group

	Fair Market
	Cost
376.473 shares of Vanguard STAR Fund	\$6,959 \$5,578



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FLASH!

ON-LINE JOURNAL ALERT!

As you may have read in the Dues Renewal packages mailed recently, *Human Factors* will be available on line in 2004. Members can opt for print only (free with membership), on-line only (free), or print plus on-line (\$90 for both).

When you fill out your renewal materials, please be sure to indicate if you prefer to receive the print version, the on-line version, or both. If you do not indicate a preference, HFES will not be sending you the print journal.



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