



COMMITTEE on SOCIAL IMPLICATIONS of TECHNOLOGY

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EDITOR: NORMAN BALABANIAN

A "DEBATE" ON NUCLEAR POWER PLANT SAFETY

A review of: "Nuclear Power Plant Safety--I," by Gadi Kaplan and Ronald K. Jurgen; and "Nuclear Power Plant Safety--II," by Gordon D. Friedlander, IEEE Spectrum 13:5, May 1976, pp. 52-75.

The articles "Nuclear Power Plant Safety--I and II" are a decided improvement over Spectrum's past coverage of the nuclear power controversy. Previous articles, while providing much useful information, have tended either to bypass the central questions raised by critics of nuclear power [1,2] or to address them in a one-sided manner [3]. In contrast, the two current articles directly address specific questions regarding nuclear power plant safety. The format consists of statements by nuclear safety critics Bridenbaugh, Hubbard, Minor and Pollard followed in each instance by one or more rebuttals by NRC (Nuclear Regulatory Commission), General Electric, and Consolidated Edison. Nevertheless, the articles are disappointing in several respects.

Although Spectrum characterizes the articles as a "discussion" and a "three-party debate" respectively, neither article provides for counter-rebuttal by the nuclear safety critics; the nuclear establishment's rebuttals are presented as the last word on each topic. Thus, the reader is not given sufficient information to judge the relative merits of the conflicting assertions. It is interesting to compare the rebuttals with the findings of the APS Study Group on Light Water Reactor Safety. For examples:

"Con Edison: ... Contrary to Mr. Pollard's allegations, the reliability and ruggedness of diesel units is well-known in the industry ..." [p. 75]

APS Study: "Surprisingly, diesel performance is one of the recognized weak points in the safety system: statistics show that about 3% of the diesels fail to start when asked (AEC/OOE, 1974a). In addition, there is a finite probability (approximately 1%) that a diesel, properly started, may trip when asked to assume full emergency load. Clearly, improvements in diesel reliability are necessary ..." [4].
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"NAME THE NEWSLETTER" CONTEST

The Committee on Social Implications of Technology has decided to provide a suitable name and corresponding logo to the Newsletter. Readers are invited to submit suggestions. Drawings of logos should provide sufficient detail to make the intent clear. Names suggested so far are:

ENGINEERING AND SOCIETY

REFLECTIONS (Logo: mirror with a reflection)

Deadline for submission is August 15. Suitable prizes will be awarded for the chosen name and the chosen logo.

New subscriptions: IEEE members wishing to receive this Newsletter should write to: Stephanie C. Wolfson, IEEE, CSIT Newsletter, 345 East 47th Street, New York, NY 10017.

The editorial staff invites letters and articles from readers. We are interested in publicizing news of all upcoming meetings, study groups, discussions, lectures, or workshops that in any way relate to the interaction between technology and society. Correspondence may be sent to any of the above editors. "The views expressed in this Newsletter are those of the respective authors and not those of IEEE."

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AN INTERVIEW WITH Dr. ENRIQUE KIRBERG

Dr. Enrique Kirberg spent twenty years as a professor of illumination engineering at the University of Chile. In 1968 (two years before the election of President Salvador Allende) he was elected Rector (President) of the Universidad Tecnica del Estado in Santiago. He served in that capacity for five years until he was abruptly removed during the military coup in Chile in 1973 and spent the next two years in prison without charges of any kind and without a trial. He was released on September 11, 1975 as a result of extensive public pressure from many sources outside Chile, including a letter from CSIT to the Chilean government.

Dr. Kirberg is now a Senior Research Associate at the Latin American Institute, Columbia University. He granted an interview to the CSIT Newsletter Editor which was supplemented by subsequent correspondence.

EDITOR: How was the military coup in Chile felt at your institution, the Universidad Tecnica del Estado (UTE)?

KIRBERG: We felt it physically when on September 12, 1973 our university was bombarded without any kind of notice. Two bombs fell directly on the Administration Building. Military troops then attacked the university and occupied it. I was immediately imprisoned and was not released until exactly two years later.

EDITOR: What has been the fate of the universities and of education in general since the military coup?

KIRBERG: There has been military intervention in all eight universities in Chile. Each university has had a retired officer named as rector. The Minister of Education is an Admiral who is a specialist in torpedoes. All university councils -- formerly composed of professors and students -- have been abolished. The military rector has total control over all academic matters; professors must teach exactly in accordance with the syllabus provided. At the very beginning more than 30 percent of all university professors were fired and many imprisoned. Large numbers of students were expelled -- at the University of Concepcion 8,000 out of 22,000 students were expelled. University budgets were drastically reduced: 10 percent in one year, 15 percent in the next. Scientific research was paralyzed and many institutes were eliminated.

EDITOR: Since universities are a national resource which even military governments would find useful, why have they been treated so harshly in Chile?

KIRBERG: The answer to that question requires some historical perspective. The university is an important factor in bringing about social change. Especially in Latin America, the university has always been a "classical" university. At the university were educated the sons of the dominant classes; there the future government ministers were trained, the future ambassadors, the future parliamentary deputies and senators, and the high officials of the government. Traditionally, the sons of workers and families with little income did not enter the university.

The election of Salvador Allende as President brought an end to this pattern in Chile and destroyed a centuries-old injustice at the universities. A number of measures were taken to this end: (a) admission quotas were established on the basis of educational origin; that is, certain percentages from the traditional high

schools, from the technical high schools, from night schools, etc. (b) scholarships were established for students from poor families. And what about the workers? Something had to be done for them. A number of workers had gone through high school but had not gone on for further study, both because they could not afford it and because the university was "something for the rich". Many had dropped out of high school lacking a year or two or three to complete it because they needed employment. So special educational programs were instituted for workers.

EDITOR: What was the nature of these programs?

KIRBERG: There were three distinct phases. (1) First, throughout the country, Schools of Equalization were established, especially in the copper and coal mines, in the principal trade unions and in particular colleges of the Universidad Tecnica. A two-year program was available in three areas: science-humanities, social science, technological. Costs were borne by the industries in which the workers were employed. "Equalization" referred to bringing those in the past who had not been able to go through high school up to that level. (2) The second phase was aimed at the graduates of the Schools of Equalization and at workers who already had completed high school. A two-and-a-half year evening program was established for them. The courses were given in the places of work: in industries, mines, fields and public institutions. Costs were paid by the employers. The degree granted was called a University Technician. (3) The third phase was an evening program in the more normal university setting for those who wanted one of the usual university degrees.

EDITOR: How did the student body change as a result of such programs and other policies of the Allende government?

KIRBERG: By 1973, we had reached a population of 7,000 workers or children of workers out of 30,000; that is, 23 percent, in my university. Five years earlier, this percentage had been less than 5 percent, and in the principal university, the University of Chile, the corresponding percentage 5 years earlier had been only 2.2 percent. By 1973, general university admissions of students from poor families had increased by 380 percent. Furthermore, students participated actively in the life of the university, both in its internal affairs and in the work which they voluntarily contributed outside the university, in the fields, factories, mines and other institutions. This involvement in voluntary activities helped to develop in them a public consciousness and an understanding of the life of the workers alongside whom they worked.

EDITOR: Were the universities involved in any other kind of activities besides teaching courses; what we here might describe as university extension?

KIRBERG: Yes. Universities became intensely engaged in a number of activities to bring culture, knowledge and art to the entire population. There were "Seasonal Schools" of 2 or 3 weeks duration, especially for adults. Choruses, orchestras, cultural radio programs, ballet, musical ensembles, theater, cinema, books, and journals were all promoted. By 1973 we were about to initiate an educational television channel. There developed an avidity for learning and culture among the masses of people. During the three years of the Allende government, the number of books in circulation tripled.

There is much to describe of this aspect of life in Chile and I am in the process of preparing a book. I am anguished to think that all of these flowers that were being nurtured have been trampled under the military boot, which itself is the negation of culture, art and knowledge.

EDITOR: As a final question, do you know other engineers like yourself who were imprisoned following the coup in Chile?

