

**Dr. ROBERT C. SUGARMAN, PE**

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### **Educational Background**

1961 B.A., Physics (Math minor), University of Buffalo

1962 Graduate Studies, Solid State Physics and Math, Purdue University

(elected to Sigma Pi Sigma, Physics Honorary Society)

1963 M.S., Experimental Psychology (Physics minor), Purdue University

1965 S.M., Experimental Psychology, Massachusetts Institute of Technology

1967 Ph.D., Experimental Psychology, State University of New York at Buffalo (Departmental Honors)

Registered Professional Quality Engineer (California Certificate Number QU2821)

### **Experience Summary**

Dr. Sugarman has conducted R&D programs in instructional system development (ISD), perceptual processes, vehicle driving, equipment design and evaluation, and physiological processes. He has authored over 60 papers and publications, numerous training programs, and 5 patent disclosures (one US patent awarded). Contributor to ANSI/AAMI HE48-1993, *Human Factors Engineering Guidelines and Preferred Practices for the Design of Medical Devices*; ANSI/AAMI HE74:2001, *Human Factors Design Process for Medical Devices*; ANSI/AAMI HE75:2009, *Human Factors Engineering – Design of Medical Devices*, and AAMI TIR49:2013, *Design of Training and Instructional Materials for Medical Devices used in Non-clinical Environments*.

Dr. Sugarman's projects have included an evaluation of a system to prevent drunken driving, an investigation of factors contributing to decreased alertness during long-duration low-event driving, studies of camouflage, the design of operator-computer and operator/maintainer-machine interfaces, and the design and evaluation of commercial products. He was selected by the international Human Factors and Ergonomics Society to participate in a program to develop a comprehensive human factors plan for the Nuclear Regulatory Commission. Dr. Sugarman's primary current work is the development of multimedia training programs for industrial operations, environmental health & safety, and maintenance and quality control for light to heavy industry. He also conducts classes on ergonomics for safety and ergonomics teams and was employed to manage quality for the start up of construction of the Buffalo Life Sciences Complex for Turner Construction Company. He has provided expert testimony in human factors engineering for civil and criminal trials for over 30 years. Recent work includes the editing of a Manual of Practice for the Roofing Consultants Industry and ongoing participation in the development of a major social interaction simulation facility at SUNY at Buffalo.

### **Employment**

1967-1982 Calspan (formerly Cornell Aero. Lab.); 1978-1982, Head, Human Factors & Training

1969-2006 State University of New York at Buffalo, State University College at Buffalo, and Empire State College, D'Youville College. Part-time Lecturer/Instructor (psychology, ergonomics, industrial engineering, statistics)

1982-Present RCS Company, RCS Performance Systems, Inc., President

2003-2003 Parsons Brinckerhoff, Quality Control Manager

### **Other Professional Activities and Honors**

- Fellow, Human Factors and Ergonomics Society. Technical Groups: Forensics Professional (former chair), Training (former chair), Health Care. Western NY Chapter of the Human Factors Society, 1982-83, 1984-85 President
- International Ergonomics Association, Technical committee on Slips, Trips and Falls
- American Psychological Association, member Division 21, Applied Experimental & Engineering Psychology
- Western New York Chapter of the Human Factors Society, 1982-83, 1984-85 President
- Assoc. for the Advancement of Medical Instrumentation, Human Engineering and Home Healthcare Devices
- ASTM, Voting Member on Committees E34 (Occupational Health & Safety), F15 (Consumer Products), F38 (Unmanned Aircraft Systems), and F 45 (Driverless Automatic Guided Industrial Vehicles)
- Reserve Deputy, Sheriff of Erie County, Scientific Reserve Division (retired)
- Western NY Science Congress, Inc., Board of Directors
- SUNY at Buffalo, Research Assistant Professor., Center for Biosurfaces, Human Factors Coordinator
- SUNY at Buffalo, Extreme Events, Human Factors Event Mitigation group
- Stavatti Aircraft Corporation, Board of Directors, Director of Human Factors Engineering
- Aero Club of Buffalo
- Aircraft Owners & Pilots Association

## HUMAN FACTORS ENGINEERING

### Human Factors Expert Testimony

Dr. Sugarman provides expert testimony in criminal and personal injury trials (both defense and plaintiff) employing his unique combination of expertise in physics and human factors psychology:

<b>product and equipment</b>	<b>warnings and labels</b>	<b>vehicle accidents</b>
<b>design induced errors</b>	<b>individual differences</b>	<b>industrial and construction accidents</b>
<b>medical equipment errors</b>	<b>training</b>	<b>slip and fall</b>
<b>perception and vision</b>	<b>cognitive psychology</b>	<b>ergonomics and workplace layout</b>
<b>instructions and procedures</b>	<b>situational awareness</b>	<b>physics</b>

In 2003, Dr. Sugarman was an invited columnist for a three-part series on Human Factors for the *Buffalo Law Journal*.

