in the interpretation of roentgenograms, and in decisions concerning surgical and medical therapy.

The conference showed that radioisotope scanning has evolved into a biomedical research tool that can be tailored for diverse kinetic studies in man and animals. The profile scans by Pochin (London) showed the fate of injected radiothyronines and demonstrated that useful quantitative information on the distribution and turnover of labeled metabolites is readily obtained by such methods.

An important byproduct of the meeting was the appointment of a task force committee to develop for the International Commission of Radiation Units (ICRU) standard terminology and definitions for scanning. The committee, consisting of W. J. MacIntyre (Cleveland), S. Fedoruk (Saskatoon), C. C. Harris (Oak Ridge), D. Kuhl (Philadelphia), and J. Mallard (London), will also develop standard phantoms for scanning research and calibration.

All the papers will be published as soon as possible by the International Atomic Energy Agency.

RALPH M. KNISELEY
Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tennessee

Human Factors in Electronics

The challenge of interdisciplinary technology was the theme of the 5th national symposium on Human Factors in Electronics, held in San Diego, California, 5–6 May 1964. The welcoming address was given by Sam Ackerman (General Dynamics/Astronautics) who represented J. R. Dempsey (president, GD/A). Their plea for cooperative endeavors among scientists and engineers emphasized the application in the applied areas with respect to the national defense posture and the efficient utilization of our human resources. The keynote address was delivered by Lt. Col. Billie McIntosh who represented E. Konecci (Office of Advanced Research and Technology, NASA). McIntosh stressed the interdisciplinary roots of cybernetics and its application of space hardware to systems engineering. He stated the need for the coupling of research with system design to ensure continued vigor and freshness in the former and continued progress in the latter. He pointed out the key problem in cybernetics is to first understand what the human brain really is and what it actually does. He also stressed the necessity for added analysis to reduce the costs of testing, increased use of information by improved retrieval methods, and emphasis on mathematical formulations of functional relationships between variables. McIntosh concluded by making a strong plea for a "crusade" attack on the real problems. He proposed devising a cost effectiveness yardstick for research, and an interdisciplinary approach to systems engineering that will result in cross-fertilized solutions to the understanding of man, his capabilities, and limitations, thus arriving at methods for calculating and measuring human reliability in advanced aerospace systems.

Don Flickinger stressed the importance of crew safety considerations in human factors tradeoffs with other design requirements, and the need for better astronaut selection criteria than past performance on stressful jobs. Flickinger also prognosticated that there would probably be no manned commercial space vehicle system within the lifetime of any of his audience.

The work of Warren S. McCulloch epitomizes the benefits to be derived from interdisciplinary teamwork. McCulloch described recent work at M.I.T. in neuroanatomy, physical modeling of the nervous system by electronics, mathematical theory-construction, and the processing of information by the nervous system (especially of the reticular formation of the central nervous system and spinal cord). He emphasized that the limiting factor in psychiatry and psychology was the lack of a suitable calculus or logic to describe what specific functions permit long-duration taus or time-delays in the feedback circuits and cybernetic nets so basic to complex performance.

Immediately following his interesting talk, McCulloch chaired a round-table state-of-the-arts session that included Larry Fogel, Ward Edwards, H. Zierhut, F. A. Muckler, and R. O. Besco. They described recent trends and accomplishments, current problems, and criticisms of work in the fields of bionics and artificial intelligence, psychotechnology, industrial design, control system research, and manual controls, respectively. Besco pointed out the need for a standardized nomenclature and set of dependent variables to allow human factors data to be placed on continua or at least cross-correlated and compared. He pointed out that vehicle control can be best described in terms of energy expenditure parameters. Muckler emphasized our inability to determine the microstructure of behavior, to specify mission requirements, and then to allocate functions to man and machine in an effective manner. The panel collectively emphasized the points made by the keynote address and decried the great proliferation of the trivia in the technical literature and the failure to isolate and work on the real problems that face the profession. Edwards underscored the information processing, human biases, and bandwidth problems of decision making. Zierhut begged for solutions to the practical day-to-day problems of design hardware and systems and the necessity for relying on intuition in lieu of quantitative knowledge of human performance. Fogel discussed and deplored the lack of precise terminology and operational definition in the theory/modeling/simulating subareas of human factors, usually designated as bionics and artificial intelligence. A lively discussion between the panel and audience followed the formal presentation that considered the question of cultural restraints involved with social engineering—how can the scientist help a backward society become prepared to accept and live with new technology and destructive capability. The relationships between basic and applied areas and how we can speed up the process of obtaining more useful data were also discussed during this period.

The technical sessions contained papers that ranged from basic research with no immediate application to any system to the most applied human engineering studies. The meeting was notable for the number of papers that were concerned with the use of computers and simulators either by way of data reduction, model construction, or stimulus production. This is indeed the age of automation and of the computer and this trend is obvious from the composition of the papers and discussion at this symposium. Another trend that can be discerned is the reduction in the number of tracking studies that were given at the meeting. This trend was also commented upon by Muckler at the round-table discussion. This and the servo-theory approach to human behavior is evidently losing some of its former enthusiasm which may indicate some maturity in the area of man-machine system dynamical control. Another trend might be noted,

that is, the one away from invention of gadgetry for its own sake, and toward the standardization of the most useful techniques and equipments so that usable information can be obtained in some depth and quantitative relatedness with other data.

The selection of some outstanding papers always runs the risk of accusation of bias and judgment, and this is no doubt true. What is new and interesting depends upon how much the observer knows and upon his predilections. The paper by Wally Sinaiko on international teleconferencing opened up a whole new field of research having the possibility of immediate results in our present highly insecure society. He described some of the studies being done on communications by telephone, teletype, language translation, and the TV-phone. Ward Edwards described some of his work on decision-making by use of Bayesian mathematics. We are leaving ourselves open to an accusation of bias by stating that this is only an arbitrary sample of what was an almost universally worthwhile symposium. We recommend that interested readers obtain a copy of the proceedings from IEEE headquarters (Box A, Lenox Hill Station, New York, N.Y. 10021).

W. E. WOODSON
M. FREITAG
General Dynamics/Astronautics, San Diego, California

Forthcoming Events

August

2–3. **Ophthalmic Biochemistry**, first intern. conf., Woods Hole, Mass.. (S. Lerman, Univ. of Rochester, Rochester, N.Y.)

2–4. American Assoc. of **Colleges of Pharmacy**, New York, N.Y. (C. W. Bliven, 1507 M St., NW, Washington, D.C. 20005)

2–6. National **Medical** Assoc., 69th annual, Washington, D.C. (Administrative Secretary, 520 W St., NW, Washington, D.C. 20001)

2–7. American **Pharmaceutical** Assoc., 111th annual, New York, N.Y. (G. B. Griffenhagen, Div. of Communications, 2215 Constitution Ave., NW, Washington, D.C.)

2–8. **Applied Psychology**, 15th intern. conf., Ljubljana, Yugoslavia. (B. Petz, Inst. of Psychology of Zagreb, Djure Salaja b.b., Zagreb, Yugoslavia)

2–8. **Reactivity of Solids**, 5th intern. symp., Munich, Germany. (B. Stuke, Physikalische-Chemisches Institut, Sophienstr. 11, Munich)

3–5. Compounds of Interest in **Nuclear Reactor Technology**, intern. symp.,