KIRBERG: Yes, there are many. A few in particular that I know are the following:

PEDRO FELIPE RAMIREZ, Civil engineer, Director of Mines in 1972-73. He is now imprisoned in Valparaiso, charged with "attempting to introduce politics into the army" but still not tried.

JOSE CADEMARTORI INVERNIZI, Industrial engineer, Minister of Economics, 1971-74. He is now imprisoned at the 3 Alamos concentration camp under the same charge.

FERNANDO FLORES, Electrical engineer, Specialist in cybernetics and computation, Minister of Finance, 1971-1973. Now also imprisoned at 3 Alamos without charges.

DAVID SILVERMAN, Civil engineer, Manager of the Chuquicamata copper mine, the largest in the world. Imprisoned and tortured, he has not been seen for many months.

I would urge interested readers to write to General Augusto Pinochet, Head of Government, Santiago, Chile and inquire about each of these colleagues. I owe my life to the international concern and protests raised on my behalf, especially from the US and from organizations such as the IEEE CSIT. The life of my colleagues, and perhaps their freedom from imprisonment, could depend on the amount of interest and concern from abroad. [Editor's note: the conditions of imprisonment of the individuals mentioned may have changed since this interview.]

Continued from page 1...

A "DEBATE" ON NUCLEAR POWER PLANT SAFETY

In one instance the two rebuttals contradict each other, given the definition of the design basis LOCA (loss of coolant accident) referred to in the NRC rebuttal.

"NRC: The containment structure for either a PWR or BWR reactor plant is designed to withstand, without loss of function, the pressure and temperature conditions resulting from a postulated design-basis LOCA or double-ended rupture of the largest pipe connected to the reactor vessel"[p. 61].

"General Electric: In the allegations about the Mark I containment, the key assumption is a postulated double-ended break of the largest pipe attached to the reactor pressure vessel ... the assumption is made that the pipe severance would be instantaneous. It is known that if piping of this type ruptures, it does so gradually, first leaking through a crack, which, if it progresses, does so slowly. Had it been assumed that this, rather than an instantaneous complete severance, had occurred, the resulting loads on containment would be well within its capability ..." [p. 60].

The assumption of the instantaneous complete break of the largest pipe--ascribed by G.E. to the critics--is, in fact, implicit in the NRC rebuttal. Thus:

APS Study: "As the primary design basis accident by which the adequacy of the engineered safety features (especially the ECCS) of each plant is measured, the AEC [now NRC] has chosen the hypothetical severance of the largest pipe in the primary system. The break is assumed to occur instantaneously, in such a way that the reactor coolant would discharge unimpeded from both ends of the severed pipe." [5]

A subtle bias seems to pervade both articles. For example, the authors characterize the statements of Minor, Bridenbaugh, Hubbard and Pollard as "contentions" and "allegations." In contrast, Spectrum shows no such skepticism in reporting on Con Edison's simulated tests on reactor control and power cable combustibility. The descriptions of the tests consist of two photographs [cover, p. 73] accompanied by captions which simply assert that "negligible damage" to the cables had occurred, not alleged to have occurred. No supporting information is given regarding the test conditions, authenticity, or real-world validity of the Con Edison "data", despite the seeming discrepancy between these simulated test results and the real-world cable fire that occurred at the Brown's Ferry, Alabama nuclear power plant on March 22, 1975. At Brown's Ferry, an electrician's candle set fire to some Polyurethane sealant, and the fire quickly spread to the cable insulation. The resulting \$100 million, 7 1/2 hour fire in the cable spreading room came uncomfortably close to causing a core meltdown. The prominence given to the Con Edison "tests" contrasts with Spectrum's non-coverage of the Brown's Ferry fire.

The shortcomings of the articles appear to be due in part to an effort by Spectrum to publish the material as soon as possible; yet, Spectrum has been in no great hurry to air the issues raised by other knowledgeable nuclear critics (e.g., Gofman, Tamplin, Ford, Kendall, Alfven, et. al.) over the past five years. Editor Christiansen conceded that the articles do no more than "open the door to further, substantive discussion of the complex issue of nuclear power implementation." [p. 52]. It is to be hoped that Spectrum will now follow through and provide the thorough, substantive discussion that is so long overdue.

References:

- [1] Gadi Kaplan, "Seeking Super Safety," IEEE Spectrum 12:6, June 1975, pp. 47-55.
- [2] Gadi Kaplan, "Bugs in the Nuclear Fuel Cycle," IEEE Spectrum 12:9, September 1975, pp. 56-64.
- [3] Norman C. Rasmussen, "Rasmussen on Reactor Safety," IEEE Spectrum 12:8, August 1975, pp. 46-55.
- [4] American Physical Society, "Report to the APS by the Study Group on Light Water Reactor Safety," Rev. Mod. Physics, Vol. 47, suppl. No. 1, Summer 1975, p. 27-28.
- [5] Ibid, p. 33.

Frank Kotasek, Jr.
CSIT Working Group on Energy
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DRAFTING CONSUMER STANDARDS

Richard Costello

The interests of the consumer have in recent times received a great deal of publicity, which in turn has produced a few real, tangible, and even significant benefits. The Consumer Product Safety Commission (CPSC), a U.S. Government body, is one of the truly significant products of the somewhat amorphous consumer movement. I speak from personal experience with the CPSC; and as an engineer and a Professor of Electrical Engineering. I offer the following account of one engineer's effort to follow his conscience and look out for the interests of society, and his own interests as well. This may sound oddly reminiscent of a soap opera, with never ending complications surrounding Young Doctor Malone. Indeed, that appraisal is very close to the truth; with all parties -- the good guys, the bad guys, the doers, and the talkers -- all viewing themselves as Young Doctor Malone, who somehow must correct the ills of society and, in particular, the ills of power lawn mowers, which is what this article is all about.

The Consumer Product Safety Commission was established by an Act of Congress in 1972, under President Nixon. It opened for business on May 14, 1973. It is responsible for the safety of consumer products, and can recall products which the Commission deems to be hazardous. The Commission also sets standards for consumer products. These standards, unlike all previous consumer standards, have the force of law. All products covered by a CPSC standard must comply with that standard, or they can be recalled by the U.S. Government. The familiar Underwriters' Laboratory (UL) standard, whose tag is often attached to electrical appliances and electrical wiring components, is a voluntary standard, without the force of law and with no enforcement provisions. The same is true of the American National Standards Institute (ANSI) codes.

Until the CPSC was established, consumer products either met no standards or met voluntary standards. In almost all cases, the voluntary standards were drafted by individuals involved in the manufacture of the product. Often, an association of manufacturers would draft its own standard. Self interest cannot be avoided in such situations. Generally, industry-sponsored standards are adequate, and sometimes even excellent -- as far as they go. The problem is that industry-sponsored standards tend to omit covering certain important safety areas.

I was involved with drafting a new standard for the Consumer Product Safety Commission, pertaining to power lawn mowers and garden tractors used to mow lawns. A voluntary standard, drafted by industry members, already existed, and a manufacturers-supported trade organization with an avowed interest in safety standards also already existed. The trade organization (Outdoor Power Equipment Institute, or OPEI) had proposed that the U.S. Government simply adopt the voluntary Power Lawn Mower Standards, known as ANSI

B71.1a, and UL-82, and make the voluntary standards mandatory.

The Consumer Product Safety Commission turned down the proposal. Instead, an offer submitted by Consumers Union, the organization which publishes the magazine Consumers Report, was accepted. Consumers Union proposed to draft a new power lawn mower standard in 90 days, utilizing both industry participants and consumer participants. The Consumer Product Safety Commission would pay organizational expenses, publication expenses, and travel expenses for consumers. Industry representatives would pay all their own expenses. Consumer representatives would volunteer their time and effort. The proposed budget totaled \$96,900, or about \$1,000 a day. This was divided as follows: \$31,800 for Consumers Union staff, \$30,200 for travel expenses, \$34,200 for testing and paper work, and \$700 for one paid consultant.

