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FLORIDA INSTITUTE FOR HUMAN & MACHINE COGNITION

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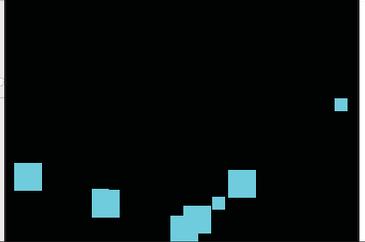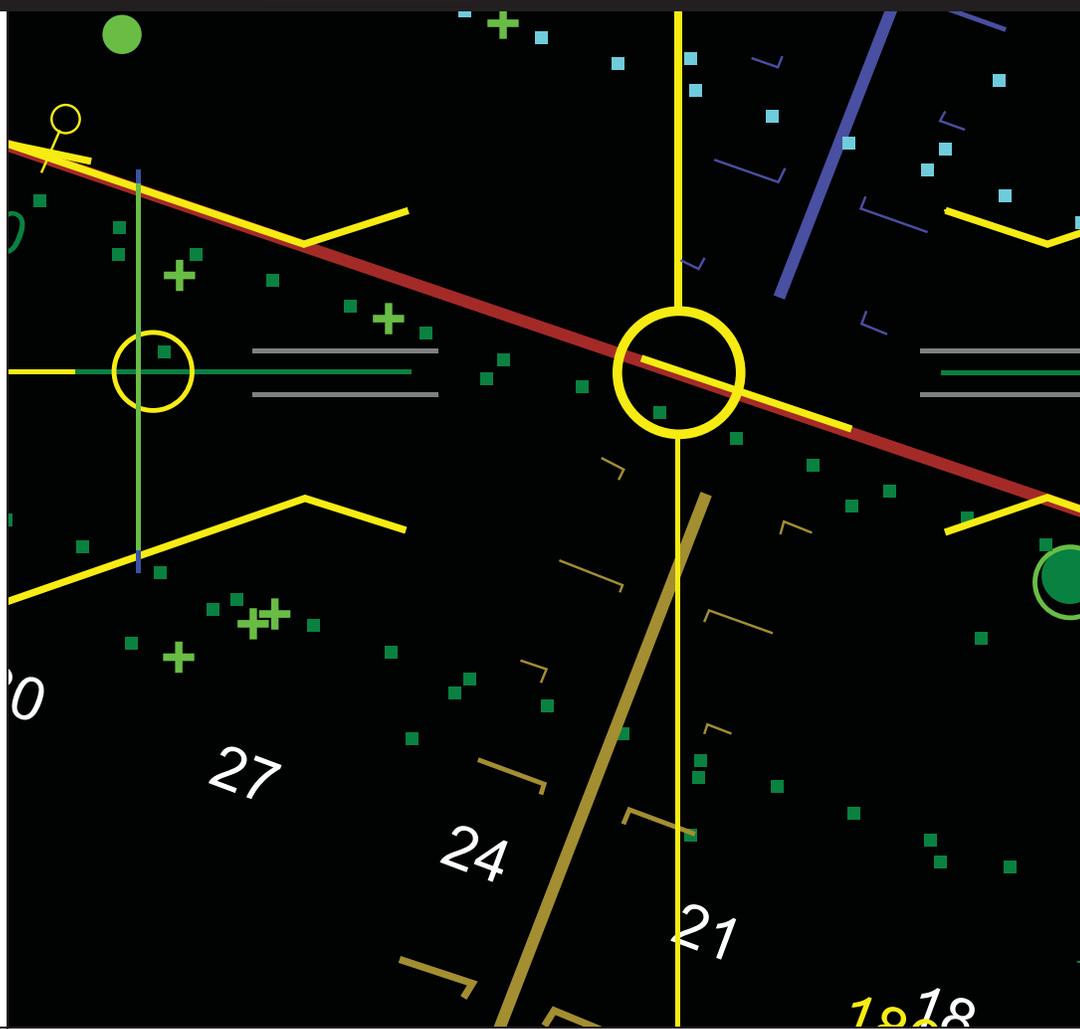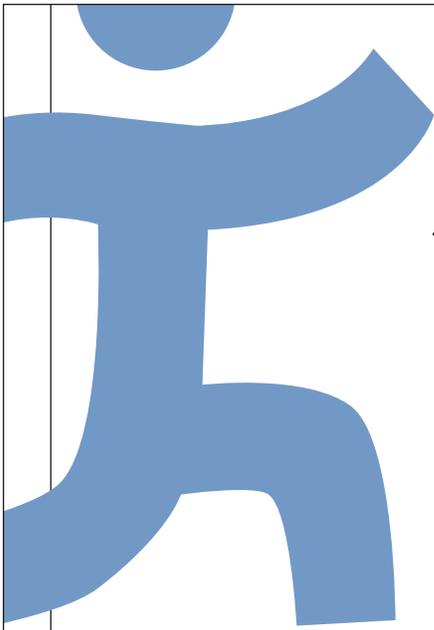
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FLORIDA INSTITUTE FOR HUMAN & MACHINE COGNITION

Dear Friends of IHMC,

It is well-known that IHMC's research focus is on the relation-ship between humans and their machines. We have been recognized worldwide for our research accomplishments, however, less obvious is the work we are doing to improve the community in which we live and work through our volunteer initiatives.

One area that deserves special notice is our education outreach. I'm proud of the fact that our staff includes some of the most remarkable scientists and engineers in the world. But I'm even more impressed that so many of them have agreed to give up some of their valuable time in order to share their passion for science with the next generation.
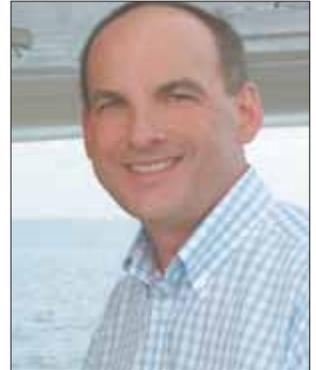
Science Saturdays is a program that has developed a tremendous following here in Pensacola. One Saturday per month, in the fall and in the spring, we open our doors to children in grades three through five and conduct hands-on scientific learning activities. These activities are free of charge and open to any children in the relevant age groups. *Science Saturdays* was launched by IHMC in the fall of 2003. This year, Baskerville-Donovan, a Pensacola-based engineering firm, has joined us as a sponsor for the activity, contributing both funding and volunteers.

