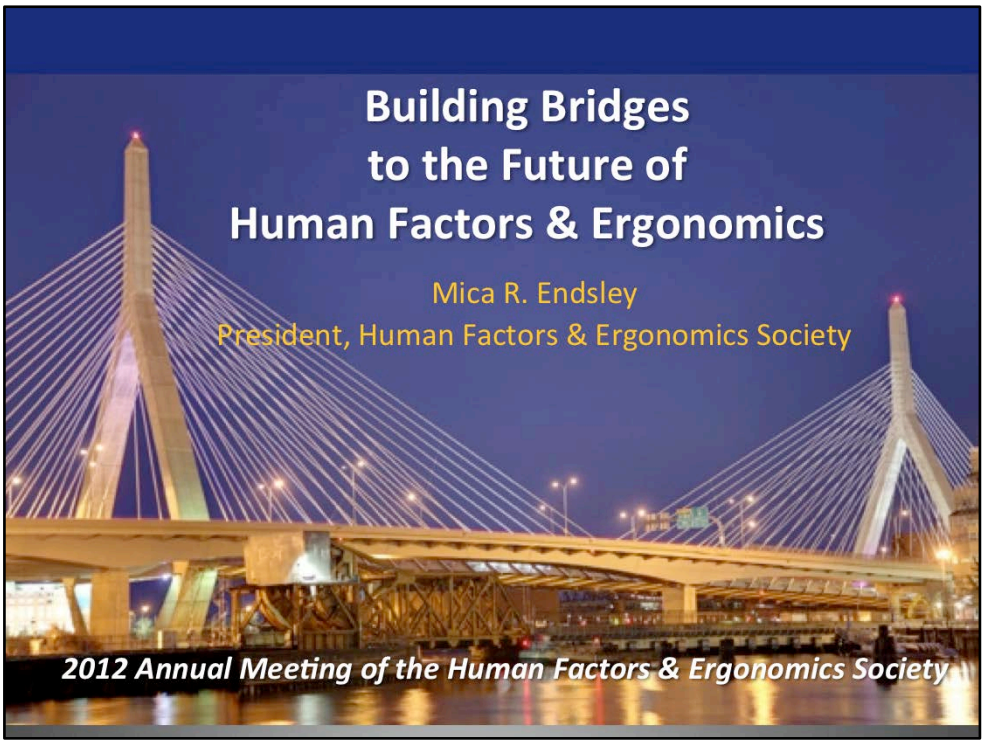


I'd like to talk to you today about how the Human Factors and Ergonomics Society is building bridges to the constituencies that we need to interact with to be successful in our goals and to create a successful future for our profession.

First we have been working to strengthen our internal bridges. Our future is dependent on the next generation of students and early career professionals who are sitting here today. Find something you are passionate about and join us in working to improve it. The rewards you will gain will far exceed what you put into it.

Today HFES has grown to 23 technical groups across a wide range of domains and focus areas within our profession. We have an active Council of Technical Groups (COTG) that works to integrate activities across these groups and which has recently initiated a student travel grant program to help bring deserving students to the Annual Meeting. The Chapter Affairs Committee is developing programs to support new chapter officers and strengthen our local presence. We have continued to add many services and activities for our student chapters, including a lounge at the Annual Meeting, a scavenger hunt, reception and Student Day activities to support them in learning more about our profession and transitioning to human factors practice.

Over the past year, we have worked on reaching out to our many committees that conduct the society's business, seeking ways to better connect with them and help to serve them better. HFES has also been working with our various publications , finding ways to improve their quality and impact even more. We have also worked to improve our communications with members, adding a new Webinar series, and reaching out via email, social networking and twitter in addition to the traditional Bulletin. For the first time, in 2012 HFES conducted its elections processes using an electronic voting system, moving us squarely into the 21st century in our internal processes.