I became involved as a consumer representative as a consequence of a letter I had written to Consumers Union, detailing a half dozen design changes I had conceived to improve the safety of power lawn mowers. Very few consumers did get involved. The principal reason for this lack of consumer involvement was the amount of voluntary working time required. The group I was involved with, the Brake and Drive Train Subcommittee, met on the average of twice a month, during workdays, for one or two days, in various parts of the country. An extremely flexible work schedule and an extremely understanding boss was an absolute prerequisite for any employed consumer. The only regular consumer participants were either unemployed (female, domestic, artists) self employed (male physicians, lawyers, and consultants); or university employed (male and female professors). One might deduce that the typical owner and purchaser of a power lawn mower, an employed male American consumer with no special knowledge of power lawn mowers, was not represented.

In case one should wonder why so much time, effort and money was being expended to improve lawn mower safety standards, the following facts may prove to be enlightening.

In July of 1972 the National Electronic Injury Surveillance System (NEISS) was established. It consists of computer terminals located at selected hospital emergency rooms across the country, connected to a central data bank. Emergency room cases are reported via these terminals and put into categories via the central computer system for analysis purposes. Based on 2,182 reported lawn mower injuries from 1973 to 1974, it was estimated that a total of 62,000 lawn mower accidents occurred on a yearly basis during those years. One hundred and forty-two of the 2,182 cases were investigated in depth by a CPSC investigator who interviewed the people involved and inspected the accident site and the machine involved, whenever possible. The following table summarizes selected findings.

TABLE 1

Power Lawn Mower Statistics and Accident Data*

Estimated Mowers in Use (1974)	30,000,000
Estimated Mowers Manufactured (1974)	15,000,000
Estimated Mower Accidents (1974)	62,000
3.8 Male Accidents/Female Accidents	
62% Accidents are lacerations.	
55% Accidents involve the hand	
11% Accidents are fractures	

Riding Mower

53% Accidents, Blade Contact
24% Accidents, Tip Over
6% Accidents, Thrown Objects

Walk Behind Mower

53% Accidents Blade Contact
30% Accidents, Thrown Objects
3% Accidents, Burns
1% Accidents, Eye

* Abstracted primarily from "Hazard Analysis of Power Lawn Mower Associated Accidents," Consumer Product Safety Commission, Bureau of Epidemiology, Aug. 1974.

The actual standards-writing procedure is one of compromise and homework. Many people will talk -- and talk convincingly -- but few will write. I found my consumer viewpoint very hard to get across at first. It became a little easier when I started presenting lengthy written proposed standards; and it became much easier when a writing task force, comprised of three industry members and one consumer member, was set up. Because I worked hard and presented multiple proposed standards, the path of least resistance proved to be the outright incorporation of my consumer viewpoint into a document supposedly written primarily by industry members. There is apparently no substitute for homework.

I observed a rather interesting and, no doubt, common occurrence. Those industry members who actually did the most work, the most writing and the most rewriting, were by far the most broadminded committee members; they did not push for an extremely weak standard, as several industry representatives did. There were extremists on both sides of the safety fence, who would not yield one miniscule point either in favor of safety or in favor of industry -- but not one of these extremists was involved in the actual drafting of the standards. One might conclude that those individuals who worked long hours drafting the proposed standards were motivated to produce a standard which had a fair chance of being acceptable to all points of view. Thus

a desire to see their work accepted automatically induced a broader point of view and the working writers, whether consumers or industrialists, exhibited more tolerance and more apparent awareness of the need to compromise within the bounds of prudence and integrity.

I do not exactly know all the reasons that led to the following personal opinion, but I am certain of its validity: I would buy a lawn mower, even a used one, from those industry members who actually wrote the safety standard. I would not buy a lawn mower, especially a used one, from those industry members or consumer members, who expressed an extreme point of view and in general did little else.

To improve future consumer participation in the standards process, and to improve the overall process of generating standards, I make the following suggestions:

- I. In order to remain on the membership list, every member of a Standards' Committee must submit a written document at each and every meeting involved in the actual drafting of the standard. This document could cover one or more of the following topics:
 - a) The committee member's opinion of points raised at the previous meeting.
 - b) The committee member's suggestions for new wording of the standard.
 - c) The committee member's suggestions for new points to be covered by the standard.
 - d) A new draft proposal, offered by the committee member as an alternative to the primary committee's draft of the proposed standard -- i.e., a minority proposed standard.
- II. Alternative recommendations for a proposed safety standard should be submitted, at least one of which represents the consumer's point-of-view.
- III. Consumers should be partially compensated for their efforts.
- IV. Direct costs incurred by consumers or supporting institutions (secretarial costs, duplicating costs, postage costs, telephone costs, materials costs, travel costs, and food and lodging costs while attending meetings) should be covered.
- V. Testing by independent non-profit organizations, with no direct financial interest in the standard, should be sought. A consumer group, a university, or a college would fit this requirement.

In conclusion, participating in the generation of safety standards turns out to be surprisingly taxing -- taxing of time, effort, and intellect. To avoid industrial bias, independent consumer participation is an absolute necessity in my opinion; yet, having volunteered once, I do not expect to volunteer again.

NEWS, NOTES, & COMMENT

Another Nuclear Power Argument

In early May a public argument over nuclear reactor safety was precipitated by Keith Miller, professor of mathematics at the University of California/Berkeley and consultant to the Advanced Code Review Group of the Nuclear Regulatory Commission (NRC). Miller had been working on codes for predicting the behavior of the emergency core cooling system (ECCS) during a loss of coolant accident (LOCA). In a memorandum and a long letter to the NRC Commissioners dated May 6 and 7, and in a televised interview on May 12, Miller charged that the codes are totally inadequate to the complexity of the problem of accurate prediction, that the present ECCS has major design flaws, and that NRC is not justified in licensing any more reactors with that design. He also expressed concern that NRC has not been candid with the American public in its implication that there is virtual certitude associated with nuclear power plant operation. Other consultants to the Code Review Group did not share Miller's views. Miller will continue to serve as a consultant.

Age Discrimination Case

A number of engineers dismissed by SPERRY on Long Island about two years ago have charged that their dismissals were a result of age discrimination on the part of the company. They have instituted legal action before the New York State Division of Human Rights and have asked the IEEE to intervene on their behalf. With the *amicus* brief submitted by IEEE in the BART case as precedent, it appears that IEEE participation in the SPERRY age discrimination case is imminent. At its May 22 meeting, CSIT passed a resolution of support for IEEE's participation in this legal case.

Policy Statements

"Recognizing that the IEEE may be called on to respond in timely fashion to societal situations that frequently arise with little forewarning . . .," Procedural guidelines were issued by IEEE in July 1975 which dealt with IEEE policy for the release of public statements by any IEEE entity (Board, Council, Society, Committee). An important issue is left unsettled by these guidelines: when an entity issues a statement, for whom is it speaking? Under similar circumstances, the American Physical Society attaches a disclaimer, e.g.: "This is a consensus of the APS Council and has not been submitted to the membership for vote." At its February 14 meeting, CSIT passed a resolution recommending to the IEEE Technical Activities Board that similar language be included in the IEEE Guidelines.

Working Group on Crime Countermeasures

At its May 22 meeting CSIT formed a new Working Group on Crime Countermeasures and appointed Professor John S. Jackson of the University of Kentucky as Chairman. Readers interested in working with this group are urged to contact

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NAS "Goes Public"

After considerable criticism (notably by Jeremy Stone of the Federation of American Scientists) for its refusal to express public concern over the plight of scientists living under repressive governments, the National Academy of Sciences (NAS) voted at its annual meeting in April to take a step in that direction. Specifically, NAS will circulate an "affirmation of freedom of inquiry and expression" which it hopes will be adopted by individual scientists around the world. One of the guidelines from the NAS Council says, in part, "we do not eschew entreaty by public vehicles; indeed, we anticipate that such actions will occasionally be appropriate." This development of a publicly expressed conscience was anticipated a year ago by CSIT by its public activities in behalf of certain imprisoned Chilean engineers; in particular, Dr. Enrique Kirberg who was subsequently released. (See the interview with Dr. Kirberg on page 3.) The text of the affirmation follows.

