

TECHNOLOGY and SOCIETY



IEEE

CONTRIBUTED PAPERS, REPORTS, REVIEWS, AND
CORRESPONDENCE OF THE COMMITTEE ON SOCIAL IMPLICATIONS OF TECHNOLOGY

SEPTEMBER 1977—#19

EDITOR: FRANK KOTASEK JR.

IEEE CANDIDATES' VIEWS

The views of the twenty-three candidates to the offices of IEEE President, Executive Vice President, and Regional or Divisional Director on two issues of current interest were solicited. The letter outlining the issues and the responses received as of press time are published below in alphabetical order within each office.

Dear (name of candidate):

As you probably know, our publication TECHNOLOGY AND SOCIETY is widely read throughout the Institute. Since you are a candidate for a policy-making office within IEEE, our readers would be very much interested in learning of your views on two issues that are currently under consideration by the Institute and are of particular concern to CSIT.

Accordingly, your answers to the following questions are solicited.

1. IEEE Support of Ethical Engineers.

On September 23, 1976, the IEEE Board of Directors approved the following policy statement:

"[IEEE] Members who are placed in jeopardy as a consequence of adherence to the Institute's Code of Ethics may be offered assistance, provided that, in the opinion of the Board of Directors or its designated representative, such assistance is warranted." [IEEE Policy 7.8.B]

NOTICE TO READERS

Starting with the March 1978 issue, T&S will be available only on a paid subscription basis at \$2 a year (4 issues), payable when you pay your regular IEEE membership dues for 1978. Please see page 20 for details.

a) Do you favor this policy?

b) Do you favor implementing this policy by setting up machinery along the general lines of USAB's "Proposed Procedures for IEEE Support of Ethical Engineers" (enclosed),* assuming that adequate safeguards are included to protect IEEE against legal liability?

2. Universal Registration of Engineers.

At its February 1977 meeting, the IEEE Board of Directors in

*A preliminary draft of the proposed procedures was sent to the candidates and appears on pp 8-10.

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effect endorsed the concept of universal registration of engineers. By a vote of 15 to 8, IEEE Policy Statement 7.3 was revised to incorporate the following clauses:

"[IEEE] Recommends that State laws uniformly reserve the title of engineer, or ---- engineer, to licensed practitioners. (---- = electrical, electronics, etc.)"

"[IEEE] Recommends that all practitioners responsible for their activities, or the activities of their subordinates, be licensed to practice. Signature to any work performed, or to show approval/acceptance of a subprofessional's activities, is one example to indicate responsibility."

"[IEEE] Recommends that the industrial exemption, as it applies to practitioners responsible for their activities, be eliminated in all State laws and that current practitioners be permitted to 'grandfather' into licensure on the basis of application." [Spectrum, April 1977, p 17]

a) Do you favor retaining these three clauses as part of IEEE policy, or do you favor modifying (if so, in what way) or

deleting any or all of the clauses?

b) What other changes, if any, in state licensing examinations and licensing regulations should IEEE advocate?

Please limit yourself to a collective total of no more than 500 words for all questions. In answering, refer to the question by number, but do not repeat the question. Please address yourself directly to the issues and refrain from personal comments on other candidates. Responses adhering to these guidelines will not be edited. To meet publication deadlines, please respond by August 23, 1977.

Sincerely,

Frank Kotasek Jr.
Editor, TECHNOLOGY AND SOCIETY

TECHNOLOGY AND SOCIETY STAFF

EDITOR:

FRANK KOTASEK Jr.
73 Hedges Avenue
East Patchogue, NY 11772
(516) 475-1330

ASSOCIATE EDITORS:

Aaron Ashkinazy
23 Farm Lane
Roosevelt, NJ 08555
(609) 448-6616

R. J. Bogumil
Mt. Sinai School of Medicine
Department of Obstetrics &
Gynaecology KPZ
New York, NY 10029
(212) 864-5046

J. H. Cyr
Naval Post Graduate School
Monterey, CA

Ronald Goldner
E. E. Department
Hooper Lab.
Tufts University
Medford, MA 02115

Joseph S. Kaufman
Bell Telephone Labs.
Holmdel, NJ 07733
(201) 949-5241

Michael Pessah
2528 Ridgeview Avenue
Los Angeles, CA 90041
(213) 222-3341

Sureshchander
E. E. Department
College of Technology
G. B. Pant University of
Agriculture & Technology
Pantnagar, India 263145

Stephen Unger
229 Cambridge Avenue
Englewood, NJ 07631
(201) 567-5923 (home)
(212) 280-3107 (office)

Len Zimmerman
Bell Telephone Labs.
Holmdel, NJ 07733
(201) 949-5737

COMMITTEE ON SOCIAL IMPLICATIONS OF TECHNOLOGY

CHAIRMAN:

J. Malvern Benjamin
Bionic Instruments, Inc.
221 Rock Hill Road
Bala Cynwyd, PA 19004

VICE CHAIRMAN:

Joseph S. Kaufman
Bell Telephone Labs.
Holmdel, NJ 07733
(201) 949-5241

CO-SECRETARY:

Peter D. Edmonds
P. O. Box 268
Menlo Park, CA 94025
(415) 326-6200 Ext. 3366

CO-SECRETARY:

R. J. Bogumil
Mt. Sinai School of Medicine
Department of Obstetrics &
Gynaecology KPZ
New York, NY 10029
(212) 864-5046

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TECHNOLOGY and SOCIETY is published quarterly by the Committee on Social Implications of Technology of the Institute of Electrical and Electronics Engineers, Inc. Headquarters: 345 East 47th Street, New York, NY 10017. Sent automatically and without additional cost to each member of the Committee on Social Implications of Technology and to other IEEE members through written request. Printed in U.S.A. Second-class postage paid at New York, NY and at additional mailing offices.

