



Human
Factors
and
Ergonomics
Society

FELLOW PROFILE

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When you want to tell where you have been and what have you done, it is challenging.

It is customary to detail one's education. The first day in the one-room school in western New York State was, I guess, routine. The next day my mother told me I had to put on my good overalls. She said, "Bob, you have to go to school today." As recounted I said, "Mother, I went yesterday." Maybe this was my first experience with: Been there, done that!

After six years of filling in blanks in workbooks and studying the big blackboard, it was on to a nearby high school and success dealing with the onerous state examinations. Next was college at the State University of New York, Geneseo, New York and a Bachelor of Education degree. Then it was the Master of Science and Doctor of Philosophy degrees from Purdue University.

It is intriguing to reminisce about the early days of the Human Factors Society.

At a meeting in September 1956, it was my approach, as part of a panel, to ask: "A Formal Organization of Human Engineering?" My answer, after careful consideration, was "Yes, it has merit." Associated with the panel's spirited discussion, a brief survey was done. Among responses . . . "a reasonable amount of annual dues was \$7.50!" It was soon after the society was formed and we had very little money that there was a unique effort to raise funds. We, the much-traveled officers agreed to pay for flight insurance and designate the Society as beneficiary. Depending on one's view, it was good that the Society never benefited financially! Among my early direct services to the Society was serving as Directory Editor in 1959-61, and Secretary-Treasurer in 1962-63. With the aid of capable volunteers, in 1964 it was a privilege, as General Chairman, to welcome to Washington, D.C. the **8th** Annual Meeting of the Society. Then, too, there were a few years as editor (usually meaning writer) of the *Newsletter of the Safety Technical Group*.

When Don Conover was Secretary-Treasurer in 1962, much of the correspondence and clerical work was done on an after-hours basis by my secretary at our Arlington, Virginia office.

In 1942, (after surgery for a long-standing condition), the Navy was in need of warm bodies so they accepted me as an aviation cadet. It was a highlight of my cadet training, to solo an airplane on April Fools Day, 1943.

Being newly married in the spring of 1944 it was great to be selected as a Naval aviator flight instructor at Pensacola, Florida. It was stimulating to teach highly motivated and talented young men to be prepared for combat duty, mainly in the war in the Pacific. There was a chance meeting with a Navy officer in Pensacola who told me about a graduate program in industrial psychology at Purdue University. Application was made for the masters program. Administrators said my candidacy was approved and to come to West Lafayette, Indiana, but housing was very scarce. By knocking on doors with my wife we found a room; later we were in an apartment in converted Army barracks.

To fund my time at Purdue, it was my good fortune to have the GI Bill of Rights and to receive a research fellowship. The fellowship was to work on a subcontract that Purdue held with the Johns Hopkins University under U.S. Navy prime contract. There was a welcome event in my Purdue days. It was the publication of my first journal article: "Industrial Noise and Hearing," *Journal of Applied Psychology*, 1948, 32, 476-489. The psychology department chairman Dr. Joseph Tiff in joined me as a joint author. After passing examinations and having done part of my doctoral research in absentia while at the

Johns Hopkins University, in 1949 it was great to share the platform with Ernest McCormick as we received the Doctor of Philosophy degree.

Having done some research and performing an administrative function on the U.S. Navy subcontract, it was good to receive a joint professorial-research appointment at Johns Hopkins University. The research there was a concentration on visual displays for shipboard control centers and studies of performance using various radar. As an assistant professor in the Hopkins psychology department in 1950, it was a challenge to teach the first college course in human engineering. Students were eager to learn about this "new" field. The textbook used was *Applied Experimental Psychology — Human Factors in Engineering Design* by Chapanis, Garner and Morgan.

There was much travel for me under the Navy contract. You see, at that time my status was a former Navy officer, and one of the few persons in the world who had both pilot experience and general knowledge of human behavior. There was need to advise military planners, airframe manufacturers and others about the benefit of applying human engineering principles. A trip to Great Britain to assess educational and military programs gave me a chance to learn about and admire the efficiency of British laboratories and test installations, which in many respects made some U.S. funding seem exorbitant and the work slow. Classified as a U.S. Navy Captain and occupying space designated for the U.S. President (he was in Washington, D.C.) in 1952 there was an opportunity to be an expert observer of human engineering aspects at a four-nation fleet training exercise in the Mediterranean. It was somewhat funny for me but stressful for the Admiral in charge of the exercise when, for a clay, somewhere a U.S. cruiser was lost!