An Affirmation of Freedom of Inquiry and Expression

I hereby affirm my dedication to the following principles:
.. That the search for knowledge and understanding of the physical universe and of the living things that inhabit it should be conducted under conditions of intellectual freedom, without religious, political or ideological restriction.
.. That all discoveries and ideas should be disseminated and may be challenged without such restriction.
.. That freedom of inquiry and dissemination of ideas require that those so engaged be free to search where their inquiry leads, free to travel and free to publish their findings without political censorship and without fear of retribution in consequence of unpopularity of their conclusions. Those who challenge existing theory must be protected from retaliatory reactions.
.. That freedom of inquiry and expression is fostered by personal freedom of those who inquire and challenge, seek and discover.
.. That the preservation and extension of personal freedom are dependent on all of us, individually and collectively, supporting and working for application of the principles enunciated in the United Nations Universal Declaration of Human Rights and upholding a universal belief in the worth and dignity of each human being.

Ethics Code Support and Endorsement

There have always been two aspects of institutional action involving a code of ethics. One deals with the encouragement and support of those engineers whose actions in accordance with ethical principles place them in a difficult position. The other is concerned with code enforcement procedures when engineers act in an unethical manner. The United States Activity Board (USAB) of IEEE has a task force devoting attention to each of these areas.

At its May 22 meeting CSIT unanimously passed several resolutions which dealt with these issues, as outlined here:

(1) CSIT endorsed a proposal by one of the USAB task forces outlining a procedure for enforcing the ethics code. This proposal, based on the established procedures of another professional society (ASCE) involves the setting up of a Professional Conduct Committee to receive and investigate charges of unethical behavior by IEEE members, and a hearing procedure before USAB to adjudicate such charges. Penalties would range from a private letter of admonition to expulsion from IEEE. Such machinery is not to be activated until procedures for the institutional support of engineers who do act ethically are in operation. The proposal also calls for open discussion of the ethics code by the IEEE membership, followed by a referendum on the code (as revised) and on any constitutional changes necessary to effectuate the enforcement procedures.

(2) No report by a second USAB task force (dealing with support) has yet been submitted. CSIT urged USAB to act on the establishment of support procedures to aid engineers whose acts in conformity with ethical principles may have placed them in jeopardy. A proposal developed last year by a USAB committee (see page 27 of the March 1976 CSIT Newsletter) was suggested as the basis for such machinery.

(3) USAB was further requested to act on the establishment of an IEEE award for ethical behavior in the public interest under difficult circumstances. (See article on page 13.)

Ethics Code Revision Endorsed

Engineering ethics and the social responsibility of engineers has been among the major concerns of the Committee on the Social Implications of Technology since its inception. The Working Group on Ethics and Employment Practices has been in the vanguard of IEEE units concerned with the development of a code of ethics. The adequacy of the IEEE Code of Ethics for Engineers published in the February 1975 issue of SPECTRUM has been under continuous discussion. A revision of that code was proposed by Stephen Unger in the March 1976 CSIT Newsletter. At its meeting of May 22, CSIT formally endorsed the revised code and urged the IEEE Board to adopt it.

IEEE Personnel Practices

The procedures leading to the IEEE staff lay-offs in January have been of continuing concern to CSIT. In some respects these lay-offs were only marginally within the intersociety employment guidelines. After a meeting with General Manager Schulke and TAB Chairman Briskman, a subcommittee of the CSIT Working Group on Ethics and Employment practices drafted proposals for IEEE Policy on Staff Discharges. At its May 22 meeting, CSIT endorsed these proposals and forwarded them to appropriate IEEE officials. It is to be hoped that IEEE will set an exemplary high standard for the treatment of professional employees, one that might serve as a model to be emulated by other employers of IEEE members. The text follows:

CSIT Proposals for IEEE Policy on Staff Discharges

1. These rules are applicable to all employees after a probationary period of 3 months for clerical level personnel and 6 months for professional level personnel. Copies are to be distributed to all employees.

2. All discharges must be justified under one or more of the categories listed below:

- (a) General staff layoff for budgetary reasons
- (b) Staff reorganization eliminating the position held
- (c) Physical or mental incapacity to perform job
- (d) Serious personality conflict with superiors or coworkers that interferes with work in a major way
- (e) Gross incompetence or negligence
- (f) Unacceptably low productivity or gross wastefulness
- (g) Serious acts of dishonesty on the job
- (h) Serious violations of justifiable and clearly defined non-trivial work rules or instructions from superior
- (i) Serious violation of the code of ethics regarding the release of IEEE information

3. Whenever possible, a transfer within the organization (at the same salary level) should be offered in place of discharge. Particularly strong efforts along these lines should be made when the reason for discharge is in category a-d.

4. At least two weeks notice should be given to clerical level employees and at least one month's notice should be given to professional level employees prior to discharge. During the notice period, reasonable time off without loss of pay should be granted for employment interviews. When the reason for discharge is in category e-i, and in other special cases, any portion of the notice period may be replaced by additional severance pay.

5. Upon notice of discharge, the employee should be informed as to the reasons both in writing and in a personal interview.

6. An employee who considers his or her discharge to be unjustified should have the right of appeal to the personnel committee referred to in the 4/3/76 CSIT resolution (see appendix). Written notice of appeal must be filed within 2 weeks of notification and the appeal should be adjudicated prior to the expiration of the sum of the periods referred to in items 4, 7 and 8.

7. On discharge, all employees are entitled to pay corresponding to any accumulated vacation to which they are entitled at that time.

8. Severance pay should be computed as a minimum of one month's pay plus one week's pay for each year of employment. When the reason for discharge is in category e-i, then severance pay may be decreased substantially, or, in extreme cases, not given at all.

9. Health and life insurance coverage should be continued on discharge for an interval corresponding to the sum of the periods referred to under items 4, 7 and 8.

10. For each full year of employment, 25% of accumulated pension rights should be vested - so that there would be full vesting after 4 years.

Appendix: April 3, 1976 CSIT Resolution

Resolved that a personnel committee of the IEEE Board of Directors be established, to consist of between three and five IEEE Officers not members of the executive committee, for the purpose of review of personnel procedures and relations, and in particular that it review and approve in advance significant actions affecting IEEE staff. This committee shall serve as a board of appeals for staff members.

LETTERS

To the Editor:

As a member of the IEEE/IRE for almost 35 years, may I comment on the March issue no. 13 relating to nuclear power.

1. I am distressed for three reasons that the IEEE Board would urge that the "rapid development of nuclear power be stimulated."

First: Assuming that the rapid development is necessary, the particular statement is not logically put together. The conclusion is at least a partial non sequitur to their summary. For someone who knows the whole story, it can appear that the Board also may know the story. On the other hand, if the Board were pushing a vested interest, they could say exactly the same thing. Therefore, the Board can appear to be supporting vested interests, and I view that possibility as being bad for the IEEE and the profession.

Second: Assuming some development is necessary because there is no other choice, it does not follow either in fact or from the Board's summary that the rapid development is desirable.

(A conclusion sometimes reached is that some development or expansion regrettably is necessary as an interim solution. One says interim because it may be unlikely that the public will accept the breeder, and there

isn't enough uranium at reasonable prices, less than \$100 a pound, for more than another decade of initiating plans for more reactors.)

Third: Even if development is judged by the Board to be desirable, there are many members of the IEEE who believe that development should be stopped now. Consequently, I think the Board would have done better to summarize the facts as they see them, together with the consequences of the alternatives as they see them, thereby maintaining some credibility for objectivity. (Rapid development means abc, development means def, a nuclear moratorium means xyz. The principal factors are alpha, beta, gamma, etc.) Some matters that must be mentioned in a credible statement are reference to alternatives, including conservation with time scale, dollar costs, and external costs (treated inadequately in the statement), reference to nuclear power itself with time scale, dollar costs, external costs, supply of uranium, reactor safety, and the breeder reactor (quite inadequate in the statement), the impact on the economy, growth, jobs, ERDA's management, the international situation according to at least a couple of the more representative scenarios (not mentioned in the statement).