Another effort we're particularly excited about is the *I LOVE Science* (Increasing Local Op-portunities for Volunteers Enthusiastic about Science) program. This effort was conceived in the spring by State Rep. Holly Benson, in conjunction with IHMC, Gulf Power and the school systems of Escambia and Santa Rosa counties. In a nutshell, *I LOVE Science* is the "to-go" ver-sion of *Science Saturdays.* In this case, volunteers go to fifth-grade classrooms in the two-county area once a month to offer a hands-on presentation that complements the current class studies. This is a tall order since there are more than 250 classrooms, but I'm pleased to announce that we have volunteers signed up for every one!

I would be remiss if I didn't congratulate IHMC researchers Greg Hill for his work with the Escambia County school mentoring program and Nate Chambers for his web assistance to teachers worldwide. Greg was recently honored with the Community Drug and Alcohol Coun-cil's Spirit of Prevention Award for his volunteer efforts at Hallmark Elementary School. Nate recently created www.wetheteachers.com, an educational website to assist teachers nationwide.

Talented, dedicated people are the lifeblood of IHMC. But these amazing individuals could not have joined our ranks if their passion for discovery and innovation had not been nurtured and encouraged when they were young. It is to their great credit that they are working now to instill that same passion in a new generation. We will all reap the rewards.

Best Wishes,

Ken Ford

Kenneth M. Ford, Director

IHMC BOARD OF DIRECTORS

Human Centered Visualization

> ### "Vision is the art of seeing things invisible."
> — Jonathan Swift

Initiating change, particularly revolutionary change, is difficult in any environment. As a result, change in almost all cases tends to evolutionary rather than revolutionary. This phenomenon is especially true in those domains where a mistake can be costly in terms of money, but even more so when the mistake can cause injury or loss of life. Perhaps nowhere is this more true than in aviation; and specifically in the realm of cockpit instrument display technologies.

It is interesting that aircraft cockpit displays are still largely living in the age of steam. This is to some extent a historical accident. Early flight pioneers, with no readily available means of instrumenting their primitive flyers, modified the gauges designed for steam engines and fitted these to the aircraft. Today,

remnants of these old display devices still exist in modern cockpits where we find digital simulations of the old steam gauges, sometimes even with little digital screws, modified only by the shape of the dial and the relative positions of the instruments.

Flying a modern aircraft under instrument conditions (in clouds and/or in darkness) is a difficult-to-learn skill that requires many hours of training. The pilot must first learn and practice an "instrument scan" whereby he looks at a series of gauges in sequence, takes a piece of information (altitude, airspeed, wing attitude, heading, etc.) from each gauge, then mentally combines that information to create a picture of what the aircraft is doing. This mental image is then compared with a set of numbers and diagrams specifically representing the

Traditional cockpit display
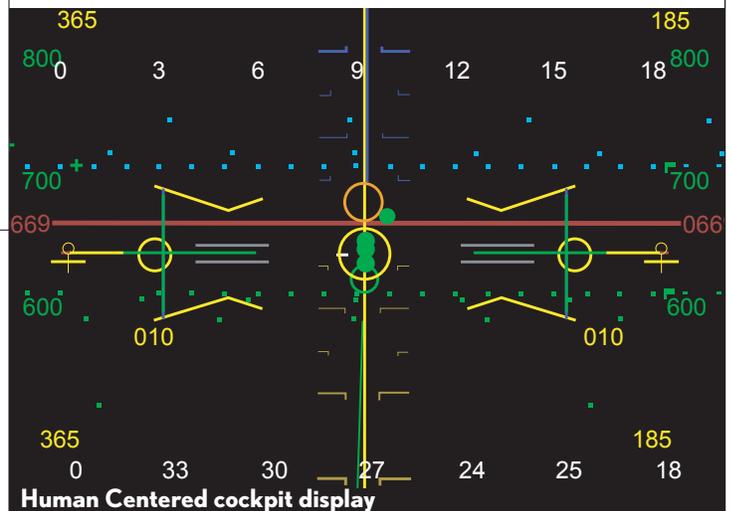
Human Centered cockpit display

performance parameters of the aircraft being flown to determine what, if any, corrections to the flight path need to be initiated. The sequence is repeated continuously throughout the period of instrument flight. One can clearly imagine that this is a rather intense cognitive task load that can become quickly overwhelming in a high stress environment such as air combat.

At IHMC Dr. David Still, Tom Eskridge, and their coworkers have developed a cockpit that is truly revolutionary. Through a new understanding of the physiology of the human visual system

and taking advantage of the way computers can translate and display digital flight information, IHMC has radically changed aircraft cockpit displays.

This new human-centered visual display takes all of instrument scan data and presents it in a way that is easy for the pilot to process. The creators of this revolutionary concept, IHMC's Still and Dr. Leonard Temme, formally with the Naval Aerospace Medical Research Laboratory's, both have backgrounds in vision science and they have capitalized on the advantages of ambient, non-focal vision to present

SCIENTIST PROFILE
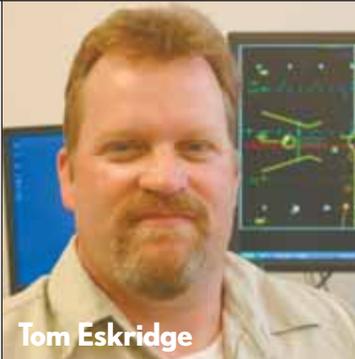
Tom Eskridge

Hometown: Mascoutah, IL
Education: B.S., mathematics and computer science, M.S., computer science, Southern Illinois University-Carbondale
Joined IHMC: 2001

Tom got into science almost by default. His original plan was to play tennis throughout university, then teach at a local club. However, before starting to play tennis for Illinois State he was required to declare a major. His dad remembered that Tom had liked a computer class in high school, so at his suggestion, Tom chose computer science. Eventually he found he enjoyed computers more than tennis.

Tom started a company in 1990 and gave up tennis altogether. His company focused on using analogical reasoning to create classification tools for industry. Their largest market was chip manufacturers, particularly Intel, and, when the tech bust came, he decided to sell the company.

In the heyday of the company, Tom frequently drove through the Pensacola area with his family. They were quite enamored and thought they might retire here. When Tom sold his company, he saw an ad about IHMC and decided to come.

He hasn't regretted the decision. IHMC is just what Tom wanted his company to be. He enjoys the interdisciplinary nature, the minimal management structure, and the opportunity to know and work with such a range of talented researchers. Tom has worked on several different projects, including Visual cockpit displays and CmapTools. One project he is working on now is the development of a new ontology extension for CmapTools.