In 1951, on loan from Johns Hopkins in Baltimore to the Naval Research Laboratory in Washington D.C. as a consultant, my human engineering know-how was part of a 30-member team of experts. Work was on a high priority project. We were modifying the control center facilities of the cruiser North Hampton to be the fleet control center ship for the U.S. President. When a twenty-foot long model was presented to the Secretary of the Navy, acceptance was easily won. The Secretary's enthusiastic approval was due mainly to the scale clay models of all machines, personnel and equipment in the control center. The talented model maker had "sold" our creation. The rest of us could have stayed home.

For essentially university promotion, the Johns Hopkins University Science Bureau regularly presented national broadcast television programs. The director invited me to present one on Human Engineering. With charts, models, simulated data collection using a live subject, etc., everything went smoothly as scheduled. Then a full appreciation of "time," viz, five minutes was forcefully taught me. You see, thinking that my presentation was complete, there was only to relax until the last few minutes of commercials was finished. Suddenly the producer signaled that it was necessary for me to "fill in" five minutes. Somehow, mainly by repetition, and overcoming great stress, it was done. Compliments on telling the human engineering story was much appreciated and it was well-learned that when you are on television be ready to "fill-in!"

After study and research at Purdue including human behavior, and at the Johns Hopkins University doing research and providing human engineering advice to industry and government agencies, it was my decision to form the Applied Psychology Corporation in 1952. It was the second company with the aim of human engineering research and consulting. In 1966, to show that our services were broader than was suggested by the term "psychology," the name was changed to Century Research Corporation. Early we stated our objectives in this way: The right man . . . Working safely . . . With proper tools . . . On a necessary job . . . In a stimulating environment.

In 1956 we moved from a two-room office near the District of Columbia police station to our own three-story office-laboratory in Arlington, Virginia. We were near the Pentagon and several Federal agencies, mainly on Constitution Avenue in the District of Columbia. The location was great for me. It was within walking distance from my home in Riverwood Estates just across the Potomac River opposite Georgetown University.

In almost all research performed by the Century Research Corporation, my role has been as research director and usually as a direct participant. The dedication and high quality of the work done by company staff is gratefully acknowledged. Only a few of our many projects will be briefly described here. The first research by my new company was sponsored by the U.S. Bureau of Aeronautics. Findings were published in 1953 with the title: *Information Requirements for Air Navigation*. Besides what aviators needed to know to keep the airplane in the air and reach their desired destination, mission requirements were rated as essential.

It was gratifying to learn that, although completed a number of years before, our report: *Human Factors in Design of Desert Equipment* which was sponsored by the U.S. Army Ordinance Corps was used as a guide by the military in the Pentagon at the time of Desert Storm.

In a study of workplaces for the blind we found that modifications to aid the blind (including application of human engineering principles) were almost always used by the sighted.

Sponsored jointly by the Transportation Agency, State of California and the U.S. Bureau of Public Roads in 1967, we had research teams in both San Francisco and Los Angeles areas to directly collect information. The purpose of the study was to determine how freeways might be made generally acceptable and appealing. We found that Los Angeles people were more accepting than were those in San Francisco. The title of our final report was: *Attitudes Toward Transportation*.

It's a quaint saying; "You never miss the water until the well runs dry." Dealing with this ominous view, was the focus of a study for the Office of Water Resources Research. The title of our final report: *Social Aspects of Urban Water Conservation*.

Many products and procedures can benefit society if they are used. A number of our research efforts have aimed at efficient ways to obtain public acceptance. Held in 1972 near Dulles Airport in the Washington D.C. area was an exposition of transportation equipment and services from around the world. An in-person survey was made by Century Research Corporation of transit users and observers to ascertain their preferences and reactions to proposed new developments. The study was sponsored by the Urban Mass Transportation Administration, U.S. Department of Transportation. It was stimulating to see exhibits and meet world leaders of transportation companies, especially those involved in moving masses of people.