Dr. Sugarman has over 40 years of experience in a variety of human factors engineering projects. He has been a participant or supervisor in applied research and development efforts for many commercial and military systems.

### Nuclear Power Industry Review

The Nuclear Regulatory Commission contracted with the Human Factors and Ergonomics Society to investigate the human factors problems in the nuclear power industry and develop a comprehensive long-range plan for research to improve the regulatory process. Dr. Sugarman was one of seven nationally recognized experts selected to conduct the study. All aspects of human factors were investigated by the study group: human engineering (design of control boards and displays), procedures and operator aids, personnel and staffing, and training and training devices. Although each participant studied all aspects, Dr. Sugarman had prime responsibility for the training and training devices data collection. Site visits were made to power plants in all stages of construction and operation, NPP vendors, training facilities, all relevant components of the NRC, National Laboratories, and INPO and EPRI (industry-sponsored organizations), as well as other contacts specific to each area.

The group began the project with an intensive indoctrination program, including a week of classroom and hands-on training at the Tennessee Valley Authority nuclear training facility. Subsequently, all relevant NRC and industry-sponsored program plans and literature were studied, which combined with the extensive interviews during the site visits, resulted in the development of the three-volume report NUREG/CR-2833.

### Human-Machine Interface Design

Dr. Sugarman was the human factors engineer for the design of a ground power generator and air conditioner to replace current Air Force flight line equipment. This project required the design of operators' stations and maintenance procedures suitable for worldwide environmental conditions. For LTV Aerospace & Defense, Sierra Division he performed an operator panel and workload evaluation. Prior to that project, he supervised a team of human factors specialists for the design of the new Army XM-82 Automated Liquid Agent Detector system. The sponsor praised the ALAD as the best human-factored equipment designed for the chemical warfare inventory for deployment by low skill level soldiers. Another project resulted in recommendations for the user-computer interface for the Defense Intelligence Agency applications of the Safe database system. That system accommodates both novice and expert analysts. He was also a consultant for the development of video display terminal information displays for General Mills.

Dr. Sugarman was responsible for the development of a handbook to be used for the conduct of design reviews for new aircraft. The handbook was formatted in the style of Operational Sequence Diagrams so that the tasks and interrelationships for all team members were laid out chronologically. Critical milestones and events were easily noted. Behavioral and equipment oriented task analyses have been carried out by Dr. Sugarman using a wide variety of techniques, including the OSD and mission/function/task analyses for equipment design and the more elaborate design and the more elaborate training task analyses for Instructional Systems Development.

### Perceptual Processes

Representative studies of perception conducted by Dr. Sugarman include a study of the effects of centrifuge accelerations on human brightness thresholds, analytic, laboratory and field investigations of aircraft visibility, an evaluation of the effects of blue-tinted lenses on visual acuity, a project in which simplified visual and olfactory tests were incorporated into a "kit" to be used by non-chemists for the detection of hazardous materials, and a series of experiments to determine factors which would improve identification of suspects by witnesses.

At the State University of New York at Buffalo, Dr. Sugarman worked on a study of visual adaptation in a uniform visual field. For his dissertation he was concerned with the perception of motion and visual localization in space. In addition to developing a new theoretical approach to these problems, Dr. Sugarman contributed supporting evidence for his theory through a series of studies that employed both pursuit and saccadic eye movements and used both real and illusory movement of the stimuli. While at the Massachusetts Institute of Technology, Dr. Sugarman conducted research in the area of visual adaptation and spatial orientation systems. Dr. Sugarman's research at Purdue University concerned the ability of humans to judge the position of blurred borders.

### Vehicle Driving

Dr. Sugarman directed a project that measured variables related to the level of alertness of an automobile driver, including maintenance of speed and lane position, steering wheel inputs reaction time, EEG, and EKG during long distance, low event driving on a highway. That study was an on-road validation of factors that were found to be significant in an earlier simulator study of driver alertness. In another study, glare was used as a stressor to degrade performance during night driving. In a third full-scale study, some of the cues used by drivers in a skid condition were evaluated by controlling the information available to the drivers by means of auxiliary displays.

Dr. Sugarman directed a comprehensive evaluation and optimization of an ignition interlock device to prevent intoxicated individuals from starting their cars. In that study, subjects who had been given a large dose of alcohol were tested on the interlock device, on a driving simulator task, and on a battery of psychomotor and cognitive tasks while being periodically measured for blood alcohol concentration.