Outside of work, Tom is pursuing his Ph.D. in philosophy from Binghamton University, where his thesis work is on modeling human analogical reasoning. He also is an avid sailor. When he, his wife, and two sons moved to Pensacola, they lived on their 30 ft boat for two months. If Tom had realized how much they would enjoy that, they wouldn't have bought the house. Eventually, they will move onto a new boat. He also enjoys his neighborhood and "goofing off" with his family.
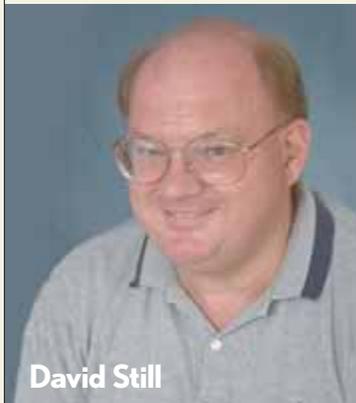
David Still

Hometown: Rockville, MD
Education: A.A., science, Montgomery College; B.S., science, Regent's College; M.B.A., Troy University; O.D., Illinois College of Optometry; Ph.D., physiological optics, Indiana University
Joined IHMC: 1998

Working on human centered cockpit displays are a confluence of two of Dave's passions, vision and flight. In high school he aspired to become a pilot, but his vision was too poor. The son of an optometrist, he decided to pursue optometry instead.

In the Navy, Dave served as clinical optometrist initially. Eventually he enrolled in graduate school while in the Navy. His Ph.D. research was on the physiology of the eye, particularly the peripheral vision system. He returned to regular Navy work as a vision scientist. First he wanted to work on submarine systems, making visual objects out of auditory objects. After being transferred to Pensacola, he joined the Naval Aerospace Medical Research Laboratory at NAS Pensacola. While there he led, with Leonard Temme, the effort which resulted in a visual system for fixed wing.

During his work with the Navy on a helicopter instrument scan project, Dave began collaborating with IHMC. When he retired from the Navy, he came to IHMC full time to pursue OZ further. He enjoys IHMC's collegial atmosphere, the sense of scientific community, cooperation, and technical support. Especially appreciated is the focus on research, the lack of regulations, and the absence of mandatory meetings on topics unrelated to scientific research. With his unusual background and desire to turn research results into useful products (he has three patents), Dave finds IHMC's multidisciplinary team structure and goal of "research that makes a difference" an ideal fit.

Dave has continued his passion for flight as a hobby. He is a licensed pilot, though, interestingly, he is not licensed to fly on instruments. He also is building his own airplane, a Rutan Long-EZ, in his free time. He also enjoys spending time with his wife, two daughters, and son.

information to pilots in a more intuitive way. By presenting data graphically, this new display allows pilots to acquire and process more information at a glance. Now pilots can focus on a particular issue of interest, inside or outside the cockpit, while their peripheral vision monitors the flight parameters of their aircraft.

Researchers at IHMC are also developing instrumentation for helicopters and UAV's using similar principles to those developed for the flight instrument displays for fixed wing aircraft. For helicopters, the end result would allow pilots to maintain a hover with no external visual cues in conditions of reduced visibility such as blowing snow, sand or dust.

For UAV pilots, maintaining situational awareness is challenging when all you have is the "through the soda straw" view from cameras. Using a human centered display, though, UAV pilots can get a good sense of the aircraft's status at a glance without losing significant situational awareness.

As UAV's become more ubiquitous, it will be useful, and maybe necessary, for a pilot to control multiple vehicles. Pilots will then need to be able to ascertain an aircraft's situation in a quickly and intuitively. Instead of having to scan instruments on

IHMC staff testing a human centered cockpit display

each vehicle's display, the pilot could quickly glance at each display to assess the vehicle flight situation.

Although the human centered cockpit display was originally designed for aircraft, the principles can be applied in many settings. Any domain where the rapid and intuitive correlation of a number of data streams is necessary to understand system status could benefit. For instance, anesthesiologists must assess heart rate, breathing rate,

> ■ ■ ■ **Through a new understanding of the physiology of the human visual system...IHMC has radically changed aircraft cockpit displays. ■ ■ ■**

blood oxygen levels, and other information in order to decide how much of which drug to give a patient. A graphical representation that correlates each variable with the others could allow anesthesiologists to determine the patient's status easily and rapidly.

Military command and control also requires processing many numbers to make a decision. For example, troop and equipment numbers, logistical status, and time relationships all factor into planning and controlling a mission. IHMC researchers are exploring the use of graphical representation on maps to provide such critical data in a way that can be absorbed by the commanders at a glance, directing their attention rapidly to trouble spots.

By making large amounts of data easily and intuitively understandable, Still, Eskridge, and their IHMC coworkers have freed the human operators of many types of systems to use their minds for the more complex tasks for which only their mental capabilities are well suited.

RECENT LECTURES

■ ■ ■ IHMC's Evening Lecture Series

Kathy Sullivan

Sullivan gives perspective on space flight

Kathy Sullivan, a former NASA Astronaut, a veteran of three shuttle missions, and the first American woman to walk in space, knows first hand that space exploration still has the power to excite people. In her address "Quo Vadis: The Who, What and Why of Spaceflight in the Early 21st Century?" she explored the history of space exploration and examined the current status of space efforts worldwide.

Competition between the United States and the Soviet Union shaped the beginning of the space era into a competitive race. While nations collaborate today on missions ranging from planetary probes to the International Space Station, prestige and sovereignty still drive some initiatives, such as China's recent entry into human spaceflight and several lunar exploration campaigns.

The tremendous challenges inherent in space flight and exploration can provide strong impetus for science and technology research and inspiration for education. The initial U.S. space efforts were founded on the science and technology base created during World War II, relying heavily on both the expertise and technologies developed in the 1940s. Sullivan noted that other nations "observed the leavening effect on education, inspiration, and aspiration" and the cascade of benefits garnered by the US and USSR through their Cold War space endeavors. Space exploration is a grand challenge that "drives so many

technologies across so many disciplines to such a high degree of performance" and so helps catalyze education, workforce development and innovation throughout a country.

Today's US space program is focused on returning to the moon, but must complete assembly of the International Space Station and produce a replacement to the shuttle for carrying people. What about nascent privately-funded space flight and tourism efforts? Sullivan applauds their initial successes and the rejuvenation of public interest they have generated. But she's pessimistic about the likelihood that such businesses becoming technology transformers that drive spaceflight costs dramatically lower. Still, she cautions that one should "never sneer at cartoons" – artist's concepts of possible futures – since need and innovation often do turn them into practical realities.