The American Meteorological Society from time to time issues authoritative and factual white papers on public issues (as on fog dispersal). I think the professional societies must do this sort of thing. I think it is unwise for their boards to take positions of advocacy, except advocacy for presenting the whole factual story to the public. After all, it is the public who should and will make the decisions.

2. The statement on the California Initiative is equally inadequate or worse. It offers not a single reason for opposing the initiative. Is it not possible for the IEEE to correlate the relationship of jobs, the economy, and availability of electric power? The matter is not even mentioned!

3. It appears to me that unless the IEEE management either learns how, or pays some attention to laid-off staffers who have already learned how, or members who know how, to speak on public issues without forfeiting professional integrity and credibility, the Institute will not be fulfilling its mission. The IEEE cannot and must not avoid the public sector issues, but it should participate in a dignified way professionally rather than seemingly as just another special interest lobbyist.

While trying to set down some concise thoughts on these difficult questions, I note that the IEEE of necessity is particularly involved in all sorts of energy questions. From an electrical engineering standpoint, it is not clear whether electrical engineers can do more for society via nuclear power, or via solar conversion and long distance high voltage dc transmission to alleviate but not eliminate the storage problems. I think the potentialities of all these and several other options, and their implications for the professions should be explored by the Board.

The IEEE has done a great deal for society and for the profession. In the future I hope we do even more.

Seville Chapman, Director
Assembly Scientific Staff
Albany, New York

To the Editor:

Mr. Rabow's article in the March 1976 issue ("The Application of System's Engineering to Societal Problems") continues to illustrate the dilemma of the technologist in trying to bootstrap certainty into human society -- as if there was a definable "good" or agreement on "performance objectives".

I find that Mr. Barus' article in response reflects the key reality in this dilemma: there is no agreement as to what the objective should be. In this regard and on the example illustration in the article of an educational system, I submit the following quote reflecting a major breakthrough in educational thinking:

"As things are ... mankind are by no means agreed about the things to be taught, whether we look to virtue or the best life. Neither is it clear whether education is more concerned with intellectual or moral virtue. The existing practice is perplexing: no one knowing on what principal we should proceed -- about the useful in life, or should virtue, or should the higher knowledge be the aim of our training: all three opinions have been entertained. Again, about the means there is no agreement: for different persons, starting with different ideas about the nature of virtue, naturally disagree about the practice of it."

-- Aristotle, Politics, vii (circa. 300 B.C.)

John Metelski
Washington, D.C.

To the Editor:

I was very pleased to receive, late last year, issue #11 of the CSIT Newsletter. Until that time, I had not been aware of the existence of CSIT. The views expressed are very much my own and, in fact, part of the reason for my retirement to come up here and do the subsistence farming thing was because I thought I was perhaps the only IEEE member holding such views! I greatly enjoyed Balabanian's "Engineering and Ideology", the essay on Glorioso and Hill's book.

I spent twenty-odd years with a major communications firm (WU) and, although I was successful in that my gadgets worked and I hold a number of patents, the social benefit of my work was zilch. I did have the pleasure, after retiring from WU, of working with an ophthalmologist in a small privately-funded non-profit R & D where I played a large part in the development of a very useful piece of diagnostic ultrasound equipment. Only to see the cost go from \$1000 at the factory to \$6000 to the using doctor, by the time the manufacturer, a large defense aerospace firm, had loaded on its overhead, and the distributor and salesmen their profits and commissions.

My interests now are at the so-called "intermediate technology" level. With a garden, and a few sheep and chickens, and a wood-burning stove in the kitchen, it is gratifying to see how little need be wasted, or passed on to the municipality to dispose of. Anything that cannot be eaten by ourselves or the livestock, that will not rot in the compost heap, or will not burn in the stove, is all we have to dispose of; and believe me, that's not much!

I was incensed at the position of the IEEE Board on nuclear power as reported in the March issue of the Newsletter and sent them the following letter:

The Board of Directors, IEEE

I am writing to express my sorrow upon reading your "Statement on the Need for Nuclear Power". Apparently you are attempting to reassure the lay public as to the safety of nuclear power. Your statement completely ignores these facts, among others:

1. The private utilities themselves, as well as the insurance companies, do not have sufficient confidence in the safety of nuclear power plants to be willing to assume the liability for any accident that may occur. Instead we have a statutory limit on liability, so that victims may receive only pennies on the dollar, and even that limited liability is largely subsidized by the taxpayer.
2. The costing of nuclear power is artificial, being based in part on artificial prices for enriched uranium provided from government sources, and on artificially high prices paid by the government for reprocessed uranium. Further, the true cost of reprocessing has not been determined, since no commercial plant has been able to meet the necessary safety precautions and still operate at a profit.
3. The problem of nuclear waste disposal has not been solved.
4. The danger of diversion of plutonium to improper uses has been adequately demonstrated by the recent example of India.

What makes the matter distressing is that a large and increasing sector of the lay public is fully aware of the facts I have cited above. What then will be their opinion of your Board, and indeed of the IEEE of which I am a member?

Frank T. Turner
RR #1, Plympton, Nova Scotia

To the Editor:

One of the frustrations of living abroad is the very late delivery of publications. I received the March issue of the CSIT Newsletter and the February issue of Spectrum yesterday. This frustration is further enhanced when an article arouses one sufficiently to indulge in response that is sure to arrive after most people have forgotten the stimulus.

I believe that in any presentation concerning alternative solutions to the energy crisis it is incumbent upon us all to emphasize the cheapest "source" of energy, namely energy conservation. While capital costs of installing energy sources vary from the hopeful and optimistic guess of \$300 per kilowatt to the more realistic estimate of total system cost of more than \$3000 per kilowatt, plus required fuel costs, each dollar spent on energy conservation saves up to five kilowatt hours each year. This is the equivalent of an installed source of electrical energy at about \$1600 per kilowatt, without any further fuel costs, ever!

This is the alternative that the United States has only budgeted \$10 million for, this year. It is this type of policy decision by the entrenched energy policy makers that has resulted in increased imports of Arab oil and greater dependence, rather than independence. It is time that persons making policies have no supply axes to grind, be they nuclear, electric, oil, gas, coal, etc. Our policy makers must look to the possibilities inherent in conservation, solar, cogeneration and other technologies available now.

If we do that we may find that the nuclear argument is academic, since nuclear power plants fill a need we do not have.

I was happy to read that you feel the requirement to test the "presumed need for energy" must be met. Then why was it not done in the same issue? Why was Mr. Redfield's quote of the NAE report allowed to stand unchallenged? The projection for Zero Energy Growth presented in the Final Report of the Ford Foundation Energy Policy Project, "A Time to Choose; America's Energy Future," is surely significant. For Mr. Redfield to claim that the future infinite energy need is one of the "facts that are not in serious dispute," is to indicate an ostrich-like attitude on his part.

Please extend some needed effort to aid the cause of energy conservation, the cheapest "source" of energy the world has.

Avram Kalisky
Coordinator, Electronic
Research Projects
Technology Division
Ministry of Commerce and
Industry
State of Israel

To the Editor:

The following letter was sent to IEEE President Dillard upon my reading the Board's statement on the need for nuclear power in the March issue of the CSIT Newsletter.

Dear Dr. Dillard:

I wish to refer to the March 1976 CSIT Newsletter and to the views expressed therein concerning the actions by the IEEE Board of Directors in involving the Institute in the general nuclear power issue and in the California Initiative.