IEEE CANDIDATES' VIEWS

PRESIDENT 1978

IRWIN FEERST, P.E. (petition candidate)

1. I support, wholeheartedly, the fledgling efforts of IEEE to act as a professional defender for its members. I have so stated, in writing, for four years. But I do more than merely express my support - I have acted as well. Perhaps you recall the unfortunate case of the former employee of Loral Electronics Corp. who was terminated because he refused to work "free" overtime to the extent of 18 hr/week. He was denied unemployment compensation because management claimed that his dismissal was because of "misconduct". He came to me for assistance in his appeal of this denial after having been refused help by IEEE. I wrote a brief (copy enclosed) and accompanied him to his appeal. The hearing examiner, after hearing my testimony, ruled that he should receive his unemployment pay. It is my observation that, all too frequently, IEEE candidates are willing to say whatever is necessary to get elected; what separates the adults from the children is the willingness to act.

I am, however, opposed to having IEEE file mere amicus curiae briefs in these matters. This is not an advocacy position; rather it is one in which IEEE takes no side in the dispute and merely informs the court of what may be pertinent facts. It is my view that IEEE should serve on the side of the aggrieved engineer.

2. I do not support the concept of universal registration for engineers as the present policy statement is worded. Registration confers neither exclusivity nor prestige nor higher income on the engineer. Moreover, it is unwise to encourage NSPE (the ultimate beneficiary of registration) in their repeated attempts to undercut IEEE.

This policy statement was the subject of an all-day meeting in suburban Virginia on Saturday 6/4/77 which I attended. One very important point was made by one of the speakers: Many IEEE members who sign off on drawings and/or work done by subordinates are mathematicians, physicists, etc. and are therefore ineligible to become licensed engineers. IEEE, having first promulgated the policy and having then requested comments from the membership, is now in the embarrassing position of revising it.

DR. IVAN A. GETTING

Please note that there seems to be a difference between my copy of the IEEE policy numbering and the numbers in your letter. [Sorry, my mistake.--Ed.]

1a) Engineering is a learned profession with a well-recognized obligation to advance the public good. The public is well served when qualified engineers practice their

profession with high ethical standards. I therefore support the Engineer's Code of Ethics. The nub of the question is the enforcement of this code by IEEE both: (1) Policy 7.9.B. for the protection of the engineer; and (2) Policy 7.9.A. where the infraction of the code is made by the engineer.

In order to be effective in developing and maintaining ethical standards IEEE must assure that its handling of complaints is objective and even-handed. Complaint inquiries must recognize that engineering decisions are influenced by pragmatic considerations of technical feasibility, schedule, cost, and sometimes conflicting engineering judgment which can be evaluated only after-the-fact. IEEE should become involved in advocacy on behalf of engineers when the issues are clearly defined and well supported by facts; in this respect, I support current IEEE policy.

b) The proposed procedures for the implementation of the policy should receive further study and some rewrite. The procedures for implementing Policy 7.9.B. as now proposed would appear to give IEEE a pseudo-judicial role where the means to acquire data are dependent upon voluntary cooperation. Concomitantly, the parties in dispute are subject to constituted legal action, and IEEE should not set itself up as a substitute for legal redress. Searching for truth is often a thankless job; the "facts" appear different to the various players in the drama. Often the "truth" lies in between; and, then, should there not be procedures to implement Policy 7.9.A? By defending one aggrieved engineer, the IEEE may inadvertently be impugning the judgment and jeopardizing the career of other engineers. Thus, while the objectives of the proposed procedures are laudable, their detailed implementation needs further study to assure that unnecessary harm is not done in enforcing ethical behavior which is largely a matter of individual conscience.

2a) The current IEEE policy on registration needs to be reconsidered. The membership of IEEE includes many types of professional people, including metallurgists, physicists, administrators, educators, public servants, etc. The rapid growth in electronics has resulted from the combined efforts of all of these components. Correspondingly, IEEE policy should support each of these elements consistent with the professional characteristics of the component. I urge every electrical engineering graduate to become licensed; certainly electrical engineers who have a public practice should be licensed as a minimum protection to that public. Licensing should not be established as a restraint in trade; I do not favor the removal of the industrial exemption.

b) IEEE should continuously monitor the changing attitude of our society and its impact on licensing. In certain states licensing is being taken over by consumer advocates often not qualified to establish criteria for professional examinations. Where licensing requires technical qualification, consideration should be given to continuing re-examination to assure the public that the practitioners are maintaining currency with the advancement in the art and changes in the laws and the codes.

EXECUTIVE VICE PRESIDENT 1978

CARLETON A. BAYLESS

1a) Yes. I agree fully.

b) There are many important issues and procedures to be explored as we go into this new arena for IEEE. The Board of Directors heard an excellent presentation on this same topic at Minneapolis last month. It will come before us again in November. At this particular time I favor proceeding cautiously and keeping the membership informed about each step we are taking. Ethics and adherence to the IEEE Code of Ethics is not limited to the United States. I hope we can set up procedures that are applicable worldwide. To summarize--I believe in setting up implementation procedures, but I have some reservations on some parts of this particular procedure. I am confident that the different groups who are working on the implementation matters will come up with an acceptable and effective procedure soon.

2a) I believe that the adoption of this policy has brought the subject to the surface for deliberate, in-depth interaction--after having been discussed in a variety of forums for years without any substantive results. One conference has already been held in Washington, exchanging facts, problems, and attitudes. Another is scheduled, at which time employers will give their additional inputs. I'm confident that after the "hearings" are held--those mentioned and others to be scheduled--a practical implementation plan can be worked out and perhaps certain parts of the policy will be reconsidered and changed. There are problems due to the varied makeup of our membership--physicists, practitioners, managers, software specialists, etc. IEEE policy should provide professional support for many different elements.

b) Implementation of the IEEE policy requires the solution of as many problems as there are states, and the amount of time required to accomplish the goals will be significant; state reciprocity, standardization, variety of disciplines, continuing certification of competence, legal liability, and so on. I believe that a beginning must be made. After experience is gained on problems/solutions, we will advance from the ineffective situation of today to a satisfactory level of professionalism for all of our Institute constituency--members, industry, government, and public.