After leaving NASA, Dr. Sullivan served as Chief Scientist at the National Oceanic and Atmospheric Administration (NOAA). In this position, she oversaw a wide array of research and technology programs

ranging from climate and global change to satellites and marine biodiversity. For nearly a decade, she served as President and CEO of COSI (Center of Science and Industry), one of the nation's leading centers for innovative, hands-on, inquiry-based science learning resources. She now pursues her passion for teaching and learning as COSI's Science Advisor. In addition, Kathy is Vice Chairman of the National Science Board and active on many other corporate and non-profit boards.
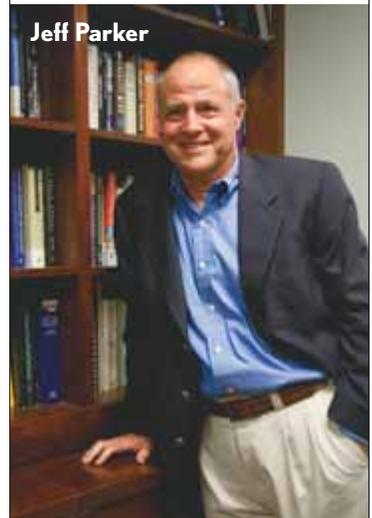
Jeff Parker

Parker outlines tips to success

Entrepreneurship is controlling your own destiny, according to Jeff Parker, a "serial" entrepreneur. This perspective can empower and excite people in many fields. On May 31, Parker enumerated some "lessons learned" in his lecture "The Art of Serious Fun

■ ■ ■ **Space flight and exploration provides a strong motivation for science education and research.** ■ ■ ■

RECENT LECTURES

■ ■ ■ IHMC's Evening Lecture Series

– The Keys to Entrepreneurial Success".

Parker developed these tips for presentations to business students when he was asked to discuss his business experiences. He enjoys talking with people and tries to give insight into both successful and unsuccessful business experiences.

Some of Parker's tips focus on important steps for starting a company. Gain experience, do something you know, and have a strong business plan. Other important tips relate to running the company, such as focusing on marketing, keeping good relationships with employees, and maintaining positive cash flow. Additional tips give insight into the life of entrepreneurs—Parker stressed the importance of marrying the right spouse, someone who will understand the demands of entrepreneurship.

Jeff Parker cofounded Corporate Communications Broadcast Network (CCBN) in 1997 and served as the company's Chairman and CEO from its inception to its sale in March, 2004. Prior to founding CCBN, Parker cofounded 38 Newbury Ventures, a venture capital firm focused on start-up and early

stage companies. Other companies that Parker has helped found include Technical Data Corporation, Business Research Corporation, and First Call. He was Chairman and CEO of Thomson Financial, a major provider of proprietary financial information to the investment and corporate communities. He also was Vice President and Senior Fixed-Income Portfolio Manager at Fidelity Investments and has held management positions at Smith Barney, Loeb Rhodes, and A.G. Becker. An alumnus and Trustee Emeritus of Cornell University, he founded the Parker Center for Investment Research at the Johnson School at Cornell.

Blakeslee describes importance of body image

A person's image of self is highly influenced by one of several body maps, according to Sandra Blakeslee, coauthor of the forthcoming book "Physical Intelligence." On June 14, She discussed the central role of body maps in many everyday interactions and how scientists are tapping them to improve health during her lecture "Sing the Body Elastic".

Blakeslee described research in psychology and neuroscience that all illustrate the central role of body maps. For example, when people and chimps use tools, they alter their body map to include the tool. That explains why people duck

Sandra Blakeslee

when driving under a bridge. Similar effects occur during virtual reality video games.

Problems with body image contribute to many medical problems. Blakeslee described research that shows that people who lose a large amount of weight still view themselves as fat, which contributes to weight regain. Stimulation of the vestibular system, by doing exercises with a balance ball, for example, adjusts the body map, thereby reducing weight gain. Similarly, anorexics have trouble translating what they see in the mirror into a body image. Studies have shown that anorexics who wear spandex suits, which alter their body map through tactile stimulation, easily gain weight.

Stroke and amputation cause drastic changes to body image. Improvements in stroke recov-

ery can occur through use of mirrors and other devices to make the mind create a new view of the body. Blakeslee described a simple technique that can help alleviate phantom limb pain, a common side effect of amputation.

A patient who had one arm amputated puts the good arm in a mirror box so the good arm appears as the bad arm. Simply moving the good arm reduced the patient's pain.

Blakeslee has been writing about science and medicine for the New York Times for over 35 years. In addition, she has coauthored several books including "On Intelligence" with Jeff Hawkins, the inventor of the Palm Pilot who is today building intelligent machines based on a biological understanding of the human cortex. She wrote "Phantoms in the Brain" with Dr. V.S. Ramachandran, a book on neurological mysteries that has been translated into ten languages. A graduate of the University of California at Berkeley, Ms. Blakeslee lives in Santa Fe, New Mexico.

■ ■ ■ **Gain experience, do something you know, and have a strong business plan.** ■ ■ ■

RECENT LECTURES

■ ■ ■ IHMC's Afternoon Lecture Series

Bohus describes dialog system

Spoken dialog systems frequently are not robust to understanding errors. For example, a travel system may not recognize the city name and has no way to overcome that problem. In his lecture "Belief Updating in Task-Oriented Spoken Dialog Systems" Dan Bohus detailed a method for the system to update its beliefs throughout conversations, using later information. This approach significantly outperforms current systems. Bohus is a Ph.D. student in the Computer Science Department at Carnegie Mellon University.

Aparicio explains the importance of associative memories

Computers still can not mimic the broad intelligence of humans. By incorporating associative memories, considered key to "real intelligence," into computers, Manny Aparicio aims to improve artificial intelligence, as he outlined in his lecture "Memory-based Representation and Reasoning for Intelligent Systems." He detailed applications in predictive analytics and entity analytics across a number of industries. Aparicio is the cofounder of Saffron Technologies, which creates neural network and other artificial intelligence software products.

Hoffman details role of concept maps in military operations

Concept maps can represent knowledge and procedures in many fields. In his lecture "Sharing Operations Orders through Concept Maps" IHMC's Robert Hoffman described new CmapTools for military operations. New templates and protocols will enable the Army to reinvent its process for creating and sharing Operations Orders, as part of a larger vision for using CmapTools to support joint and coalition operations.

Yu describes techniques for sensor systems

Future autonomous sensor systems will consist of hundreds of unmanned vehicles and robots. Bin Yu discussed techniques for coordinating their activity in his lecture "AI Techniques for Autonomous Sensor Systems." He focused on distributed algorithms for data delivery and fusion, task and resource allocation, and cooperative path planning. Yu is a postdoctoral fellow in the School of Computer Science at Carnegie Mellon University.