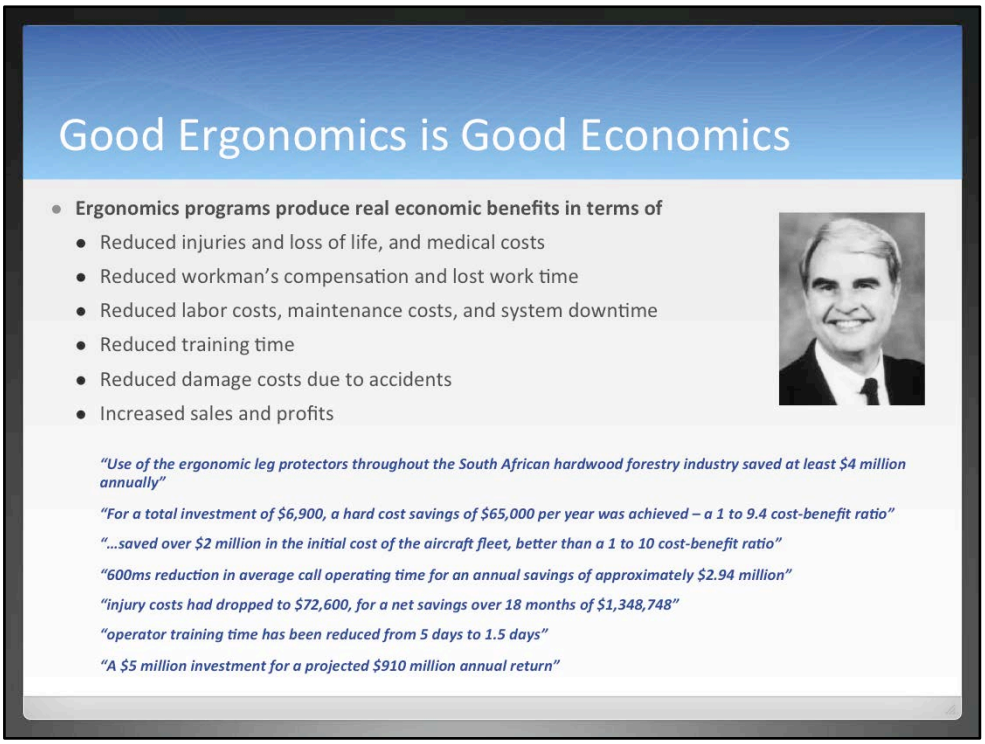
HFES has banded together with other professional societies through the Federation of Associations in Brain and Behavioral Sciences (FABBS) and the American Association of Engineering Societies (AAES) to address issues of common concern and form a larger block to respond to them. For example, over the past year HFES has signed on to letters to Congress urging support for funding of the sciences, object to major proposed legislation that would have required all research funded by government agencies to be published only in open-access journals, and to provide input on the biggest change to the Common Rule since its inception.

FABBS is also featuring HF/E success stories in a publication aimed at Capitol Hill, showing how beneficial investments in related programs and research are for achieving very real and measurable improvements in cost savings, productivity, and everyday lives.

As a significant new initiative, I am pleased to announce that HFES has engaged the services of Lewis-Burke Associates, who will provide us with new capabilities in gathering information on relevant initiatives and changes in government policies and programs and in advocating for the public policy interests of our members. In addition to our ongoing public outreach through National Ergonomics Month, we are also working to expand our activities to engage the public in better understanding the value of human factors and ergonomics, though activities such as a highly successful booth at the USA Science and Engineering and Science Festival in Washington DC.

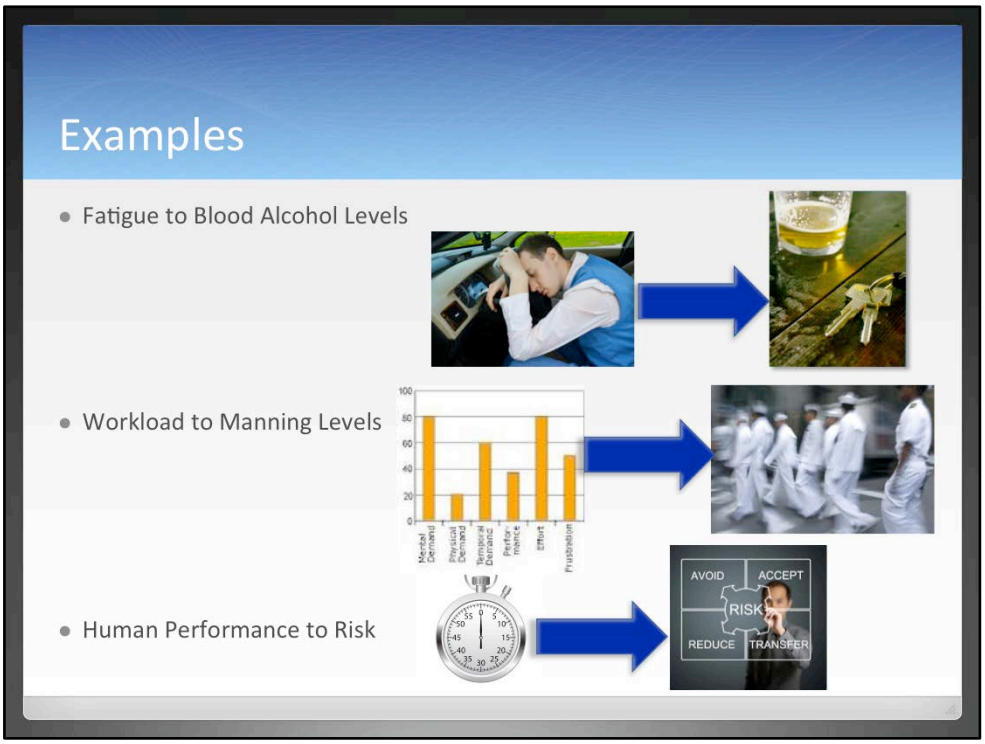
In our outreach to managers and engineers in industry, who we must work successfully with to achieve our goals, we have a number of thrusts. *Ergonomics in Design* is a practitioner focused journal, working to translate our science into practice. We have an active group of professionals developing relevant standards, and have members participating in activities such as the DoD HFE Technical Advisory Group, and the National Research Council Board on Human Systems Integration. As a significant new strategic initiative, HFES created the Special Meetings Committee to help vet and promote conferences, workshops, and other meetings of interest to members. Following on the successful launch of the HFES Symposium on Human Factors and Ergonomics in Health Care in 2012, we will be continuing this symposium again in 2013. In addition, HFES will cosponsor, with IEEE, the 2013 International Symposium on Resilient Cognitive, Control, & Cyber Systems. Leveraging these successes, we will be continuing to build our portfolio of sponsored workshops and conferences.