I am in full accord with the CSIT position that the IEEE Board has involved itself in issues that go far beyond the technological alone. The nuclear issue involves sociological, economic, biological, and political factors, among other considerations, which, in my opinion, are beyond the general purview and special competence of the IEEE. I am fully cognizant of the stated IEEE rationale on the entire nuclear question, but find this less than compelling. I also know the lengths to which the Atomic Industrial Forum, the industry and the utilities will go in an effort to promote nuclear technology, a technology which is being questioned more and more on a number of grounds, and of every aspect employed to promote it. The Power Society of the Institute understandably supports this technology since the very lives and livelihood of most of their members are intimately involved directly or indirectly with this. However, when the Institute itself supports the views of those with self-serving objectives and interests, I get concerned that this may jeopardize the credibility of the IEEE as an open, impartial, scientific society.

I would strongly urge that the IEEE refrain from issuing any further promotional statements on the nuclear issue and would even urge that the Institute issue a retraction of its previous statements.

Samuel Seely
Dept. of Electrical Eng
University of Rhode Island

To the Editor:

The following is my reply to Carl Barus' paper "Systems Engineering and Society's Problems" in the March 1976 issue of the CSIT Newsletter, in which he criticizes the position paper proposed by WG-SEPT:

When Barus writes in response to the WG-SEPT "Proposed IEEE Position Paper: The Application of Systems Engineering to Societal Problems" that systems engineering "cannot encompass all aspects of any significant problem" he misses the essential point of the proposed definition. Societal systems engineering is the technique of encompassing all significant aspects of the problem at hand, in the best way available. The systems approach is not a "technological fix", and there are no "key factors" not amenable to it.

It is my opinion that societal systems engineering can help solve all the problems referred to by Barus, including unemployment, crime, and war. I have presented some thoughts on those problems in "The Era of the System" [1] and "A Quantitative Theory of Criminal Justice" [2]. It does not matter whether the problems are labeled societal or social. Some problems are more amenable to societal systems engineering at its present state-of-the-art than others.

Incidentally, systems engineering originated with telephone systems, not weapons systems.

Barus' statement that systems engineering cannot help us if there is no agreement as to what would constitute a solution is not valid. Adjudication among goals of different advocates is one of the systems engineering tasks.

Barus seems to fault the Center School system because not all the broader educational issues have been resolved, suggesting that if the view of education changes, the Center School system might look bad from the new point of view. But this is a situation that always applies to system problems, including those for physical systems. The system can't be designed until the sub-systems are understood, and the sub-systems can't be defined before the system is understood. The solution, of course, is through successive refinement. System designs for teaching school subjects help in understanding the education process, which in turn helps setting better objectives for the curricula.

I resent Barus' implication that system designers would be unethical in not explicating goals for systems, thus behaving contrary to our position paper. The goals may be imbedded prior to the analysis of a problem, but they should be clearly identified by the time the task is completed.

Any competent systems analysis of subsystems (such as the Interstate Highway subsystem, the nuclear power subsystem, or the Vietnam War subsystem) should relate the outcome of available alternatives - including the alternative of not having the subsystem - to fundamental societal values, hence helping dissenters to those systems when those systems are on balance detrimental to society.

I'm advocating neither subservience nor elitism by IEEE. Societal systems engineers help society to attain its values, democratically arrived at, by applying their specialized skills.

In sum, perceiving the "true nature" of the societal problem at hand is part of societal systems engineering. Who else can do it?

Gerald Rabow
CSIT Working Group on Systems
Engineering & Public Tech.

References:

[1] G.Rabow, "The Era of the System: How the Systems Approach Can Help Solve Society's Problems", New York: Philosophical Library, 1969.

[2] G. Rabow, "A Quantitative Theory of Criminal Justice", IEEE Transactions on Systems, Management, Cybernetics, vol. SCM-4, pp. 300-303, May 1974; Comments and Author's Reply vol. SMC-5, pp. 140-141, January 1975.

To the Editor:

In his letter in the March issue of the CSIT Newsletter, Dean Basil Myers reiterates that there is a lack of an essential philosophy of engineering. I remember that this theme was addressed at a CSIT sponsored workshop in August 1974, held at the University of Kentucky. In fact, the cultural credibility of engineering as a body of knowledge was treated to some extent in the workshop record. Dean Myers, in his letter, says that it is not sufficient to dust off old ideas and concepts of technology and call it a history of the profession; I certainly agree. Dean Myers thought further to say that a profound history of engineering thought is needed.

In this regard, I want to make known to your readership that there is a new book written by an engineer which provides some essence of an intellectual history of engineering. This book by Samuel C. Florman is entitled, The Existential Pleasures of Engineering, published by St. Martin's Press in New York in 1976. Before introducing a profundity of intellectual history for engineering, Mr. Florman first refutes the notion that technology is inherently destructive and makes a strong argument against the stereotype of the engineer as an insensitive materialist. The author refreshingly draws on literature to support his contentions that technological development, applications of scientific principles, have long been motivated by a primordial need exemplified by human beings of all ages. He says that the most obvious existential gratification felt by the engineer stems from his desire to change the world he sees before him. For fear that my letter might not indicate it, I hasten to add that the author, Mr. Florman, has written a light-hearted book on a rather serious topic. One is left with a sense of optimism, even relief, to learn that the basic drives that urge serious engineers forward in their endeavors, in fact, have a true humanistic basis. At any rate, I recommend this short book to all readers and would venture to say it represents a rare effort aimed at codifying a philosophy of engineering.

A. Sidney Roberts, Jr.
Associate Dean of Engineering
Old Dominion University

To the Editor:

I consider the paper "Environmental Effects of Thermo-nuclear Fusion Power Reactors" by Rowland F. Pocock in the March 1976 issue to be a timely discussion of an important question. I am fairly sure that no reputable plasma physicist working in CTR will disagree with his statement: "No one can now assume that fusion offers an absolute solution to the radiological problems usually associated with fission reactors." However, there are substantial reasons why fusion reactors may have some partial quantitative and even qualitative advantages over the fission reactors in regard to radiological problems. Mr. Pocock shows insufficient appreciation of this when he states "Anyone who believes that harnessing the hydrogen bomb for peaceful use will be fundamentally less hazardous than controlling the atomic bomb reaction should consider ..."

Let me now discuss some of the specific criticisms of nuclear fusion reactors raised in Mr. Pocock's paper. In regard to the major radiological problem of fusion Mr. Pocock quotes W. Hafele and C. Starr on tritium leakage which "will have to be as low as .001% in a year." I should like to point out that recent research (1,2) shows that this is achievable in prototypical fusion plants. Secondly, the problem of ⁹⁴NB isotope produced by neutron bombardment of niobium structures is discussed without emphasizing the research in other structural materials which could produce considerably less active wastes (3). Lastly, Mr. Pocock neglects to mention that the radiological problem of fusion will be considerably alleviated with a D-D instead of D-T reaction. Tritium formed in D-D reactions remains in the reactor cycle to be burned, thereby creating no net tritium. More remote possibilities like D-He³, He³ - He³, and p-B¹¹ reactions are neutron free and can nearly eliminate the severe radiological problems.

In summary one should commend Mr. Pocock's efforts to raise questions which have been inadequately discussed in forums and literature open to the non-specialists and the general public. However, one needs to add that the radiological problems of nuclear fusion may be less than those of fission in some respects and will probably get better with further research in fusion fuels other than D-T. Lastly the additional advantages of a future fusion power plant are: inherent safety against nuclear explosion, relatively low waste heat and the potential for direct conversion.

Amiya K. Sen
Professor of EE and CS
Columbia University

References:

[1] Victor A. Maroni, A Fusion Power Plant, ed. R.G. Mills, Matt-1050, Princeton University, Princeton, New Jersey, p. 411, (1974).

[2] P.W. Davison, Ref. 1, p. 458.

[3] P. Bonanos and H.K. Perkins, Ref. 1, p. 291.

To the Editor:

The editorial on "nuclear Power and the IEEE" in the March issue was just great! Keep up the good work. The whole Newsletter is very informative and fills a serious void in current "engineering journalism."

Adolph J. Ackerman
Consulting Engineer
Madison, Wisconsin

AN IEEE AWARD FOR OUTSTANDING SERVICE IN THE PUBLIC INTEREST

J. S. Kaufman

INTRODUCTION

Because the United States Activities Board (USAB) - the professional activities board of the IEEE - has recently created a task force to consider an award for service in the public interest, it seems worthwhile to reflect on the fate of a CSIT proposal for such an IEEE award.