Mining, especially underground, always has been difficult and dangerous. Because of this we were contracted to do a number of studies aimed at making mining more pleasant and safer. To understand miner's tasks, while in the hostile underground, with camera, stop watch recorders, etc., we joined working miners in the low ceiling anthracite mines of Pennsylvania. A major cause of injury to Federal mine inspectors and to working miners has been injury to their knees. With sponsorship by the National Institute for Occupational Safety and Health we developed improved kneepads to reduce this problem. Several other studies of mining including surface mining at various locations enabled us to show the merit of applying human engineering principles.

The Federal-Aid Highway Act of 1956 authorized a basic investigation to determine what action should be taken to promote highway safety in the United States. In 1958 we received a contract from the Bureau of Public Roads to assess many factors in an effort to explain why two Connecticut cities of similar size had very different highway safety records. Mainly using a participant-observer method, with teams in each city, data were obtained to show why they were different. The results of our study were included as part of the report by the Secretary of Commerce to the Congressional Committee on Public Works. The overall title of this basic highway safety guidance document carried the title: *The Federal Role in Highway Safety*. Included was our report *Traffic, Psychology, and the Community*.

For the United States Bureau of Public Roads we performed a series of studies dealing with following distances of motor vehicles on highways. Data were obtained during

real-time, day and night driving in normal and specified situations on interstate highways. Many drivers participated including airline pilots who were available because of a strike against their airline. We found that all of the pilots, when given their choices, maintained greater following distances than other drivers. This may show the merit of general safety training and as it is related to occupation. One popular magazine carried a story about our studies with the title: "How Close is Too Close?"

Probably most well known internationally was our multi-year intensive study called "Aircraft Visual Collision Avoidance." Many engineering, science, and human factors aspects were studied. Elaborate facilities of unique design included an observation range in a remote area in New Jersey. Besides attention given to airplane-to-airplane situations, study was also done to determine effective ways to enhance conspicuosity of tall towers and catenaries. We published more than twenty technical reports detailing ways to reduce the likelihood of mid-air collisions.

For a confidential client we did a very comprehensive review of the pertinent literature and performed several practical experiments to assess the potential of cutaneous communication. After looking at basic and applied research dealing with the sense of touch it is my belief that this sense deserves a big place in the future of human factors.

Each year, mainly during the summer months, millions of young people attend camps. In 1973 relatively little was known about their health and safety while camping. To assess this, and to determine whether state laws were adequate or Federal laws were needed, Century Research Corporation performed a study of the matter. The Education Amendment Act of 1972 authorized the study. All summer our staff visited 200 selected camps on a regular basis to obtain objective data. Not specifically a goal of the study was the desire to answer the urgent question of mainly parents: "How do we know which camps are good?" We found that it is difficult — cost was not a valid way. One useful way is to ask families of previous campers. Among findings of the study was that Federal laws were not needed to assure the health and safety of campers; state laws were adequate. Of special interest to me was that about 25% of injuries were due to falls. Our sampling plan was very detailed and met all validity requirements. However, when we met with the responsible congressional committee to report our findings, a California congressman took some convincing because no studied camps had been in California.

Federal government provision of extensive recreation areas has warranted assessment. For the National Park Service, Forest Service, Corps of Engineers and Fish and Wildlife Services we conducted a number of studies, some were cost-effective evaluations. Among other purposes were to understand users behavior and to determine their needs. A pleasant personal benefit of doing these studies was the chance for a number of summers, with my family, to be in our nation's outdoor recreation areas.

Especially rewarding was the chance to serve as the human factors consultant as part of a five-person National Park Service team. The team was called: The Long Range Requirements Task Force. Members were active superintendents of National Parks (including the Grand Canyon). Our purpose was to advise the Director of the National Park Services about many needs for the next two decades and beyond.

As subcontractor to the Radio Corporation of America for several years we had a team of researchers at Ft. Huachuca on the Arizona/Mexico border. The primary responsibility of the team was to determine how to package soldiers and much complex electronic communication gear in readily transportable shelters. One personally well-remembered day was spent supervising data collection staff while being driven over the deserts and mountains in an open jeep during a blustery snowstorm!

In 1967-68 it was a privilege for me to be an "insider," responsible as supervisor of a consulting group aiding the Federal staff in establishing programs of the newly authorized National Safety Bureau, United States Department of Transportation.