REGIONAL DIRECTOR 1978-1979

Region 1

REX H. BEERS, P.E.

1. I fully support the policy of the IEEE Board of Directors in their efforts to establish a means of securing redress for our members who may be wronged while abiding by

the IEEE Code of Ethics. Operating procedures to secure this redress would have my full support as long as impartiality is assured, legal liability safeguards were established and the costs were held within bounds.

2. I support and encourage voluntary universal registration of engineers and will continue to work toward aggressive programs that will assist our members who desire to upgrade their professional status. I cannot support any of the clauses in the revised policy statement as they are presently written because of implied discrimination. It is my opinion that the language could lead to misinterpretation and abuse and/or could violate the rights of many of our members. We need to assure that all our members' rights are respected and that no member who currently meets the criteria for membership in the Institute could be wronged. In this area of registration, certification and licensing, we need to make an in-depth, unhurried study of each segment as it applies to our members and establish a policy that will address the problem and not abrogate any of their rights. The current trend by some of the States leads one to the conclusion that registration or license is purely a revenue-deriving scheme or a method of implementing parochial interests.

I would support efforts by IEEE to promote standard licensing procedures and a more liberal interpretation and/or application of reciprocity between states. With the national scope of our industry and the transitory nature of our engineers, this is the first step to making universal registration practical. The IEEE has long had a reputation for integrity and sound ideas. We must assure that this reputation continues to be unblemished in our efforts to approach this most controversial area.

HANS C. CHERNEY (petition candidate)

1a) Yes, I am in favor of this policy. I think that every organizational entity, just like every individual, should adhere to a Code of Ethics.

b) Yes. If elected I will actively support the implementation of this policy along the lines of USAB's proposed procedures. However, I feel that this Code should apply to all IEEE members, including those outside the U.S.A. I understand that we do have members in countries that are ruled by "non-democratic" governments. The Code should apply to those members as well. It obviously would apply to U.S. citizens who work in those countries, and there is no reason why IEEE should tacitly support such a double standard. The principles embodied in the IEEE Code of Ethics are compatible with the professed ideals of all governments. IEEE can encourage all of its members to adhere to the Code--and can support them when they do so--without interfering in the political affairs of other countries. If it takes some additional words in the Code and implementation procedure to make them applicable internationally, then let us get to work on it!

2a&b)

In general I favor retaining these clauses. However, I foresee some hurdles--not barriers--which have to be overcome in developing procedures to implement this registration policy. Most of these hurdles relate to the variety of job functions of IEEE members. Some of the questions have been raised before but, to my knowledge, have not been answered satisfactorily. Following are these questions--hurdles--as I see them:

What are "practitioners"?

How do we handle members who are--or work as--computer scientists, programmers, systems architects, systems designers, etc., especially when they have EE degrees and/or move in and out between software and hardware every few years (or months)? We have to keep in mind that, in most cases, the "typical" IEEE member has no voice concerning his or her job assignment. How does the procedure apply to managers and executives who are EE's, moving in and out of their positions; how does it apply to sales engineers, procurement engineers? Some outstanding innovative and inventive engineers have science (physics) degrees, but work as EE's (especially in the solid state industry). Some outstanding EE's do not have a degree at all, and others have non-EE degrees. What about EE--and other--instructors, professors, deans, etc., in engineering schools; are they "practitioners"?

Does the model of the P.E. designation as it exists today apply to employed EE's and, specifically, the IEEE membership?

At present, the P.E. designation is tailored mostly to self-employed engineers, concentrating heavily on civil engineering and to some extent, on mechanical engineering. The dynamic, changing technological environment of the IEEE member needs a different model. Perhaps Groups and Societies--alone or together with industry--could establish centers of competency to certify specialties, to participate or take over the registration, certification and/or validation process. Questions of whether communications specialists are competent to work in the power area and vice-versa are not satisfactorily answered by the present P.E. designation. In fact, someone could be a P.E. in civil engineering and work as an EE because of the non-uniformity of state laws. Today a technologist graduate can take the P.E. examination and become a registered engineer. Is this acceptable? And last but not least, instituting reciprocity between states or national registration for engineers is a key factor for employed EE's, in light of the large number of employers who operate in a number of states and want to transfer employees rather than lay them off.

So the question is really: How do we make the new registration policy work for EE's and, specifically, for our members and to the benefit of the profession? In fact, I suggested at the June 4th meeting on Registration that we take a good look at our industrial environment; i.e., take a few companies--large, medium, and small--as models and see how the new policy could be implemented and what changes would be necessary in those specific instances.

JACK L. JATLOW

I very strongly favor the policies enumerated in your letter. I believe these policies are a prime essential for improving the status of the engineering profession.

1. I favor the policy, and feel it is important that IEEE start implementing the policy. It shall be mandated to: (1) Authorize and hire a full time staff (one person to start with and increase the staff as needed) for initial review and action on inquiries and infractions of the IEEE Code of Ethics, and (2) Initiate and join with the other Engineering Societies to set up a joint unified board to process grievances relating to ethical engineering.

I find that very few engineers are familiar with the "IEEE Code of Ethics", or the IEEE list of "IEEE Members' Professional Needs". I propose that they be periodically listed in *Spectrum*. I propose that IEEE, thru its educational activities, promote a lecture on "Engineering Code of Ethics and Engineering Professional Needs," at engineering schools, for senior students. USAB's proposed procedures for IEEE support of ethical engineers are good as an initial kick-off for implementing these activities.

2. Registration of Engineers: I thoroughly agree with the IEEE recommendations and favor retaining the three clauses as part of the IEEE policy.

Region 3

ROY H. HARRIS

1a) Yes.

b) Yes. The approach proposed by USAB is responsible and equitable to all parties involved. I feel that this would be a real service to Institute members and the general public.

2a) I support the registration of engineers for the twofold purpose of protection for the public and enhancement of the status of engineers; therefore, we should encourage wherever possible in our IEEE literature the positive aspects of registration for all engineers. Protection of the public is a more critical problem for the individual practitioner or consulting engineer. The registration laws add little protection where the engineer is employed by a company with an inherent responsibility for the public safety aspects of its products.

b) The State licensing examinations should be reviewed to look at the current problem that exists in having one examination cover the extremely broad spectrum of electrical engineering in practice today.