In addition we need to chart our way to where human factors and ergonomics (HFE) needs to grow as a profession. HFES is a part of the International Ergonomics Society (IEA) which is made up of 47 federated societies worldwide to build and promote our profession across the globe. It met this past year in Brazil at the IEA Triennial Meeting to work on issues common to us all, including laying out a new document on the Future of Ergonomics (Dul, et al, 2012). In this work, they lay out two major themes: (1) Increasing awareness among powerful stakeholders on the value of high quality HFE, including communicating with stakeholders, building partnerships, and educating stakeholders. and (2) Strengthening the application of high quality HFE, including promoting the education of HFE specialists, ensuring high quality standards, and promoting HFE research excellence.



This focus reminds me very much of the work of HFES Past-President Hal Hendrick, whose motto was "Good ergonomics is good economics" (Hendrick, 1996). He knew that it was critical that we translate the impact of HFE programs into the relevant economic terms of the business world, such as reduced injuries and loss of life, reduced costs for workman's compensation and lost work time, reduced labor, maintenance and system downtime costs, reduced training time, reduced costs to equipment due to accidents, and increases in sales and profits. He gathered and provided dozens of examples of these types of very real quantified benefits on dozens of projects.

The reality is that human factors professionals are generally very good at scientifically measuring the effects of our work. The problem is that our metrics are often very different from what our customers and decision makers actually care about. To be successful we need to translate our metrics into their metrics.



There are many any successes in our profession that we as a group can track and report in terms of the metrics that our customers care about.

As an example, Drew Dawson (Dawson & Reid, 1997) did some excellent work in translating the effects of fatigue on human performance into an an equivalency chart showing how blood alcohol levels create similar types of performance decrements. This allowed industry managers to more clearly understand how work schedules had a very real impact on the types of errors and performance problems they were seeing.

In another example, we worked with a customer to quantify the impact of a proposed new system design and were quite pleased to show him the significant workload reductions that resulted from the system. The customer was unimpressed however. He wanted to know how the system would impact manning levels. We needed to do additional translation work to show how workload reductions could result in the reduced manning that the customer cared about.

In a third example, we often talk about how various system design decisions will impact human performance. However, program managers often don't care about that. What they do care about is risk — the risk of completing a project successfully and on time and the risks associated with being able to complete a mission with the system being developed. We need to work to actively translate the very real impact of system design decisions on human performance, into their impact on the programmatic and mission risk that program managers think about.

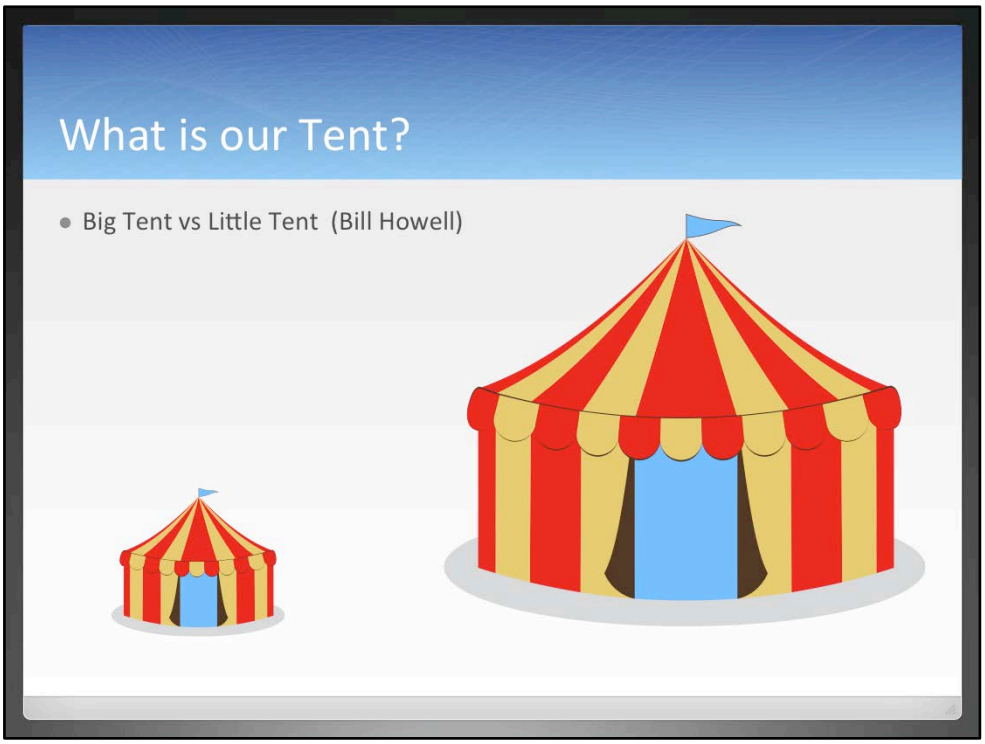
The reality is that Human Factors and Ergonomics has never been more needed. There has been a technology explosion into just about every industry, home and pocket. Technology today is everywhere that we are.