Feltovich outlines types of activity coordination

Teamwork requires interdependence. This interdependence requires coordination in time and location and a degree of predictability. IHMC's Paul Feltovich discussed ideas of interdependence during his lecture "We regulate to coordinate: Human and Machine Joint Activity." By integrating interdependence into KAoS policy services, he aims to improve teamwork and simplify interaction between humans and agents.

Gomez details concept map tools in preschool

The concept map structure appeals to preschool children, who like tangible materials. Unfortunately, without the ability to read, they cannot use linking phrases or abstract concepts. In her lecture "An Authoring Concept Mapping Tool for the Early Childhood Classroom" Gloria Gomez described pilot studies with a new tool kit. The Kit has tangible materials and voice-input devices to overcome the challenge of illiteracy. Formerly on the IHMC CmapTools team, Gomez is now an Australian government and Swinburne University-funded doctoral student.

Guy Boy discusses improved interfaces

The modern airplane cockpit includes computers for displays and navigation. In many cases, however, the computer takes over only part of the task, not always the important part. Guy Boy described the challenges of these transformations in his lecture "Procedural Interfaces." In designing procedural interfaces, Boy examines how to support task execution rather than simply one aspect of a task. These context-dependent interfaces support critical cognitive functions. Users concentrate on their task and rely on the incorporated redundancy. Boy is the Founder and President of the European Institute of Cognitive Sciences and Engineering (EURISCO).

Cooke reviews SequenceL

The complexity of computer languages increases the complexity of use. Daniel Cooke, director of the Center for Advanced Intelligent Systems at Texas Tech University, explained the simplifications afforded by SequenceLduring his lecture "A Gentle Introduction to SequenceL: The Taurus, Windows, and Computer Languages." SequenceL constructs are primarily implemented using two simple semantics, which provide algorithmic detail inthe problem solution.

Rushton discusses program verification

For many critical systems, proofs of program correctness are highly desirable, but these proofs are often difficult and cost-prohibitive to achieve. During his lecture "Semi-automatic Verification of SequenceL Programs," Nelson Rushton, assistant professor of computer science at Texas Tech University, described how such verification can occur with SequenceL declarations. With minor changes, the semantics of SequenceL support semi-automatic verification with assertions stated in SequenceL, rather than a separate logical language.logical language.

HAPPENINGS

▪ ▪ ▪ NEWS OF IHMC

IHMC hosts annual board meeting

IHMC Board
(Seated) Carol Carlan, Sandra Flake (Standing) Hal Hudson, Eugene Franklin, K.C. Clarke, Chris Hart, Vice Chair Dick Baker, Ray Russenberger, Chair Eric Nickelson, and Jim Reeves

IHMC held the annual meeting of its board of directors on June 5. In addition to reappointing members for additional terms, Eric Nickelsen was elected as chair and Dick Baker was elected as vice chair of the board. A resolution was approved honoring the efforts of state Rep. Holly Benson in securing state funding for IHMC and her general support of the Institute. A second resolution honored the efforts of Carol Carlan as the inaugural chair of the IHMC board.

Director Ken Ford gave an overview of the research underway at IHMC. A special presentation highlighted the research of Dr. James Allen and his team, with a demonstration of their task learning system called PLOW (Procedure Learning On the Web). The board was also treated to a reception on the Lady Val, the yacht of board member Ray Russenberger and his wife Valerie.

Ford presents Dr. Raj Reddy with Vannevar Bush award

IHMC's Ken Ford had the privilege of presenting the Vannevar Bush award to Dr. Raj Reddy at the National Science Board annual dinner May 9th in Washington, DC. Dr. Reddy was honored for his pioneering research contributions and educational leadership in computer science. During his 40 year career at the Carnegie Mellon University as Founding Director of the Robotics Institute and subsequently Dean of the School of Computer Science, he was instrumental in transforming computer science from a disparate group of academic disciplines into an integrated field, built upon his seminal work in human-computer interaction, artificial intelligence, speech technologies, and robotics. His current work focuses on making computer science, information technology, and communications relevant to and affordable in developing regions of the world. He spearheaded the Million Book Digital Library Project and is active in developing and promoting solutions to help those in rural environments worldwide gain access to computer technology.

The Vannevar Bush Award is among the nation's most prestiguous awards in the sciences. It was established in 1980 in honor of Vannevar Bush, the first Presidential Science Adviser. In this role he led Government science policy into post World War II era, including establishing what became the National Science Foundation.

Ray Russenberger, Larry Lemanski, Ken Ford, and Charles Carlan talk aboard The Lady Val

Dr. Ken Ford presents Vannevar Bush Award to Dr. Raj Reddy

PEOPLE IN THE NEWS

■ ■ ■ ■ NEWS OF IHMC

Carvalho attains Ph.D. and becomes citizen

IHMC's Marco Carvalho reached two big milestones this spring. After ten years in the US, he and his wife, Silvia, became citizens at the Pensacola Court House on May 5. Originally from Brazil, Carvalho has worked at IHMC since 2000. His wife works as a real estate property appraiser in Pensacola. They have two daughters, Isabel, age 6, and Camilla, age 5, both born in the US. This spring Carvalho also received his Ph.D. in Computer Science from Tulane University. He conducted his research at IHMC, commuting to New Orleans for classes. He received a B.S. and a M.S. in Mechanical Engineering from the Federal University of Brasilia, Brazil. He also holds an M.S. in Computer Science from the University of West Florida.

Novak receives honorary degree

Joe Novak received a Laurea "ab honorem" in the Science dell educazione from the University of Urbino, Italy, on May 12. The citation recognized the work he has done to improve science education, particularly his work on developing the concept

Silvia and Marco Carvalho receive citizenship

mapping tool. Novak received the degree in the company of his two sons, Joe and Bill. The University was celebrating its 500th anniversary last year. Novak has honorary degrees from two other universities, the National University of Camahue, Argentina, and the Public University of Navarra, Spain.

Hayes work judged best in show

IHMC's Pat Hayes received the Best in Show award from the Artel Gallery for their summer show, Ars Gratia Artis, for his work *Old Blue*. This piece was his first submis-

Old Blue

sion to a juried show. Hayes, who considered becoming a professional artist rather than a scientist, has been active with the local gallery and juried a previous show there.

Hayes created this piece using a variety of found pieces, with the base being his granddaughter's whiteboard and the frame made from wood of a neighborhood house that was recently demolished. He used a variety of techniques to alter the materials, including one that he learned from another hobby, clock restoration. Most of his other work is more traditional, such as figure and portrait drawing and working with pastels, but now that he has started this type, he plans to do a lot more.