Also, among many topics which we have studied (usually considering human factors aspects) are these; load carrying, topographic maps, truck cab design, camera stabilization,

glass bottle inspection, readability of technical manuals, handwriting habits, photo interpreter performance, lie detectors, fatigue, pedestrian conspicuity, reflective license plates, mining equipment signs, vehicle rear signals, job satisfaction, vehicle conspicuity, and motivations. It was in 1961 that some articles on ground effect machine (GEM) caught my attention. My comprehensive July, 1961 article in *Industrial Research* resulted in an invitation to testify before the Committee on Science and Astronautics, United States House of Representatives. My presentation included the need to apply human factors knowledge, and emphasized the importance of gaining public acceptance. It continues to be my belief that a vehicle which flies low and drives on even very rough terrain will, in the future, be cost-effective and widely accepted.

There have been jokes about how one qualifies as an expert witness. After much experience, it is my conclusion that to be an effective expert witness certain things are necessary. To endure the general stress of the courtroom, to counter the unexpected questions by aggressive attorneys, and, especially, to convince a naive jury, you need to know a lot about a little and a little about a lot. My first expert witness experience was testifying at a Federal investigation of an air accident. It involved the June 30, 1956 midair collision of Trans World Airlines and United Airlines commercial airplanes over Grand Canyon, Arizona.

Aiding attorneys by providing expert witness service has been satisfying. Some people think there are too many lawsuits. My experience is that almost no false claims are made in personal injury cases; there is almost no malingering. When testifying in personal injury and product liability lawsuits, often it has been necessary to answer the question: "What is human factors?" Hopefully my answer has educated and gained the respect of attorneys, judges, and jury members. My concern with the safety of walkers lead me in 1970 to volunteer to organize and serve for several years as chairman of the Pedestrian Committee under the Transportation Research Board. Somewhat as an outgrowth of my Pedestrian Committee service was the publication in 1972 of "The Pedestrian," a chapter in the book *Human Factors in Highway Traffic Safety Research*. With the slogan "a step in the right direction," my continuing interest in walking lead me to organize, and direct for a number of years, the Walking Association. Beside safety goals, the Association purposes have included the economic, health and social benefits of walking.

It is intriguing to reflect on the past and think about why one did certain things. These can include career choices and actions within careers. Working on a general farm in my teen years alerted me to the hazardness of many machines and work situations. Such experience, perhaps in a subconscious way, has influenced much of my career in the direction of concern for the safety of people. Working on highway construction during college years probably has influenced my long-term committee activity and my focus on highway safety research. Also, a learning and maturing experience was one summer to be the supervisor of a sizable group of laborers on a road construction job. Later, to enter a writing contest, this was the basis of my story: "My First Real Job." Even being a cheerleader in high school and college may have taught me about gaining support and engendering enthusiasm.

A National Parks ranger, knowing my general safety interest, said to me: "We have to do something about people falling in our parks." Looking into this matter showed me that there was an active committee in the National Safety Council. Joining this committee, called the Falls Prevention Committee, increased my interest and knowledge and persuaded me to be chairman for a number of years. There are a lot of disturbing statistics to demonstrate that falls are a serious problem, especially for the elderly. One statistic which is meaningful is that falls are the #1 reason for hospital emergency room visits. Much self-study and on-the-job expert witness service has prepared me to become a speaker, writer and expert on falls of humans.

Over the years it has been my frequent opportunity, both for business purposes and as a hobby, to address many professional and public groups. A number of my talks have

had, at least as a secondary purpose, to educate attendees about human engineering (human factors). When told about it, there has been an eager acceptance of the human factors field. Almost everyone has done some volunteering. My time spent on civic and business related volunteering has been personally beneficial. Prominent among my service has been continuing action to help people stop smoking. Another service, mainly an outgrowth of my expert witness work, is promoting falls prevention.

What about my health? Of course, my body has received treatment for so-called "age related" ailments. It has been good that Medicare covers most of the cost of diabetic supplies and insulin.

Choosing human factors as a career has been satisfying. It is my belief that the field deserves to be looked at in a broad way. We need to get used what we know, and to learn what we don't know. The people of the world will be the beneficiary.

It's been many days since the one-room school. Some days it seems that it might be best to say: "Been there, done that." But taking them one day at a time - - they continue.