Past President David Woods, talked about how human factors professionals are always "cleaning up after the parade" (Woods, 1999). High profile accidents such as the space shuttle Columbia, Three-mile Island, numerous aviation accidents, power system blackouts, industrial accidents such as at Bhopal, and the recent explosion of Deepwater Horizon in the Gulf clearly point to visible examples of where HFE was neglected. But along with this, we have many far less visible examples of where HFE is addressed successfully where you all are working every day.

To avoid being left cleaning up after the parade and make sure that HFE is getting addressed up front, we need to do a better job of making sure that we practice what we preach. We must work to ensure that our HFE processes and products are user-centered to fit the way that engineering design is practiced in industry.

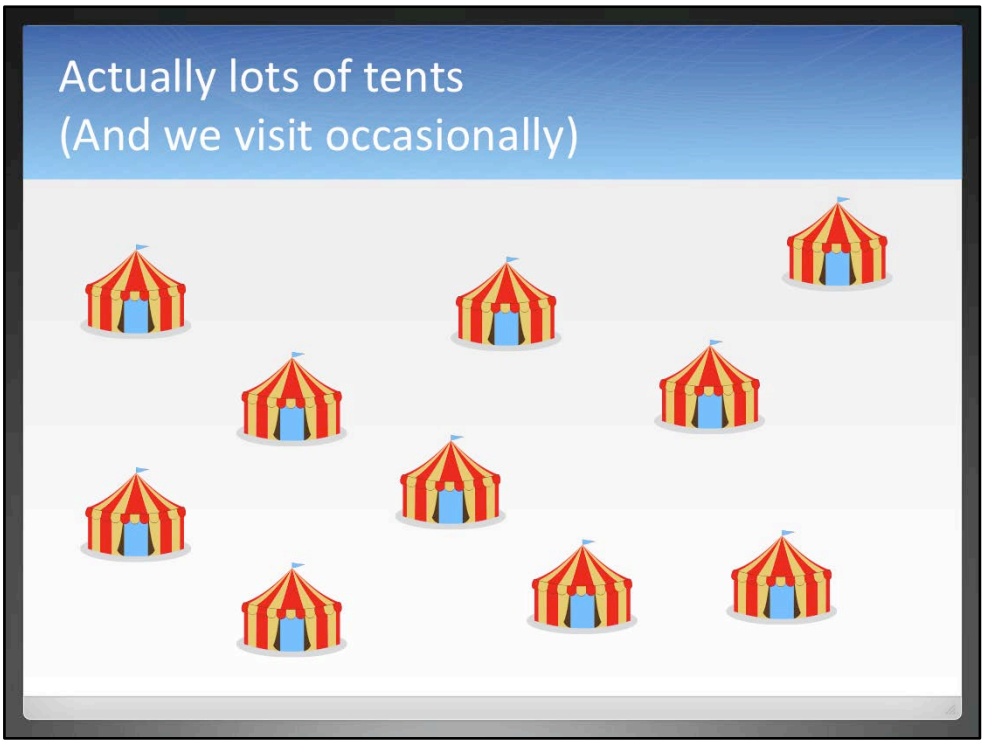
This means that we must develop user requirements fast and early in the program. They need to be clearly tied to system design decisions through the development of early prototypes. When we do this quickly, and produce clearly specified user interface prototypes of what the users really need, we have found we can be very successful in leading the parade rather than only cleaning up the mess after the systems have failed.

To achieve this goal, HFE practitioners need to do a better job of providing analytic tools and models to support engineering trade studies. The system developers you are working with will not wait for you to run an experiment. They need to know things like how will trade-offs in screen sizes or adding a system feature effect performance and mission outcomes? And we need these tools to allow us to quickly translate HFE metrics into the language and metrics of the stakeholders.