Perez joins CmapTools team

IHMC is pleased to welcome Carlos Perez back to the CmapTools group. While a student at EAFIT University

in Medellin, Columbia, Perez did an internship at IHMC. After he returned to the University he worked in the Educational Informatics R&D Lab. He received his Bachelors degree in Computer Science Engineering in 2004. Most recently he worked at Intergrupo, in Medellin, developing web applications. He and his wife enjoy the tranquility and architecture of Pensacola, and he likes his colleagues at IHMC. In his free time he watches movies and swims.

Sheppard selected for leadership program

Julie Sheppard, IHMC's General Counsel and Special Assistant to the Director, was chosen to participate in this year's Leadership Florida program. The Leadership Florida program, created by the Florida Chamber of Commerce in 1982, is designed to provide its members with an inside look at various communities, institutions, and businesses across the state. The 1 year class program includes six 3 day sessions in various locations around the state. The selection of Sheppard as one of the 50 participants this year recognizes her unique role at IHMC and her contributions to the community at both the local and state level.

RECENT BOOKS

■ ■ ■ ■ New books by IHMC researchers

Cambridge Handbook of Expertise and Expert Performance

The Cambridge Handbook of Expertise and Expert Performance contains review articles by world-leading research-ers covering research on diverse domains of expertise. In describing how experts differ from novices, contributors examine the performance of experts in a variety of tasks. Researchers also detail methods for studying expertise and how experts become experts. IHMC's Paul Feltovich and Robert Hoffman collaborated with Anders Ericsson, Conradi Eminent Scholar and Professor of Psychol-ogy at Florida State University, and Neil Charness, William G. Chase Professor of Psychology at Florida State University, in editing this volume.
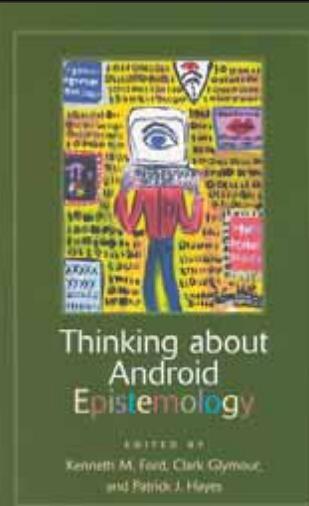
Thinking about Android Epistemology

Philosophy focuses, in many ways, on the human mind and the definition of intelligence. Generally, intelligence is defined by human capacities and limitations. The field of artificial intelligence has, for the most part, contin-ued with that definition, looking to embody human abilities in machines. In Thinking about Android Epistemology, an updated version of Android Epistemology, contributors examine alternate theories of intelligence. They provide both theoretical and practical insights, including novel approaches to expanding human abilities. IHMC's Ken Ford, Clark Glymour, and Pat Hayes edited this volume, which contains contribu-tions from noted computer scientists and philosophers, including Herbert Simon, Daniel Dennet, and Paul Churchland.

Working Minds: A Practitioner's Handbook of Cognitive Task Analysis

Cognitive task analysis assists researchers in many fields in understanding the skills and strategies decision makers use in a variety of settings. Working Minds: A Practitioner's Handbook of Cognitive Task Analysis provides tools for doing this analysis, including methods for data collection and tools for data analysis. The results of this type of analysis can assist system developers in building decision support software, managers in work-ing with employees, market researchers in developing products, teachers in developing training materi-als, and many others. The book includes insight into cognitive task analysis from the authors' personal experi-ences and also an overview of the current understanding of cognition. IHMC's Robert Hoffman collaborated on this book with Beth Crandall,
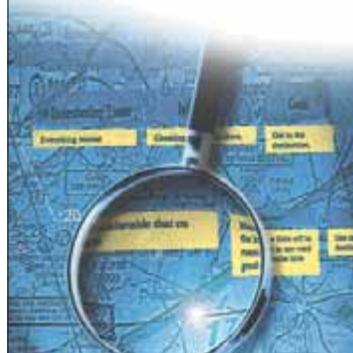
Senior Technical Director of Klein Associates, a division of Applied Research Associates, and Gary Klein, Chief Scientist of Klein Associates.
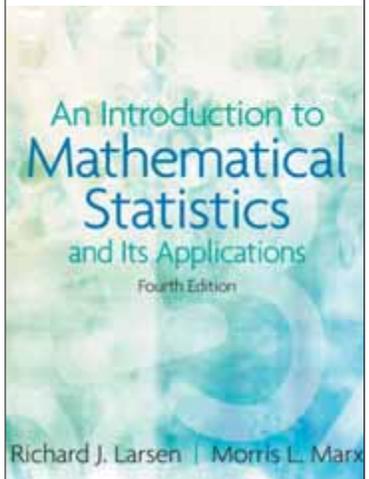
An Introduction to Mathematical Statistics and Its Applications, 4th edition

Correct application of statistical methods is criti-cal in many situations. An Introduction to Mathematical Statistics and Its Applica-tions, 4th edition illustrates the mathematical basis of statistical methods, highlight-ing the theories behind the application. Standard statisti-cal tools are derived from first principles with mathematical proofs. Using a range of case studies and real-world data, it clarifies common misun-derstanding and helps the reader understand when to use various statistical tools based on the mathematical founda-tions. IHMC's Morris Marx collaborated with Richard Larsen, Professor Emeritus, Department of Mathematics, Vanderbilt University, in writing this volume.

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FUNDING

From April to July 2006, IHMC was awarded over $3.0 million for research

◼◼◼◼ NEW FUNDING AWARDED TO IHMC FROM APRIL THROUGH JULY 2006

Coordinated Operation of Humans, Agents, and Unmanned Vehicles for Littoral Warfare

PI: Jeff Bradshaw
Amount Awarded: $1,509,529
Source: Office of Naval Research

The use of unmanned systems in the military is growing. In future military scenarios, large numbers of unmanned ground, air, underwater, and surface vehicles will work together, coordinated by a smaller number of human operators. In order to be operationally efficient, effective, and useful, these robots must have competent physical and sensing abilities, they must be able to perform complex tasks semi-autonomously, they must be able to coordinate with each other, and they must ultimately be observable and controllable in a useful and intuitive fashion by human operators. Supporting the Naval Surface Warfare Center in Panama City, FL (NSWC-PC), we will advance research in support of coordinated operations through several research thrusts. Dr. Jerry Pratt will lead a team investigating biologically inspired robot platforms for advanced mobility. Dr. Ken Ford and collaborators will develop a system for distributed coordination through process integrated mechanisms. Dr. Jeff Bradshaw, Mr. Niranjan Suri, Dr. James Allen, Dr. Anil Raj, and Dr. Choh Man Teng will collaborate in examining challenges for joint activity in human-agent-robot teams. These research endeavors will all be aimed at providing enabling technologies for scenarios that can be performed by teams of robots under mixed-initiative control by human operators.