CARY R. SPITZER

- 1a) Yes.
- b) Yes.
- 2a) These clauses should be retained but modified as discussed below:

I. The title "engineer" should apply to anyone holding a four-year or post-graduate degree from an ECPD accredited institution.

II. The second clause is acceptable only because it is a recommendation. I remain to be convinced that all practitioners need to be licensed.

III. Clause III is acceptable as written since it contains a "grandfather" provision.

My concern about licensing lies within the examination itself. The examination suffers from the same limitations as any written examination in that it is impossible to fully portray all pertinent facets of a problem in writing and thus it becomes difficult to assess the prospective licensee's performance in the real world. Testing, to a very great extent, demonstrates only that the person knows or doesn't know the answers to the stated questions. The ability to do well in a license examination is, I believe, only weakly correlated to performing a sound engineering task. I also remain to be convinced that being required to pass an examination will raise the quality of engineering talent - its largest effect will be to reduce the quantity of talent available which, incidentally, is a goal sought by some IEEE members.

- b) I can offer no suggestions for changes pending further study.

Region 5

PROF. DARRELL L. VINES

- 1a) Yes, as long as the Board of Directors is fair to the Engineer as well as the membership. It is possible that we might have a member who is absolutely obnoxious and would cause trouble wherever he is. Be careful!
- b) Maybe. Keep the staff small! No more than one person. Have plan to phase out in two years if there is not enough for the person to do. Let us not create a monster.
2. Yes, states should reserve "engineer" to licensed practitioners. A graduate from an ECPD approved University or college should automatically be licensed.

Assuming the above is true, then each engineer-supervisor should also be licensed.

Industrial exemptions can surely lead to problems as in 1a), so that the elimination of the exemption may be good. I'd hate to have a union type arrangement so that PDQ Inc. had to hire me for a signature.

Region 7

E. F. GLASS, P.E.

1a) No.

b) No.

IEEE is not an appropriate organization to impose, through its own Code of Ethics, either legal or economic constraints on individuals or groups of individuals outside its own membership. It does not have the right to do so, and without the support of law any assuming of vested authority is illusory and a misapplication of the Institute's economic and staff resources. Laws are enacted by governments; they are administered by the legal profession; and they are applied to individual citizens or groups. The process cannot be reversed. And without enforcement rights and procedures a "Code of Ethics" is only a set of guidelines for professional conduct of the membership, with little significance to the rest of the world. "Censures" applied without legal or economic penalties are little more than formalized complaints.

IEEE should provide leadership and co-operate with all groups of professional engineers to extend and strengthen state legislation covering the practice of engineering. Protection of public interests should be defined to include engineering as a natural resource to provide state employment opportunities, accredited programs for engineering education in state colleges and universities, and the protection of the physical and economic interests of the public from works of engineering by non-qualified opportunists. The public in each state has a right to such basic protection, and their elected legislators have a responsibility to ensure that it is provided.

IEEE in concert with the professional engineers of other disciplines in each state could develop a successful program with state legislators to strengthen the self-governing role of the profession. Continuation of lobby activities by not only a minority of professional engineers but also a minority of discontented members of IEEE will have little chance of serious attention and will continue to be a serious divisive and costly element of our own organization.

2a) No.

I support the registration and licensing of all practicing professional engineers, but question the reference to "universal". For practical application of the licensing process I would support the amendment of existing state(s) legislation to register all practicing engineers to ensure protection of the public from the serious consequences of the engineering failures. Registration by defined engi-

neering discipline or sub-discipline introduces unnecessary complication and support to a skeptical public of closed shop protection of "vested interests". Bylaws and a Code of Ethics can effectively apply personal responsibility to limit practice to be consistent with academic training and professional experience. The National Society of Professional Engineers would continue to coordinate and encourage national standards for licensing and registration, codes of ethics, and accreditation of engineering programs in state colleges and universities.

b) Nil.

IEEE should avoid a direct "advocate" position on all issues associated with the legal and so-called "professional" self-interests of its members. This does not mean that the Institute should discontinue its activities to resolve the recognized complex and serious problems. It does mean that IEEE might re-direct its interests to coordinate and support similar concerns and objectives of all groups of professional engineers. There is a need for legislation to define all employers of professional engineers as clients, and to include the work forces of industries and corporations with "the public" and entitled to full protection from unqualified and irresponsible engineers. Professional electrical engineers comprise fewer than 15% of the engineering profession and to the legislators with direct responsibility to the public, their identity is even less significant. Continued allocation of IEEE resources to "right the wrongs" of its own small world of citizens, with all the advantages of advanced education, will be a futile investment.

PROF. DONALD A. ROY

1a) Yes.

b) Yes.

2a) Yes, because of the large majority of U.S. engineers in the IEEE. Rewording the clauses to make the recommendations universal is desirable.

b) Being a Canadian, I cannot really comment on this question other than to recommend a national body similar to the Canadian Council of Professional Engineers (C.C.P.E.) to coordinate and to promote uniformity of licensing examinations and licensing regulations.

DIVISIONAL DIRECTOR 1978-1979

Division I

DR. MOHAMMED S. GHANSI

1. I am not against IEEE support of ethical engineers providing that only serious and substantive issues which fall

within the scope of IEEE be considered for assistance. I favor implementing this policy by setting up machinery along the general lines of USAB's proposed procedures; however, care should also be exercised so as not to go overboard on staffing the Ethics Committee, or becoming involved in trivial issues. The Institute must furthermore exercise caution in defining the parameters of its involvement.

2. I am against universal registration for engineers. I don't think this issue has been carefully thought through. Its implementation is at best a difficult task and it could have undesirable effects on the members as well as the industrial community. If state laws are not uniform on this issue, mobility and transfer of engineers may become difficult. I believe graduation from an accredited program with a minimum of a B.S. degree should be sufficient to establish the credentials of a practicing engineer. The Institute should consider taking a more active role in upgrading standards for accreditation.