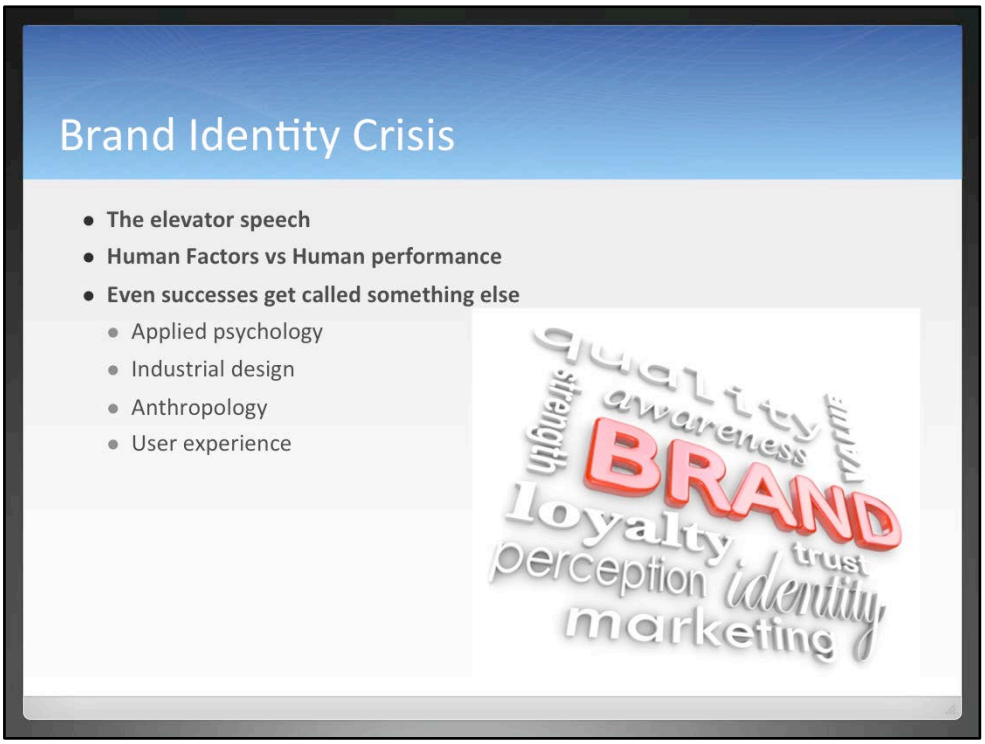


A second issue which is critical to the future of our profession is the organizational institutions we have for educating and practicing HFE.

The late Bill Howell once famously posed this as the big tent or little tent question (Howell, 2001). By this he meant do we have a small tent, restricting the practice of HFE to those with a limited set of skills and educational backgrounds? Or do we have a big tent, taking all comers from a wide variety of backgrounds who are interested in our field?



The reality is that we all actually live in lots of different tents. We are housed in psychology, engineering, business, medicine, occupational therapy and a variety of other departments and institutes in both academia and industry. And occasionally we visit with each other on our shared interests and experiences at meetings like this one.



This has created what people in the marketing profession would call a brand identity crisis. Providing a clear concise "elevator speech" description of what we do to those who ask in casual settings is often quite difficult. I've encountered customers who think human factors programs address something different than human performance. And we find that even HFE successes reported in the media often get attributed to something else, such as applied psychology, industrial design, anthropology or, the latest buzzword, user experience. People as a whole have a very poor understanding or recognition of what HFE is and the value we can provide across a wide range technologies and systems that people interact with.

Part of this problem is due to the lack of cohesion of our profession across these many tents. It was okay for our field to start out in this distributed manner. But after more than five decades, we are now out of our infancy and well into adolescence. But we are still like the 25 year olds living in our parents basements. Those in psychology lament that they are viewed as "too applied" in a world that only values "basic research". Those in engineering complain of being viewed as "too soft" by other engineers. And still others find themselves as being spread around in ones or twos, with no critical mass for support in organizations focused on other skills and issues.

While the diversity of our profession is in general a good thing, it has created this brand identity problem with our future students, employers, customers and consumers often being unaware of our existence despite a great track record of accomplishments in many domains.

To mature as a profession we need to build our own tent. We need to move out of our parent's basements into a place of our own. The education and practice of HFE needs to come together into clear recognizable organizations that clearly state who we are and that incorporate the key underpinnings of our profession, including our key scientific foundations, and our engineering tools and methods that allow us to apply this knowledge in practice. To this we need to add training in engineering economics to provide the skills needed to translate human performance metrics into the value propositions that others care about.