Integrated Learning from Observation, Language and Practice

PI: James Allen
Amount Awarded: $600,000
Source: DARPA

Humans learn through a variety of modalities, including observation, trial and error, and instruction. We also find that different tasks are more suited to different learning methods. Currently, computer learning is limited to mainly step-by-step instruction. Through this grant, IHMC researchers will explore adding natural language capabilities to an integrated learner. Human instructors would be able to explain the steps while acting them out, possibly increasing the speed by which the system learns. In addition, the researchers will work with the program manager to create program-wide evaluation plans for the integrated learning program.

Composing the Right Mix of Humans & Technology for Lunar Surface

PI: Ken Ford
Amount Awarded: $298,324
Source: NASA

As NASA plans to explore the lunar surface, it will be critical to deploy the right mix of human and robotic activity for the tasks involved. IHMC researchers will collaborate with an interdisciplinary team from NASA, academia, and the private sector to investigate methods to determine how to compose the best blend of humans and technology to explore the lunar surface. It is important to make explorers as effective as possible given the expense and technical hurdles in transporting them to other planetary surfaces. As part of this investigation, we will consider two complementary approaches to augmenting and extending astronaut performance. The first involves dynamic allocation of activities amongst members of human and robotic teams and the second involves utilization of technologies to enhance the capabilities of the astronaut in his planetary space suit.

Toolkit for Role-Aware Exchange of Knowledge

PI: Tim Wright & Robert Hoffman
Amount Awarded: $247,596
Source: Charles River Analytics

Real-time collaboration often involves fluid, dynamic assignment of responsibilities within a community of users. As a task develops, users are asked to fulfill a variety of roles that shape their interaction with the system. Existing collaboration tools do not allow either different roles for users or fluid role membership. The Toolkit for Role-aware Exchange of Knowledge will support real-time, role-based information sharing systems. With this funding, IHMC researchers will create templates using CmapTools for various scenarios for knowledge modeling of collaboration. Based on the models developed, they will create ontologies for software agents to utilize in facilitating collaboration.

FUNDING

■ ■ ■ NEW FUNDING AWARDED TO IHMC FROM APRIL THROUGH JULY 2006

Joint Systems Engineering Method

PI: Robert Hoffman
Amount Awarded: $100,000
Source: CHI Systems

New computer systems may work wonderfully in the laboratory, but, once they enter the real world, there are often problems integrating them with the actual work environment. Cognitive systems engineering provides methods and tools for creating systems that work in a real environment. IHMC researchers will assist collaborators at CHI Systems, Inc., in developing CogLink, a systems development tool which will integrate cognitive systems engineering techniques. The effort will initially focus on the development of command and control, intelligence, surveillance, and reconnaissance technologies.

Real-Time Bio-Sensors for Enhanced C2ISR Operator Performance

PI: Anil Raj
Amount Awarded: $81,934
Source: Quasar

Fatigue and stress are leading causes of accidents and poor judgment across many disciplines. IHMC researchers have been developing tools to correlate physiological measurements, such as brain activity and heart rate, with fatigue and stress. If a system can determine when an operator is not performing at optimal efficiency, it can take over some low-level tasks or attempt to arouse the operator. Under this grant researchers will study the physiological indicators during simulated unmanned combat air vehicle operations. They will then relate the data to cognitive/emotional states and task performance.

Coastal Zone Mapping Imagery LIDAR

PI: Choh Man Teng
Amount Awarded: $75,567
Source: Army Corps of Engineers

The proliferation of sensors and the increasing memory capacity of computers have led to an increase in data and a growing reliance on computers for data analysis. Unfortunately, most data sets have flaws that are not identifiable by standard statistical methods but which a human can identify easily—a computer glitch leading to a series of blank photographs, for example. IHMC researchers will develop smart algorithms to reduce the human interventions during editing and processing of coastal zone mapping imagery under this grant. Such algorithms should improve the consistency of data processing results and reduce the time necessary to achieve the results.

Courses for Intelligence Community

PI: Clark Glymour
Amount Awarded: $55,070
Source: Department of Defense

Inferring causes in complex systems such as military command and control requires a deep understanding of causal reasoning. IHMC's Clark Glymour, an expert in causal reasoning, will lead two courses for the intelligence community on reasoning. The first, Theories of Knowledge, will explore our understanding of human knowledge. The second, Applications of Recent Research on Causal and Statistical Reasoning, will use simulated scenarios to explore causality.

Policy Engine Architecture

PI: Jeff Bradshaw
Source: Raytheon
Amount Awarded: $49,677

IHMC's KAoS policy and domain services are effective tools for governing the interactions of software agents and general-purpose grid computing environments. This grant will fund the adaptation of KAoS for various needs of Raytheon. Changes will include redesigning the policy engine architecture for dynamic ontology switching and creating new protocols for request and response. The architecture will allow easy changes to policy definitions and relationships. IHMC researchers will also support Raytheon personnel in the use of the policy tools, including CmapTools, and assist in structuring the ontologies for test scenarios.

Generic Risk-Adaptive Semantically-Rich Policy

PI: Jeff Bradshaw
Amount Awarded: $30,000
Source: ISX

As networks grow in size and flexibility, the traditional means of security are quickly becoming outmoded. Systems must be able to accept new members rapidly with limited information. This grant will support IHMC researchers in integrating the KAoS policy and domain management services framework with software developed by ISX Corporation to create a system with the necessary security and flexibility. The resulting system will provide risk-adaptive control for large, dynamic networks.

Algebra I Mathematical Character Set

PI: Alberto Cañas
Amount Awarded: $24,000
Source: University of North Florida

IHMC's CmapTools have proven to be a useful tool to describe relationships and concepts. In math, however, many notations are not in standard characters. This grant will fund the incorporation of a mathematical characters set into CmapTools. Such characters will expand the applications of CmapTools into more fields.