### Other Product Development and Evaluation

Dr. Sugarman has been personally responsible for many industrial studies. Among them was an independent evaluation of competing micrographics equipment performed for the business products marketing group of the Eastman Kodak Company. Other studies to evaluate the operator interface of products included automated teller machines, voting machines, and hospital equipment.

## **TRAINING AND TRAINING DEVICES**

Dr. Sugarman has several decades of experience in the analysis and design of military and commercial training systems. His leadership in this area led to his selection as part of the Human Factors and Ergonomics Society project for the Nuclear Regulatory Commission to review human factors aspects of the nuclear power industry. He was given prime responsibility for the review of training and training devices. Dr. Sugarman has been a training consultant to military and commercial organizations.

In the mid '70s, Dr. Sugarman combined his academic experience in the psychology of learning and his research experience with human performance measurement in his capacity as Project Manager of the B-1 Aircrew Systems Approach to Training. This program involved a multidisciplinary team of approximately twenty scientists and engineers. Instructional System Development (ISD) methodologies and systems analysis techniques were adapted to the task of designing the instructional system for the crew of the future B-1 strategic bomber. Under Dr. Sugarman's direction, alternative training system components were determined complete with detail relating to syllabi, training media descriptions, schedules, time-phased costs, and requirements for facilities, personnel, and equipment. Among the features of this program were the specification of behavioral objectives, an investigation of the current and projected state-of-the-art in flight and systems simulation, and the development of a Training Resources Analytic Model which provided a complete time-phased analysis of training resource requirements, and served as a tool for sensitivity and trade-off analyses among system options.

Dr. Sugarman was also the supervisor for the development of the instructional system for the Navy E-2C aircraft crew. Unlike the B-1 program, the principles of ISD were applied to an aircraft in the operational inventory in the E-2C project. Media and lesson specifications were prepared, implemented, and validated during the second phase via revisions to an existing training curriculum for this early warning aircraft.

With the B-1 and E-2C programs as a foundation, Dr. Sugarman led further ISD efforts for the Marines F-4J fighter aircrew, Navy F-18 fighter/attack pilot, the maintainers and operators for the Navy SH-60B LAMPS Mk III helicopter (subcontract from IBM), the Douglas Aircraft Corporation development of the Navy VTXTS replacement jet training system, and the Gulfstream-American proposal for the Air Force Next Generation Trainer aircraft.

As a follow-on to the B-1 ISD program, Dr. Sugarman supervised a project for the Strategic Air Command which resulted in the development of procedures for simulator certification (SIMCERT) to be used to evaluate the training effectiveness of full and part-task simulators. He assisted the Singer-Link Flight Simulation Division in the development of a proposed design for the B-1B weapon system trainer. Dr. Sugarman was also responsible for the development of new techniques for early estimation of major training system resource requirements, training effectiveness evaluation techniques for Army Test and Evaluation programs and an evaluation of personnel and training for Coast Guard Marine Safety Officers.

## OTHER PROJECTS

Since forming his own company in 1982, Dr. Sugarman has primarily been involved in creating hundreds of hours of training programs for industry, including heavy manufacturing, pharmaceutical, food manufacturing, high technology companies. Content has included operations, maintenance, quality, product and company familiarization, and environmental, health and safety. Delivery systems used cover the full range from standalone PCs to web-based training. In addition Dr. Sugarman built a full-scale maintenance trainer for the computerized rear door of an Orion Bus Industries passenger bus. The working model incorporated bus driver controls, electronic and hydraulic systems, and the interface for a wheelchair lift. The simulator was delivered to the New York City Transit Authority.

Dr. Sugarman provided human factors expertise for the safety features and labeling of an integrated filtration/HVAC unit and portable isolation shelter marketed by Iso Air (formerly FailSafe Air Safety Systems, Tonawanda NY). He also developed the Owners Manual and presented emergency medical team training courses for this equipment.

Another recent project was the development of training and certification programs for the SISA (Secure Information Sharing Architecture) Alliance, a joint effort by Microsoft, Cisco, and EMC to provide the government with secure information sharing worldwide.

A sample of training programs Dr. Sugarman has developed includes operations, maintenance, environmental health and safety, statistical process control, and technical systems knowledge:

- Dresser-Rand. (NY State). Created 34 maintenance courses in an ongoing contract, for compressors and steam turbine operators, mechanics, and rotating equipment engineers. These e-learning courses teach in-depth theory, operations and maintenance practices that parallel traditional, instructor-led classes, and offer quality refresher training to meet just-in-time learning for turnaround projects.
- Guardian Industries. (Michigan). In an ongoing contract, creating multilingual training courses for its glass manufacturing plants on four continents. From raw materials to annealing and quality control, RCS is developing a series of basic and advanced technical training courses for new hires and experienced workers.
- GlaxoSmithKline Inc. (Canada). Collected task data from subject matter experts, engineering staff, and vendor manuals for line operation and set-up; defined performance-based training goals; and developed technical training for Tablet Bottle Line, Liquids and Lotions, Compression, and Granulation lines deployed over Glaxo's Intranet. Used established cGMP policies and Environmental Health & Safety work practices to develop a Core Training Program for all employees.
- FailSafe Air Safety Systems (Tonawanda NY). Designed safety labels, developed operating and maintenance manuals, conducted on-site training classes for a Portable Isolation Containment System consisting of a 10-bed shelter and the FASS 3T Filter/HVAC unit.