In the summer of 1973, a sub-group of the Working Group on Ethics of CSIT drafted a proposal for a new "IEEE Field Award for Outstanding Service in the Public Interest". Although the BART case [1] served as the immediate catalyst, there was general agreement within CSIT that such an award was clearly needed. This general agreement was based on the belief that engineers should be sensitive to and (insofar as possible) responsible for the social ramifications of their work, and that such an award would help foster a work environment conducive to such values. (None of the 11 current IEEE Field Awards -- nine of which existed in 1973-- cover this vital area of Service in the Public Interest)

HISTORY OF THE CSIT PROPOSAL

In October of 1973, a second draft of the award proposal was unanimously adopted by CSIT and forwarded via CSIT's (then) Chairman Bruce Barrow to the Technical Activities Board (TAB). In response to comments from TAB, a 3rd and final draft emerged from the January 1974 meeting. This draft proposal is reproduced below:

REVISED PROPOSAL FOR A NEW IEEE FIELD AWARD: (1/74)

- Title:
IEEE Award for Outstanding Service in the Public Interest.
- Purpose of the Award:
It is intended that the award recognize the engineer or group of engineers who acted to protect the public interest; particularly when such action was taken despite personal risk. It is to be hoped, that by focusing on such actions in this manner:

 - i) Engineers will become more sensitive to the need for personal action, when warranted, in the public interest.
 - ii) The Awardee(s) will gain recognition, as public compensation for professional injury that might be incurred.

This award is to be made annually as are all field awards.
- Sponsor:
To be found. Hopefully, this award shall consist of a certificate and one thousand dollars.
- Criteria:
Same as other IEEE Field Awards.
- Selection Procedure:
Will follow general procedures detailed under "How to Nominate" and "General Administration" in IEEE Awards section of the IEEE Activities Manual.
- Award Specification: See item 3 above.

7. Composition of Awarding Committee:

Recommend ex-officio members, e.g.,
Chairman, CSIT
Chairman, EQC

CSIT's incoming chairman for 1974, Harold Goldberg enthusiastically supported this award proposal and transmitted it via TAB to the IEEE Awards Board (then chaired by Marvin Chodorow). The awards board meeting of November 1974 referred the proposal for study to a 3 member sub-committee consisting of

C.C. Cutler, Chairman
T.H. Crawley
J.W. Simpson

This sub-committee could not agree on the merits (or demerits) of the award proposal and transmitted the following two opinions to the awards board:

Opinion For

The necessity for maintaining or even improving ethical and moral behavior in engineering is vital. The IEEE has given much print to this in editorials and articles, and it is desirable to do something more concrete. The establishment of and granting of an award for "outstanding service in the public interest" would show that we are serious in the matter, and would do much to encourage people to act responsibly toward the public interest. I call to your attention the Spectrum editorial of June 1967, "Duty to Dissent". It is sometimes necessary to make difficult and controversial choices, but it is weakness to avoid them and "play it safe". IEEE should take a leading position and should encourage engineers to live by conscience, not by expedience. Also, there must be many instances of individuals taking action in the public interest, making a personal sacrifice to work in government service, implementing safety standards, or stimulating a recognition and use of more ethical standards of operation or communication within an organization, that would not be controversial.

On this basis, an award is most appropriate.

Opinion Against

The granting of an award for outstanding service in the public interest, such service being of a nature that it involves some personal professional risk or sacrifice, is daring, because it is almost sure to involve the making of judgements in very controversial situations. In each of the examples of deserving candidates which have been suggested, strong opposing opinions, and even legal and political positions are involved. For an organization like the IEEE to take sides in such matters could upset many members, and possibly even result in litigation. Even refusing an award could have embarrassing overtones. Our membership, even our boards are naive in such matters and it would be better to avoid the situation entirely by only granting awards based on technical professional accomplishments.

By this argument, the proposed award should not be approved.

Faced with this lack of consensus, and cognizant that the IEEE Board of Directors must ultimately approve an award board's decision, the awards board forwarded the CSIT proposal with the two subcommittee opinions to the IEEE Board of Directors.

Rather than waiting for the Board of Directors to weigh this CSIT proposal, the IEEE Executive Committee at its April 1975 meeting voted to reject the establishment of a permanent Field Award in the area of Public Service. It did however decide that case-by-case awards could be

considered by the Executive Committee. An excerpt from page 37 of the minutes of this April 1975 executive committee meeting is reproduced below:

IEEE Executive Committee April 8-10, 1975

68. Field Award Proposed by CSIT. Dr. Jones presented a proposal from the IEEE Committee on Social Implications of Technology, to establish a Field Award for "outstanding service in the public interest". It was the sense of the Executive Committee that a Field Award for public service not be established but that case-by-case awards would be considered by the Executive Committee provided they originate from major Boards of the Institute and shall be limited to the presentation of one special award each year.

Mr. Dillard [current President of the IEEE] moved that the Executive Committee reject the establishment of a permanent Field Award in the area of public service. (The motion carried with 6 in favor of the motion and Directors Cotellessa and Goldberg opposed.)

Mr. Goldberg moved that the Executive Committee approve the following resolution:

"RESOLVED that Awards for Public Service may be recommended by any major Board of the Institute subject to the approval of the Executive Committee and Board of Directors." (The motion passed with 7 in favor of the motion and Director Cotellessa opposed.)

MORE RECENT HISTORY

During the same time that the CSIT award proposal was being considered, the BART case was also making itself felt. Based on the carefully documented research of Stephen Unger, a motion for IEEE intervention in the BART case was adopted by CSIT. A similar motion for IEEE intervention was subsequently adopted by the Ethics and Employment Practices Committee of USAB. Ultimately the landmark IEEE intervention in the BART case took the form of an Amicus Curiae Brief [2].

At the November 1975 CSIT meeting a motion nominating the three BART Engineers (see reference 1) for an "Award for Public Service" was unanimously passed. This motion, based on the executive committee's resolution on case-by-case awards is currently being transmitted to USAB for its consideration. The manner in which this motion is considered may indicate whether the case-by-case "Award for Public Service" will be used to recognize engineers who "acted to protect the public interest, particularly when such actions were taken despite personal risk", or whether it will be used for public relations purposes to decorate someone's lapel.

References

1. Unger, "The BART case: Ethics and the Employed Engineer," CSIT Newsletter, 9/73.
2. "Engineering Ethics: The Amicus Curiae Brief of the IEEE in the BART Case," CSIT Newsletter, 12/75.

* This committee no longer exists. For reasons unknown to the author this effective standing committee has been replaced by "task forces" -- see IEEE Spectrum, March 1976.

ETHICS

REPORT OF THE NPSS

ADHOC COMMITTEE ON ETHICAL STANDARDS

An AdHoc Committee on Ethical Standards was appointed in conformity to item VII-A in the NPSS AdCom Minutes of May 14, 1975. This committee consists of J.R. Roth, NASA Lewis Research Center, Chairman; D.C. Cook, Naval Research Laboratory; G.A. Gerdin, University of Illinois; W.C. Jennings, Rensselaer Polytechnic Institute; R.E. McCoskey, Harry Diamond Laboratories; and R.F. Shea, at large, members. The findings and recommendations of this committee are summarized in two parts; general recommendations for a new IEEE Code of Ethics, and a second part detailing the defects of the present code. This report represents a consensus of the entire AdHoc Committee. This report has been endorsed by the NPSS AdCom in its meeting on November 20, 1975. It is the intention of the chairman of this committee to submit this report to TAB, CSIT, and the IEEE board of directors for action. If action is not forthcoming, these recommendations may be aired in the CSIT Newsletter and/or in the letters column of the IEEE Spectrum and may form the basis for future unilateral action by the NPSS.