Genes to Cognition Online

PI: Alberto Cañas
Source: Hewlett Foundation
Amount Awarded: $8,496

High school level science is often taught as rote memorization. Cold Spring Harbor laboratory aims to change this practice by integrating neuroscience research into high school psychology and biology classes. They are examining how best to support teachers and students using their Genes to Cognition Online program. Concept mapping has been shown to improve understanding, and therefore, they plan to present the knowledge on the site using concept maps. In collaboration with Cold Spring Harbor, IHMC researchers will use this grant to develop a skeleton concept map for students as well as a rubric for evaluating concept map changes.

LOCAL NEWS

■ ■ ■   IHMC hosts summer research interns

IHMC hosts summer research interns

Part of IHMC's mission is the training of future scientists. During the summers we have a large number of students who contribute to our research. This past summer we had students from around the world working on projects in a variety of fields.

Summer research experiences give students a chance to get practical skills and learn about life in a research setting. The students reported that they enjoyed the collegial nature of IHMC. They had the opportunity to learn about a range of research areas by attending lectures, interacting with researchers, and talking to each other.

Kristopher Brosch is a sophomore at the University of Florida and from the Pensacola area. He worked with Niranjan Suri on software for mobile agents.

Greg Drake just graduated from the University of West Florida, majoring in Computer Information Systems. He improved the content for web pages on robotics projects.

Shervin Emami received his Bachelor's degrees in mechatronics engineering and computer science from the University of Sydney, Australia. He is pursuing his Master's degree in robotics at the University of Brisbane, Australia, and worked this summer with Jerry Pratt and Peter Neuhaus on the embedded systems of a wheeled robot. Emami is a naturalized Australian, born in Iran.

Columbine Gardair is a graduate student at the Institut de Cognitique (IDC) in Bordeaux, France where she is studying human-machine interfaces and interactions. She worked with Anil Raj on sensory systems.

Will Hedgecock is a junior at Vanderbilt University, majoring in computer engineer-

ing. He worked with Anil Raj on multisensory input systems, particularly developing the tongue display to provide information for divers navigating underwater. He is from the Pensacola area.
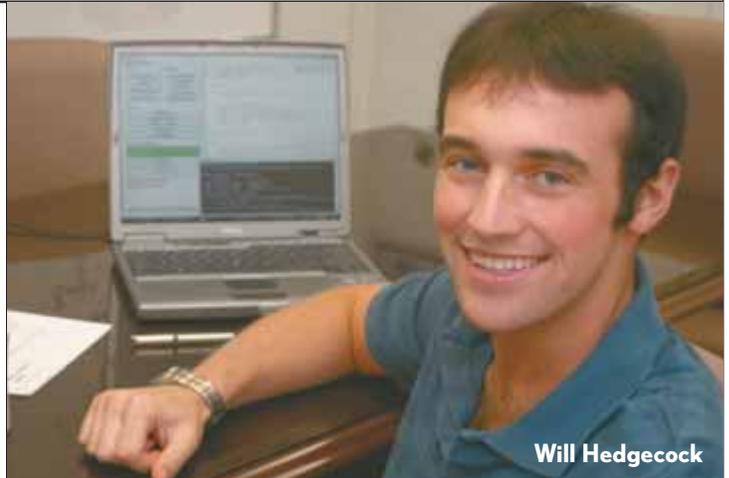
Victor Ragusila is a senior majoring in mechanical engineering at the University of Toronto. He explored a variety of design possibilities for the wheeled robot being developed by Jerry Pratt and Peter Neuhaus. A Canadian citizen, he was born in Romania.

John Rebula is a recent graduate in mechanical engineering from Massachusetts Institute of Technology. John assisted Jerry Pratt and Peter Neuhaus with the control algorithms for a quadrupedal robot.

Chris Wilmer of Canada is a senior at the University of Toronto, majoring in nano-engineering. He worked with Jerry Pratt and Peter Neuhaus, designing and simulating prototypes of a wheeled robot with arms.

Will Hedgecock

Shervin Emami

Chris Wilmer

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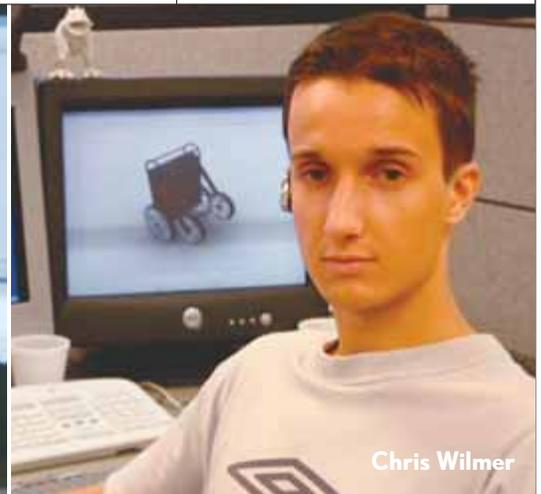
LOCAL NEWS

▪▪▪▪ IHMC EDUCATION PROGRAMS

I LOVE Science begins

Survey after survey has indicated that hands-on science activities spark students' interest in science. Many teachers, particularly in elementary school, feel unprepared to lead these activities. However, scientists don't know how to get involved in science education, even though, according to the Bayer Facts of Science Education, 85% of scientists say they would participate, if asked.

We asked, and now they have come. During the spring, IHMC, Gulf Power Company, and state Rep. Holly Benson partnered with the Escambia and Santa Rosa County School districts to create *I LOVE Science* (Increasing Local Opportunities for Volunteers Enthusiastic about Science). This program will draw volunteers from the community to provide a 1-hour, hands-on

science activity each month for all 5th-grade classrooms.

Each month, volunteers will be provided with all of the materials they will need to lead activities aligned with the 5th-grade science curriculum. Activities will include balloon rockets, solubility testing, reaction time testing, momentum crash tests, and camouflage, among others.

The partnerships created between the volunteers and the teachers will likely catalyze many more volunteer interactions, such as science fair mentors and judges. Volunteers have signed up to partner with each of the nearly 250 5th-grade classrooms in the two counties. In addition, many have proposed special units on their areas of specialty, and school district staff has assisted them in targeting other elementary grades.

Baskerville-Donovan to sponsor *Science Saturdays*

Baskerville-Donovan, a state-wide engineering services firm headquartered in Pensacola, will sponsor IHMC's *Science*

Saturdays program this fall. *Science Saturdays* is a monthly hands-on science program for kids in grades 3-5. Each session is led by a volunteer scientist. This sponsorship will allow IHMC to continue the program and improve the activities, including providing additional

resources for students to continue their experience at home. In addition, we are looking forward to including Baskerville-Donovan engineers as activity leaders, giving students new role models in scientific fields. We are grateful to Baskerville-Donovan for their generous support.

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