Division III

PROF. MISCHA SCHWARTZ

1. On the first question, relating to IEEE support of ethical engineers, I am wholeheartedly in favor of this policy and do favor its implementation along the general lines of USAB's proposed procedures.
2. On the second question, I still do not see the need for universal registration. The main problem, in my mind, is that of raising the esteem of engineering as a profession in the U.S. I feel there are better ways of accomplishing this goal (and with it, of course, improving the economic status of our profession). As an example, we should greatly increase our current efforts to have legislators and government policymakers rely more on the technical expertise available through engineering societies such as the IEEE. We should seek out ways of improving the utilization of engineers by industry, of ensuring that trained engineers really do the creative work of which they are capable.

Although I retain an open mind on the question and am willing to listen to further arguments in favor, I just do not see how universal registration is applicable to the problems we in electrical engineering face. Most electrical engineers work in teams or in relatively large groups. How can our professional activities be compared to those of doctors, lawyers, or even consulting engineers, working as individuals or in relatively small offices? Note that scientists, including those working in industry, are not registered, and often get a better press than engineers. I just cannot see how universal registration, with the myriad problems it will create--establishing and monitoring licensing examinations; judging a person's ability in engineering on the basis of one set of standardized examinations; designing, writing, and keeping up-to-date such examinations; coping with

necessary government licensing bureaucracy; etc.--will help improve the status of electrical engineers in our modern society.

Division V

DR. RICHARD E. MERWIN

- 1a) Yes.
- b) Provision of this type of protection to IEEE members placed in jeopardy by following the Institute's Code of Ethics is a well-justified membership service.
- 2a) The clause should be altered to read Professional Engineer (as it is now recognized in most states). The title of engineer is descriptive of one's occupation and background and of one's qualifications to sign contracts and other legal documents as a specialist of some kind.
- b) The IEEE should advocate more meaningful Professional Engineer licensing exams which reflect the specialty of the licensee. At present, most licensing exams deal with Civil Engineering specialties. Electrical engineering specialties (especially data processing) are entirely ignored by present licensing exams.

PROPOSED PROCEDURES FOR IEEE SUPPORT OF ETHICAL ENGINEERS

Draft Report Prepared by
USAB* Ethical Conduct Activities Task Force: Dr. Stephen T. Kowel; Walter Elden, P.E.; Dr. Stephen Unger; Faith Lee, P.E.; Victor Zourides, P.E.; John Thatcher, P.E.

A. Objectives

The intent of these procedures is to give positive support to those engineers whose careers are jeopardized as a consequence of their sincere efforts to practice their profession according to the letter and spirit of the IEEE Code of Ethics. As outlined below, this would include giving advice to those who anticipate problems as well as aid to those already penalized. A closely-associated goal is, where appropriate, to call attention to possible threats to the public interest that engineers may encounter in the course of their work. A considerable educational role will also be provided by the appropriate publication of fictionalized and actual cases. This will serve to sensitize IEEE members to the sorts of problems they may encounter in the practice of their profession.

B. Authority - Policy No. 7.8(B) of the IEEE Board of Directors, adopted September 1976.

C. Creation and Composition of an Ethics Committee (EC)

The key IEEE entity for administering these procedures is the Ethics Committee (EC), composed of five IEEE members (member grade or above), appointed for staggered, renewable,

*USAB = United States Activities Board.

EDITORIAL: IMPLEMENTING THE CODE OF ETHICS

At its June 18, 1977 meeting, USAB approved a pair of draft proposals for setting up machinery to implement the IEEE Code of Ethics. These two documents, which are reprinted below, propose procedures to: (1) provide IEEE assistance to engineers who are placed in jeopardy as a consequence of their adherence to the IEEE Code of Ethics, and (2) take appropriate action against IEEE members who violate the Code of Ethics. The Proposed Procedures were submitted to the IEEE Board of Directors, which has placed them on the agenda of its Nov. 1977 meeting. Meanwhile, the drafts are being revised, mainly to make their language appropriate for inclusion into the IEEE Bylaws. At present, the Bylaws contain no provision whatsoever to assist engineers placed in jeopardy as a consequence of adherence to the Code of Ethics, and the provision for dealing with infractions of the Code by members is inadequate.

A genuine effort by IEEE to encourage adherence to the Code of Ethics would be of great benefit to our profession, the Institute itself, and our society. I would urge all IEEE members to express their views on these Proposed Procedures (and on universal registration) in letters to the IEEE Board of Directors and to Spectrum. Suggestions for improving the Proposed Procedures are most welcome and may be sent directly to the Chairman of the USAB Ethical Conduct Activities Task Force: Dr. STEPHEN T. KOWEL, 103 Sun Harbor Drive, Liverpool, NY 13088. F.K.

three year terms by the IEEE Assembly (the elected members of the Board of Directors). They should be chosen insofar as is feasible from a broad spectrum with respect to geography, type of employment, age, etc. It is proposed that the same committee shall administer the ethics enforcement procedures discussed in the companion report. The EC should have appropriate staff support. It is expected to draw heavily on volunteer members as well as PAC's and local sections.

D. Procedures

As a general rule, cases are initiated by individual engineers (not necessarily IEEE members) contacting the EC either directly or through other IEEE entities. Direct initiation by the EC may also be undertaken. Cases are referred initially to the staff for preliminary screening to filter out those that are frivolous, inappropriate, or obviously unjustifiable.

If the engineer is simply asking for advice, this might be provided informally by the staff, depending on the complexity and importance of the situation. Otherwise the staff reports to the EC, which might consider the matter directly and render an opinion or it might appoint an ad hoc committee of one or more IEEE members to study the matter and report back to it.

Upon consideration of this report, the EC would then pass on advice and take any other action it deems appropriate.