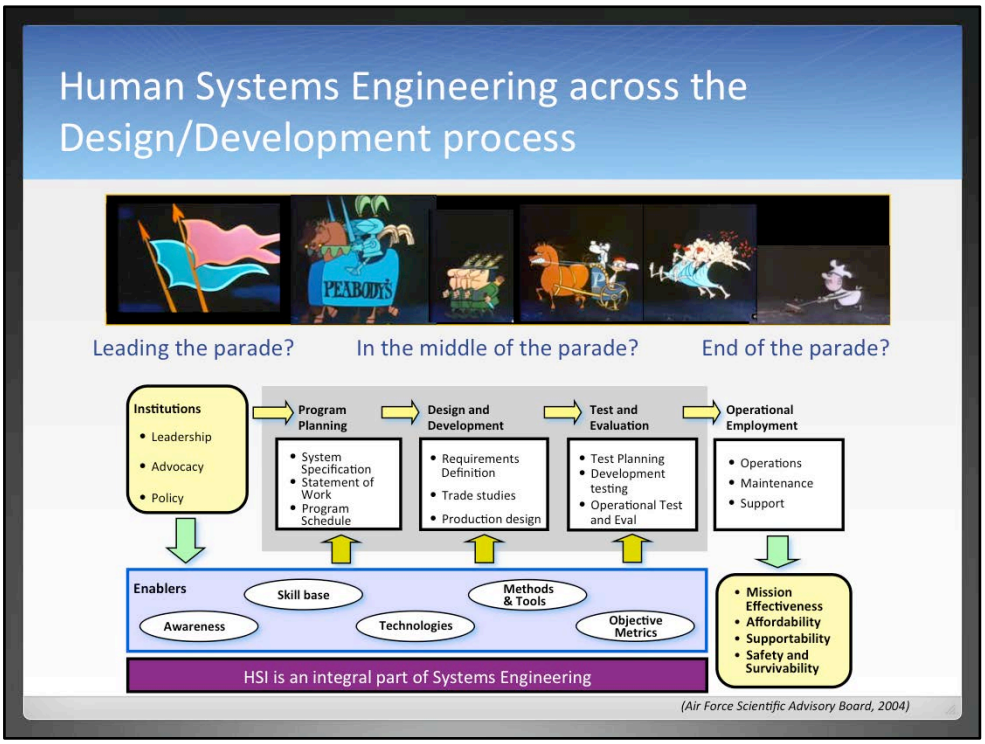
For example, chemical engineering is not distributed across chemistry and engineering, but includes both the foundational scientific knowledge of that field, along with the relevant engineering skills associated with successfully applying that knowledge to the design and large scale production of chemical processes and products.

Similarly Human Systems Engineering should encompass all the foundational knowledge and skills our profession needs to both pursue the science side of HFE, which will always be needed, and to ensure that knowledge is successfully incorporated into system development in practice, on equal footing along side the skills and knowledge of our brethren engineers.

And tent is probably the wrong metaphor. We to make sure that we create institutions with strong foundations that are single, integrated cohesive programs which provide a common consistent foundation in our training of student.

Our current disciplinary diversity is both a strength and a weakness. There are certain recognized skills and knowledge that are required to be good at what we do, and that we need to make sure our all of our graduates are getting. Certainly specialty areas will always exist, as they do in other professions. None-the-less, being able to define core competencies and establishing cohesive programs are the sign of a mature profession. And we need to instantiate educational programs at the undergraduate as well as graduate levels, to put us on par with other engineering disciplines. The basic practice of HFE should not require a graduate level research degree at this point. It severely limits the pipeline of professional in our field going out to practice in industry.

The development of stand alone Human Systems Engineering programs will provide the visibility and standing needed to be recognized by others outside our professions as legitimate players in this space. There have been a few examples of movements towards this concept (e.g. USC, Embry-Riddle, Penn State). We need to move more strongly towards such a model nationwide.



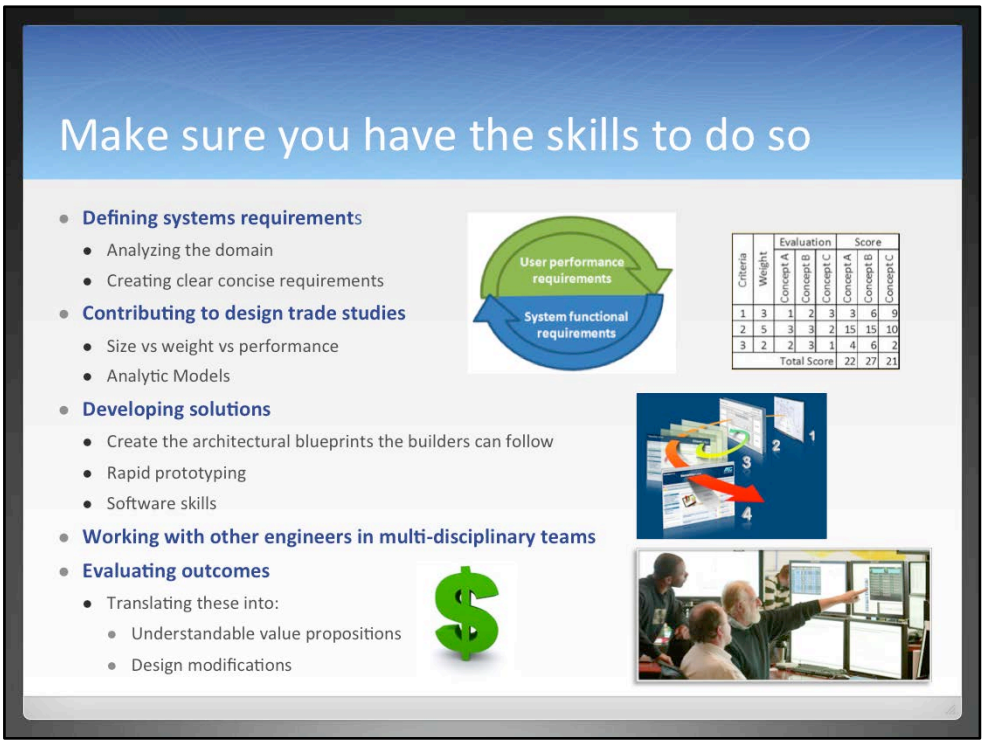
It is well known that HFE needs to be integrated across the engineering design and development process. If we are not leading the parade, and the middle of the parade we will always be doomed to be at the end, where we can do little good. The key to achieving this goal lies is in examining what allows people to successfully practice HFE throughout the System Design and Development Process.