- Medeva Pharmaceutical (Rochester NY). Developed training course for a new packaging line including principles of operation, controls and displays, startup and shutdown procedures, operating adjustments, troubleshooting procedures, and monitoring / inspection procedures.
- Nabisco (Niagara Falls NY). Developed training program covering plant's cGMP for employee and vendor training.
- Praxair. Developed training program for engineers covering best practices for Oxygen Systems field modifications.
- General Mills (Buffalo, Chicago, Lodi CA). Developed operations and maintenance training programs for major production and packaging lines. One program, for a new line, reduced launch time from 3 months to 2 days. Developed for the new equipment before it arrived on-site.
- Exposure Control Technologies (Cary NC). Developed and deployed web-based training and certification program for laboratory fume hood operators for pharmaceutical companies and academic research laboratories.
- Combustion Engineering/ABB (Chattanooga TN). Print reading program for heat exchanger production workers.
- Ford Glass Plant (Tulsa OK). Operator programs for warehousing, packing, and shipping.
- American Motors (Chrysler) Brampton (Canada). Quality control program.
- Dofasco (Canada). Multiple programs for computer operation print reading, grinding machine operation, plant lubrication system, line operation, statistical process control, and safety. Developed guidelines and instructions for the construction of test items for annual safety testing.

Other representative clients include: Asea, Brown, Boveri; Morrison-Knudsen; Ford Motor Company; Corning; General Motors; DuPont; United States Navy; Delphi Harrison; Ontario Hydro; Hayes-Dana; Kodak; Teledyne; Co-Steel Lasco

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2. Braunstein, M.L., White, W.J., and Sugarman, R.C. "A Preliminary Study of the Use of Stress in Part-Task Driving Simulators" Presented at 42nd Annual Meeting of Highway Research Board, January 1963.
3. Sugarman, R.C. "Estimated Location of the 'True' Edge of a Blurred Light-Dark Border". *Journal of Engineering Psychology*, Vol. 2, pp. 144-154, 1963.
4. Sugarman, R.C. "Equivalence of Orientation in Intermanual Tactual Discrimination". Unpublished Master's Thesis, Massachusetts Institute of Technology, June 1965.
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6. Sugarman, R.C., and Cohen, W. "Perceived Displacement as a Function of Induced (Illusory) Movement" Presented at Eastern Psychological Association Meeting, Boston, MA, 1967.
7. Sugarman, R.C., and Cohen, W. "Perceived Target Displacement as a Function of Field Movement and Asymmetry" *Perception and Psychophysics*, Vol. 3, pp. 169-173, 1968.
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9. Sugarman, R.C. "The Effect of Night Driving Glasses on Visual Acuity and Light Transmission" Calspan Report VK-2890-B-1, October 1969.

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11. Deutschman, J.N., Hammill, H.B., and Sugarman, R.C. "Visual Contrast Reduction Investigation (U)" Wright-Patterson AFB, Report AFAL-TR-70-11, December 1969, SECRET.
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17. Sugarman, R.C., and Kovel, S.M. "Development of an Eye Position Sensor" Calspan Report VH-2992-B-1, October 1970.
18. Sussman, E.D., Sugarman, R.C., and Knight, J.R. "The Use of Simulation in a Study Investigating Alertness During Long Distance, Low Event Driving" Presented at the 50th Annual Meeting of the Highway Research Board, January 1971.
19. Sugarman, R.C. "Phase I Report - Experimental Plan for the Optimization and Evaluation of the Phystester Ignition Interlock Device" Calspan Report FE-5030-B-1, August 1971, ADMINISTRATIVE CONFIDENTIAL.
20. Zavala, A., Sugarman, R.C., and Rice, R.S. "Driver Training for Emergency Situations" Presented at the Automotive Engineering Congress, Detroit, MI, SAE Publication No. 720144, January 1972.
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23. Sugarman, R.C., and Cozad, C.P. "Phase II Report - Experimental Results for the Optimization and Evaluation of the Phystester Ignition Interlock Device" Calspan Report No. FE-5030-B-2, May 1972, PROPRIETARY.
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