Where a conflict exists (usually between an employer and an engineer), and in some advisory situations, a waiver letter (Appendix A) is obtained from the engineer at the start of the process. If the engineer is asking for assistance, the staff may try to resolve the problem by informal inquiries. Indeed efforts are made at all stages to settle conflicts informally, and it is anticipated that these will usually succeed. When the staff encounters an appropriate prima facie case that it cannot resolve informally, it reports to the EC. Upon review, the EC, if it feels the case may have merit, appoints an ad hoc committee of two or three suitably-detached IEEE members. A vote of three in favor is required for EC committee action. It is anticipated the committee will meet at regular intervals to consider such cases.

This investigating committee (IC), with staff cooperation, carries out a thorough investigation, reviewing documents, interviewing concerned parties and witnesses, and calling, if necessary, on IEEE members (or others) for technical advice. It then prepares a careful report incorporating all of the pertinent facts and views expressed, noting, if necessary, refusals by any parties to cooperate with the investigation. The report concludes with a recommendation by the EC on the merits of the case. That is, a recommendation as to whether an engineer has suffered professionally because of his adherence to the Code of Ethics. It is not essential that the IC make any determination on the technical issues involved in the matter.

If the IC finds the engineer to be substantially in the right and the EC concurs, then the report is published (after review by counsel), over the signatures of the IC members, in Spectrum or some other publication sent to all IEEE members. The identity of the engineer may be suppressed if this is felt to be in his best interest. Note that all proceedings to this point are kept in strict confidence. The only exception being that the EC may decide to publish, for educational purposes, versions of some cases, so edited as to conceal the identities of all parties involved.

In addition to publication, the EC also forwards to the IEEE Board of Directors (or possibly to USAB if this is considered the appropriate body) recommendations for actions by the Institute in support of the engineer. These may include, but are not limited to, the issuance of a formal statement commending the engineer's behavior (to help counteract possible retaliatory bad references by the employer), formal censure of the employer, the filing of an amicus curiae brief, direct entry into a case by IEEE attorneys, other forms of financial aid to the engineer, requests to public agencies that they intervene, and notifications to other professional societies who may have members employed by the organization involved. The actions taken by the board would also be made public.

Besides responding to particular cases, the EC may engage in other activities consistent with its overall purpose. These include the publication of illustrative fictional cases, cooperation with similar committees of other societies, and the publication of commendations of organizations that set outstanding examples in respecting the professional prerogatives of their engineers.

E. Information - Once final disposition is made, all data, etc. not published should be destroyed.

APPENDIX A

Waiver Letter Addressed to Ethics Committee by Engineer Seeking Aid:

I believe that I have been improperly treated by _____ as a result of my adherence to the IEEE Code of Ethics, and hereby request assistance from the Ethics Committee. The situation is outlined in the enclosed statement.

You may contact other individuals or corporate entities concerned insofar as is necessary to conduct a thorough investigation. I absolve IEEE, its operating groups, and all individuals associated therewith of any responsibility for the consequences of your investigation of this matter, and I agree to take no legal action against the Institute as a consequence of its findings.

Notarized.

Signed,

APPENDIX B

Supplementary Remarks to Support Proposal

1. Objectives.

The machinery described here is intended to support engineers only in ethics-related matters. Other factors are to be considered only if directly related to the ethical issue. (For example, a pay cut used to pressure an engineer into backing down on an ethical matter.)

Employers of engineers will benefit significantly from these procedures. Their engineering staffs will tend to operate at a higher professional level and avoid the kinds of disasters that often result from evasions of responsibility. Responsible organizations will also receive some protection from the unscrupulous practices of irresponsible competitors.

With respect to protecting the public interest, if the engineers involved in the BART case or in the design of the DC-10 had been able to call on a prestigious engineering society to review their allegations and bring them to the attention of the appropriate agencies at the initial stages, much grief would probably have been averted. Note that in such situations it is not necessary that the EC come to a definite conclusion on the technical merits. Conveying to a regulatory agency, for example, that an objective, preliminary study by a respected group reveals a strong likelihood of a serious problem would generally suffice to trigger a full-scale investigation. Good judgment must of course be exercised to restrict such actions to serious matters.

2. Composition of the Ethics Committee.

Obviously it is essential that the EC, its staff, and the volunteers cooperating with them be competent, dedicated individuals. A long-term goal might be to make EC membership a full-time, prestigious, paid position, possibly serving a group of engineering societies (a proposal by Victor Paschkis of the ASME) and administering a common intersociety code of ethics.

3. Procedures.

It would be a mistake to attempt to specify rigid procedures in advance. Only experience can lead to the development of

effective detailed machinery. Careful records should be maintained to facilitate this learning process.

The experience of the American Association of University Professors (AAUP) has been most useful in developing the procedures outlined here. The AAUP has, since 1915, successfully investigated cases, published reports, and censured university administrations without encountering any serious legal problems. Here the thrust has been in the area of denial of due process relative to tenure and reappointment. The AAUP scrupulously avoids the appearance of acting as a collective bargaining agent. It acts to investigate reports of infractions of its principles and to report its findings. It is most interesting to note that the AAUP receives more than 1000 inquiries a year, which are primarily handled by three full-time staff members. Of these cases no more than ten ever reach the stage of a published report by the investigating committees. All actions are reviewed by counsel, and no

suit has ever been brought against the Association.

The American Chemical Society has for a number of years investigated and published findings relative to employment practices. It has censured a number of chemical and non-chemical companies, and no legal action has ever been brought against it. Furthermore, it appears that no economic sanctions have been brought against the Society. There have been no cancellations of advertising or other support of the Society.

Both AAUP and the ACS require a waiver similar to the one suggested in the above appendix.

By having all documents reviewed by legal counsel before publication, by scrupulous adherence to confidentiality, and by conducting careful, thoroughly impartial investigations, the Institute should be able to protect itself adequately against legal liability.

PROPOSED PROCEDURES FOR HANDLING ALLEGED INFRACTIONS OF THE IEEE CODE OF ETHICS BY MEMBERS

Draft Report Prepared by USAB Ethical Conduct Activities Task Force

A. Objective

To establish the procedures for receiving, investigating, evaluating, and taking appropriate action to resolve reported infractions of the Institute's Code of Ethics by members, and to educate the membership on ethics-related issues.