In terms of having a real input on how a system is designed, I have found that typically across industry two factors matter.

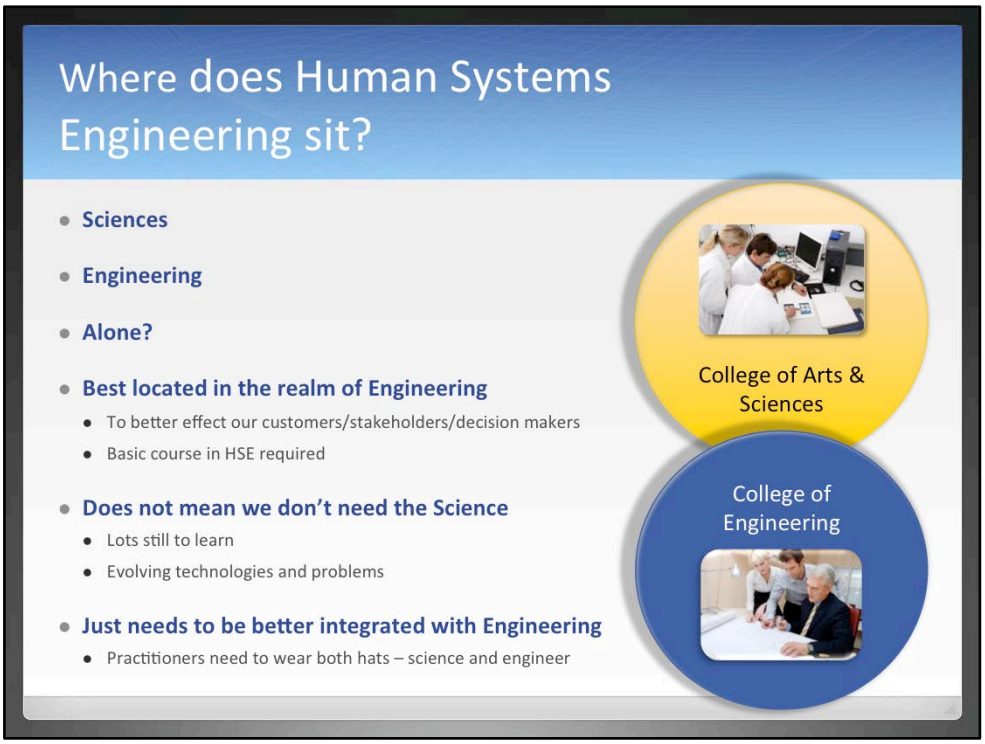
Often it is the individual who has possession of the tools of creation who has the power to drive the design. HFE professionals need the capability to wield those tools or HFE considerations will always end up being secondary.

In other cases, it is the person who creates the blueprints who controls the design of the system. Detailed HFE requirements must be imbedded in the up front requirements for new system development. HFE professionals have to get to the table prepared and able to create the detailed user interface requirements that are needed for the system design before the design process starts.

To do this HFE professionals have to learn to translate experimental research into design requirements and specifications. Even you are only 90-95% sure of the solution, you will achieve far better outcomes than if you do not participate in this process. There is usually room to fix any remaining issues during development, but only if you have a seat at the table by showing you are able and ready to participate in engineering terms in the timelines dictated by this process.