GENERAL RECOMMENDATIONS

1. The Code of Ethics published in the February 1975 Spectrum is not an adequate guide for NPSS members and should be modified or replaced.
2. The February 1975 Code should be considered an interim document, effective only until institute-wide efforts can produce a more satisfactory ethical code.
3. The 1912 "Code of Principles of Professional Conduct" of the AIEE should be incorporated in a revised Code of Ethics for the IEEE.
4. A permanent institute-wide Committee on Ethical Standards should be appointed by the IEEE President. This committee should be responsible for preparing a more satisfactory ethical code and then for obtaining an institute-wide consensus in support of it.
5. After formulating a revised Code of Ethics, the Committee on Ethical Standards should circulate the draft to all groups, societies, and local sections for their comments. The final code should not go into effect until the Executive or Administrative Committees of at least 2/3 of all groups, societies, and local sections have endorsed the code; and until at least 3/4 of all IEEE members voting in a referendum have approved the code.
6. After a permanent ethical code is arrived at, it would be the function of the Committee on Ethical Standards to hear, adjudicate, and report its findings on complaints of unethical conduct made by IEEE members, responsible citizens, and by organizations and institutions.
7. The Committee on Ethical Standards should be empowered to censure any individual member and, in particularly notorious or flagrant cases, to revoke the IEEE membership of any individual member found to have violated ethical norms, after giving the individual adequate opportunity to respond.

8. The Committee on Ethical Standards should be empowered to censure and, in particularly notorious or flagrant cases, to maintain and publicize a list of all institutions and organizations found to have promoted or required unethical conduct of IEEE members, after giving the institutions or organizations adequate opportunity to respond.

9. Any expenses incurred by the Committee on Ethical Standards are to be assessed upon the individual groups and societies in an amount proportional to the size of its membership for the preceding year.

10. The February ethical code gives the individual IEEE member no assurance of support from his fellow professionals. The revised ethical code should contain an explicit statement that the IEEE will, if necessary, undertake the financial and other burdens required to enforce its code of ethics on individuals or institutions. It should be made quite clear that both individual IEEE members and their employers are expected to act ethically, and that either can expect to be judged if they transgress the ethical code.

11. The revised ethical code should be prepared with much greater sensitivity to the standards and beliefs of our non-U.S. IEEE members.

CRITIQUE OF THE FEBRUARY 1975 CODE OF ETHICS

Preamble

The preamble does not properly state the reasons for having and following an ethical code. It suggests that the only reason for conducting work in an ethical manner is "to obtain the confidence of colleagues, clients, and the public." Clearly there are better sociological reasons for human beings to be ethical. No mention is made of the importance of ethics to civilization in general, or to engineers in particular. In fact, it suggests that if we did not live in a "complex technological society," there would be no need for engineers to be ethical.

Article I

It is not clear that it is possible to mandate a high level of creativity, as suggested in this article, or that a high level of productivity is always the most ethical thing to do.

Items 1 and 3 are somewhat contradictory. The first says an engineer should accept responsibility for his actions, then the other implies he should accept responsibility only when he is qualified.

Article 1 (3) implies by the "or" that full disclosure of their qualifications (or presumably lack thereof) is an acceptable substitute for qualified training or experience.

Article 1 (4): The phrase "recognize the importance of current events in their work" is vague. What is intended?

Article 1 (5): The paragraph is cheapened by the phrase "and for adequate compensation." What is "adequate compensation?" By whose standards? Decided by whom? Smacks of potential unionization, and/or restraint of competition, the current bane of other professions, e.g. legal. It is not clear what "adequate compensation" means or what it has to do with ethics. Making engineers wealthy does not make them ethical.

Article II

This code puts all the responsibility on the engineer as an employee to behave but none on the employer. Article II.2 says that the dissemination of job-related information is "subject to legal and proprietary restraints" and Article III.3 states that information is to be held in confidence. There is nothing wrong in general with this except in the rare case where public statements by management are in conflict with the confidential information and the public interest. It is not specifically stated what an engineer is to do in this case, be a "good soldier" and go along with management as happened in the Nixon administration and Hitler's Germany, or be forthright and inform the responsible authorities. Many cost overruns (example, C5A, F111) and much pollution may have been avoided in the past if the latter action had been taken, but instead those who spoke out tended to get hounded from their jobs. This code does not support those who would speak out strongly enough, but commands them, in general, to conform with their employer's wishes. This code might be satisfactory if the employers were forced to accept a legal code to prevent them from suing or firing employees who speak out in the public interest, but as it stands, it gives the conscience of the employee no protection.

Article II (1): It is not only unethical to be prejudiced, it is also illegal. Items such as this belong in a legal code.

Article II (5): The phrase "Support and participate in the activities of their professional societies" is self-serving to the IEEE and is not a proper element in a code of ethics. Which professional societies should one participate in? If we actively supported all the professional societies that we are eligible for, we would be too busy and too poor to do anything else.

Article III

We disagree with the tone of this article. In essence it says that in order to be ethical, one must be a good "company man." It implies that employers are always ethical and always make the right decisions. Engineers must be encouraged to speak out against employers or clients when they believe it is in the best interests of society.

Article III (3) refers to a "conflict of interest" which is never defined. If this is going to remain part of the code, then it should be elaborated.

Article III (4): It is possible to contribute services to the customer of an employer or client with the permission of the latter, which this would seem to prohibit.

Article III (5) finally begins to get to the heart of ethics, but it only scratches the surface.

Article IV

The only problem with this article is that it implies that these are things engineers should do in their community, presumably after work. These standards should be blended into the work environment as well. What good is it for an engineer to speak out against pollution at night and then proceed to pollute all day at work?

Article IV (1) seems a bit weak regarding the responsibility to oppose improper or illegal activities without regard to the consequences, which can be rather severe.

Article IV (2): Possible conflict with I (4), if services are rendered free to these organizations.

CODE OF ETHICS FOR

ENGINEERS IN MEDICINE AND BIOLOGY (EMB)

The following code of ethics was drafted by the Ethics Committee of the Group on Engineering in Medicine and Biology (EMB) in September 1975. It has subsequently been adopted by the EMB AdCom.

Preamble

The following principles are established to aid individuals practicing engineering in medicine and biology to determine the propriety of their actions with relation to patients, health care personnel, sponsors, students, clients, customers, and the public. These standards are intended to promote and maintain a high level of ethical conduct.

A. With respect to patients engineers shall:

1. Use their knowledge and skills for restoring health and wellbeing;
2. Promote peace of mind, bodily comfort and personal dignity, without infringing on the roles of nurses and physicians;
3. Adhere to instructions of responsible physicians;
4. Answer questions clearly and sympathetically about the purpose and function of equipment for which they are responsible but refer questions about diagnosis, therapy and prognosis to the responsible physician;
5. Refrain from incurring unnecessary costs.

B. With respect to health care personnel engineers shall:

1. Represent honestly their own capabilities and specify accurately the performance and characteristics of equipment under their control;
2. Promote interdisciplinary communication and understanding while recognizing and maintaining respect for differing cultural values;

3. Eschew professional jealousy and destructive competition;
4. Inform the responsible person of observations of deficiencies that may influence diagnosis, therapy, or prognosis, including specifically performance, safety or misuse of equipment, and where conflict arises, to do so formally in writing.

C. With respect to students engineers shall:

1. Provide guidance in the study of significant problems that offer opportunities for professional maturation and employment;
2. Refrain from exploiting positions of authority over students' entries upon professional careers.

D. With respect to clients and customers, engineers shall:

1. Provide prompt and efficient service after sales;
2. Assure avoidance of false or misleading reports or advertising.

E. With respect to sponsors engineers shall:

1. Assure accuracy and completeness of proposals and reports;
2. Refrain from incurring unnecessary costs.

F. With respect to public interest engineers shall:

1. Avoid waste of human, animal, material and financial resources;
2. Apply their expert knowledge to inform and educate the public, including the correction of false or misleading reports and advertising;
3. Comply with voluntary standards and recommended practices.

G. With respect to experimental animals engineers shall:

1. Advocate protocols that use no more animals than are necessary to achieve significant results;
2. Minimize pain and suffering;
3. Adhere to regulations concerning animal care.