B. Authority - Policy No. 7.8(A) of the IEEE Board of Directors, adopted September 1976.

C. Administrator of Complaint Investigations and Proceedings

An Ethics Committee shall be formed and shall have the full responsibility and authority to carry out the assigned duties of the procedures set forth herein. The makeup and operating procedures of the Ethics Committee shall be set forth elsewhere and may include duties other than those prescribed herein, as approved by the IEEE Board of Directors. (Refer to the Procedures for IEEE Support of Ethical Engineers.)

The Ethics Committee shall report to the IEEE Executive Committee. The Ethics Committee shall, in addition to other duties, administer the following main functions in the most expeditious manner consistent with constraints imposed by legal aspects, availability of volunteers, witnesses, etc.:

1. Receive complaints.
2. Initiate complaints when deemed necessary.
3. Conduct investigations to determine probable cause.
4. Assemble and conduct hearings to resolve complaints.
5. Review findings of the hearing proceedings and report findings to the Executive Committee and to all affected parties.

D. Appeals Review Board

The Executive Committee, upon receiving the findings report of the Ethics Committee, shall convene and serve as an Appeals Review Board. Its decision shall be reported to the IEEE Board of Directors for final action.

E. Final Board Action

The IEEE Board of Directors shall take final action in all matters covered by this procedure and shall approve any recommended disciplinary action to be taken against a member. The Executive Committee shall administer the approved disciplinary action on behalf of the Institute.

F. Complaints of Infractions of the IEEE Code of Ethics

1. Any person, IEEE member, or the Ethics Committee may file a complaint.
2. The complaint shall be prepared in writing and signed by the person filing the complaint.
3. The complaint shall specify the section of the Code of Ethics which is alleged to have been violated and describe the particulars of the alleged violation. Supporting material may be provided with the report.
4. The Ethics Committee is empowered to seek any information not available in the original complaint.

G. Processing of Reported Infractions

1. Complaints and evidence of reported infractions shall be received by the Chairman of the Ethics Committee and copies transmitted to all members of the Ethics Committee.
2. The Ethics Committee shall meet on a pre-scheduled basis and review all complaints received.
3. The Ethics Committee shall make a determination at the meeting whether there exists a basis for conducting an investigation. If such a basis does not exist, either because of lack of evidence or because of a determination that no infraction has occurred, the Ethics Committee may close the case and shall notify in writing the individual who filed the complaint.
4. If a determination is made that another body or society has interest in the matter, the Ethics Committee may choose to refer the case to that body as well.

H. Conduct of Investigations

1. Investigations shall be conducted after the Ethics Committee has determined that the allegations contained in the complaint warrant gathering additional information in order to determine whether an infraction has indeed occurred.
2. The Ethics Committee shall appoint an Investigating Committee (IC) for each case.
3. The Ethics Committee shall provide the Investigating Committee with copies of the complaint at the time appointed, with proper instructions governing approved rules, methods, and procedures for conducting an investigation.
4. The IEEE member named in the complaint and the individual bringing the complaint both shall be notified, by certified letter, by the Ethics Committee of its decision to investigate.
5. Both parties to the complaint shall be informed of the fact of the inquiry and notified where hearings, if any, are to be held in connection with the investigating committee's work. The member against whom the complaint is brought and his/her representative shall be invited to appear.
6. The investigation shall be conducted in order to gather additional facts or to receive statements from witnesses. Interviews in person, written inquiries, and hearings to gather pertinent testimony shall be conducted.
7. Upon completion, the Investigating Committee shall decide whether "probable cause" has been substantiated. Probable cause shall mean that there is reasonable basis for believing that the facts alleged in the complaint, if proven, would constitute cause for expulsion, suspension, or censure of the member against whom a complaint has been brought and that the facts alleged in the complaint can be proven.
8. The Investigating Committee shall prepare a written report of its investigation, its findings, and its conclusions, and shall submit it to the Ethics Committee Chairman.
9. At all times, the Investigating Committee shall protect the privacy of the individuals by not disclosing matters of the case to outside persons.
10. In the event the Ethics Committee decides to conduct a hearing, a member of the Investigating Committee shall be prepared to provide his service as the Manager. The Manager will present the case on behalf of the IEEE at such a hearing.

I. Ethics Committee Review and Processing of Investigating Committee's Report

1. The written report, received from the Investigating Committee, shall be reproduced and distributed to all members of the Ethics Committee.
2. This case shall be placed on the agenda of the next regularly-scheduled meeting of the Ethics Committee, or a specially-called meeting if circumstances are so warrant.
3. The Ethics Committee shall review the report and recommendations of the Investigating Committee. The Committee shall make a determination at the meeting whether "Probable Cause" of an infraction of the IEEE Code of Ethics has been substantiated.
4. If the IC has determined that no probable cause exists, the Ethics Committee shall close the case, notify all parties in writing by certified mail, and submit a written report to the IEEE Executive Committee. Privacy shall be maintained in the matter.
5. In the event of a finding of probable cause, the Ethics Committee shall (1) notify all parties in writing by cer-

- 2) notified mail, stating the alleged infraction, the person bringing the charge, the member against whom the complaint is made, the date, time, place, and the rules and procedures for conducting a hearing to resolve the matter; (2) notify the IEEE Executive Committee by written report; (3) select the member of the Ethics Committee to be the Presiding Official to conduct the hearing; and (4) appoint a member of the Investigating Committee to serve as the Manager of the case on behalf of the Institute.
6. The Ethics Committee shall institute the selection of peer members to serve as a Hearing Board in the proceedings. The Hearing Board shall be comprised of six randomly selected IEEE members residing in the same Region as the member against whom the complaint is brought. The Presiding Officer shall act as mediator in any questions arising concerning challenges to the seating of anyone on the hearing board.
7. The Ethics Committee shall have the authority to accept a plea of guilty by the member against whom the charges are brought. This plea shall be entered in the record and the proceedings terminated. The plea shall be obtained in writing. If this action is taken, the Executive Committee and all parties shall be notified of the fact by written report.