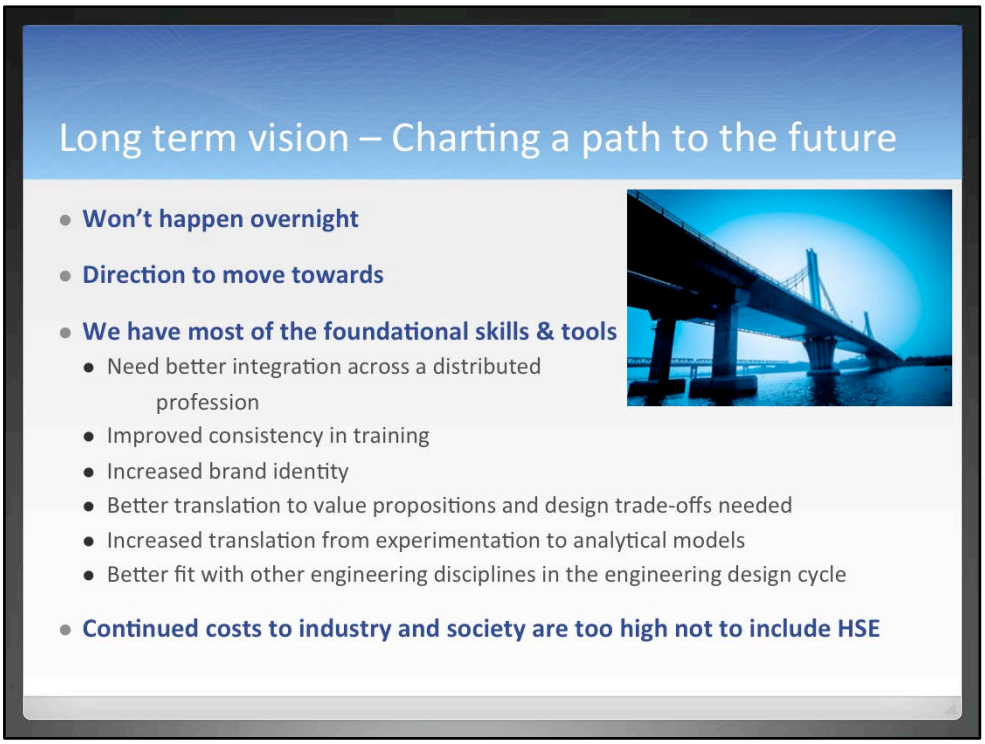
Developing these integrated Human System Engineering programs will take time. For those of you who are students today, make sure you are getting all the key skills you will need to be successful in your careers, drawing from these keys areas. You need to know to create clear concise user interface requirements by analyzing the real needs of users in the domain. You will need to be able to contribute to engineering trade studies by translating HFE research into analytic models. You have to be able to clearly articulate your design solutions using rapid prototyping and the language of programmers to create the architectural blueprints the builders can follow. You need to be prepared to work on multi-disciplinary teams with other engineers, who have different values, languages, approaches and perspectives. And you need to be able to objectively measure the outcomes of you design solutions and translate those measurements into the value propositions of your stakeholders.



One question that quickly arises when we talk about a unified Human Systems Engineering program is where such an entity should reside? Should it be a part of a College of Arts and Sciences, more closely linked to other basic science programs? Or should it be a part of a College of Engineering more closely linked to other engineering disciplines? Or should it exist on its own, outside of these more established arenas?

I am sure the answer to this will be controversial and that different solutions will emerge in different universities. For my part, I believe that Human Systems Engineering is best located in the realm of engineering. The customers, stakeholders and decision makers we need to interact with in practice generally come from those backgrounds. We need to talk their language and be recognized by them as a fellow engineering discipline. In addition, the goal of making sure all engineers receive at least one introductory course in HFE would do a great deal for improving their understanding of the science behind HFE and how it positively benefits the programs that they will work on in the future.

This does not mean that the experimental or science base of our field would be lost or diminished. A sound and vibrant research foundation will always be needed in HFE, particularly considering the rapid pace of technological change and the evolving challenges of human work. I just mean that what our profession does needs to be better integrated with other engineering disciplines, yet have a clear and unique identity in that process. The best HFE work requires us to be able to wear both hats, that of a research scientist and that of an engineer solving real problems.



This is a strategic vision for a mature profession.

I recognize that it won't happen over night, but it is a direction to move towards.

The good news is that HFE already has most of the foundational skills and tools that are needed. We just need to do a better job of integrating these capabilities across our distributed profession. We need to improve consistency in training our students to have the full range of needed skills. We clearly need to improve our brand identity to improve the degree to which HFE is incorporated into system development programs across a wide variety of domains. We need to do a better job of translating our results and findings to the value propositions and design trade-studies common in engineering practice. We need to increase the translation of our experimental research findings into usable analytical models to support this process. And we need to make sure our processes better fit with other engineering disciplines in the engineering design cycle.

The continued costs to industry and society are too high not to be including Human System Engineering within the product design and development process. It is up to us to better situate our programs and processes to facilitate that inclusion.

It has been my honor to serve as HFES president this past year and to work with you all to build a more effective profession in the future.

References:

Air Force Scientific Advisory Board. (2004). Report on Human System Integration in Air Force Weapon Systems Development and Acquisition.

Dawson, D., & Reid, K. (1997). Fatigue, alcohol and performance impairment. *Nature*, 388(235).

Dul, J., et. al (2012). A strategy for human factors/ergonomics: developing the discipline and profession. *Ergonomics*, 55(4), 377-395.

Hendrick, H. W. (1996). The ergonomics of economics is the economics of ergonomics. *Presidential address to the 40th Annual Meeting of the Human Factors and Ergonomics Society*, Philadelphia, PA. https://www.hfes.org/Web/PubPages/Hendrick.pdf

Howell, W. C. (2001). The human factors/ergonomics parade: A tale of two models. *Presidential address to the 45th Annual Meeting of the Human Factors and Ergonomics Society*, Minneapolis, MN. https://www.hfes.org/Web/PubPages/Howell.pdf

Woods, D. D. (1999). Watching people watch people at work. *Presidential address to the 43rd Annual Meeting of the Human Factors and Ergonomics Society*, Houston, TX. http://csel.eng.ohio-state.edu/productions/hf99/