J. The Hearing Procedures

1. The proceeding shall be conducted in accordance with the conditions stipulated in the written notification.
2. The Presiding Officer shall be the official in charge of seeing that the hearing is conducted in accordance with the written rules and procedures established by the Ethics Committee. All points of order, resolution of disputes, clarification of instructions, and administrative functions necessary to the proceeding shall be the responsibility of the Presiding Officer.
3. The order of the proceedings shall be as follows:
 - (1) Opening instructions by Presiding Officer.
 - (2) Presentation of the case by the Manager. The cross-examination of all witnesses shall be permitted.
 - (3) The member against whom the complaint is lodged shall present a defense against the charges, have the right to advice of legal counsel or any other chosen person, and may introduce any witnesses, and material facts; the Manager shall have the right to cross examine any witnesses brought by the member.
 - (4) Both sides shall make closing statements; first the Manager, then the member against whom the charges are brought.
 - (5) The Hearing Board shall deliberate in closed session, shall have the right to examine witnesses and material facts, and shall reach a decision by a vote of two thirds (4 out of 6). This result is reported to the Presiding Officer for transmittal to the Ethics Committee.
 - (6) In the event that the Hearing Board finds the member guilty of an infraction, it shall set a maximum penalty by a vote of two thirds (4 out of 6).
 - (7) In any event, their findings shall be transmitted to the Presiding Officer who forwards it to the Ethics Committee.
 - (8) A sound recording shall be made of the hearing if requested and kept on file by the Ethics Committee until a final action required under these procedures. At that time all records, evidence, etc. shall be destroyed, except for a digest stating the essential elements of the findings.

K. Review Actions by Ethics Committee After Proceedings

1. In closed session, the Ethics Committee shall review the findings and recommendations of the Hearing Board.
2. In cases where the Hearing Panel finds no infraction of the Code of Ethics, the report is for the information of the Ethics Committee only, and the case is closed. The member against whom the complaint was made and the person making the complaint will be notified by certified mail.
3. In cases where the Hearing Panel finds infractions of the Code of Ethics, the Ethics Committee shall review the case and, if in agreement, shall take action approving of the finding. It may at its discretion reduce, but not increase, the recommended penalty. Both the person against whom the complaint has been brought and the person bringing the complaint shall be notified in writing by certified mail.
4. In cases where the Hearing Panel could not reach an agreement, by the required two thirds margin, as to whether an infraction had been committed by the member, the Ethics Committee shall have the option of declaring the member against whom the complaint has been brought to be innocent of infractions against the Code of Ethics, or the Ethics Committee may initiate the process of creating a new Hearing Board to hear the matter again.
5. If deemed appropriate, the Ethics Committee shall submit information obtained during the hearing to the appropriate State Board of Professional Engineers for use in connection with determining possible violations of the Engineering Registration Law or the State Board's Rules of Professional Conduct.
6. If the Ethics Committee is not in agreement with a finding that the member has committed an infraction of the Code of Ethics, it shall submit a written report of its decision to the Executive Committee along with the report of the Hearing Board. The Executive Committee shall then serve as an Appeals Review Board. In the event of an appeal by the member against whom charges were brought, this report shall be taken into consideration during the appeal period.
7. The Ethics Committee shall determine whether the member plans to appeal the decision or comply. If no appeal is planned, a statement shall be obtained to this effect in writing within two months. If no notice of an appeal is received within two months the Ethics Committee shall prepare a final report and submit it to the Executive Committee.

L. Appeals Review by the Executive Committee

1. The member found to have committed infractions of the Code of Ethics shall have the right of appeal for up to 60 days after being notified by the Ethics Committee of its decision. The Ethics Committee shall inform the Executive Committee of the forthcoming appeal.
2. The appeal shall be submitted by the member directly to the Executive Committee stating the basis of the appeal.
3. The Executive Committee shall convene in closed session at the next regularly scheduled meeting, as an Appeals Review Board, to consider the matter.
4. The Appeals Review Board shall consider the merits of the appeal and review the case, the written reports of the Ethics Committee, and any other material relevant to the case.
5. The member and the Manager in the hearing proceedings

shall have the right to appear before the Appeals Review Board to present arguments.

6. The Appeals Review Board shall make a decision on whether to uphold the finding presented to it by the Ethics Committee or to reverse the finding. It will require a vote of two thirds by the Appeals Review Board to decide any issues.
7. The Appeals Review Board may at its discretion recommend reduction of the penalty. A written report shall be submitted to the IEEE Board of Directors and the member, and the person bringing the complaint shall be notified by certified mail.
8. The Appeals Review Board, by a two thirds vote, shall file a written report to the IEEE Board of Directors and the member, and the person bringing the complaint shall be notified by certified mail.

M. Final Institute Action

1. The members of the Board of Directors shall each be supplied with a report of the case, citing the member against whom the complaint is brought, the person bringing the complaint, the charges, the finding of the Hearing Board together with its recommended penalty, the report of the Ethics Committee, and the report of the Appeals Review Board.
2. The case shall be considered at the next regularly-scheduled meeting of the Board, at which time the Board shall make a decision in the matter. A decision shall be reached by a majority vote of the full Board and by two thirds of the members who vote on the question.
3. The Board may reach a decision to either sustain the finding and penalty recommended by the Appeals Review Board, sustain the findings brought to it but reduce the penalty recommended, or reverse the finding. Of course, finding that the member has committed no infraction cannot be overturned once made at a lower level.
4. Upon reaching a decision, the Board shall notify the member and the person bringing the complaint, by certified mail, within 20 days.
5. The Board shall notify the IEEE membership of an expulsion, suspension, or censure. Any such notification shall include a statement of the finding on which it is based.
6. No person who has been expelled from membership and no person who has been suspended shall (during the period of the suspension) be allowed any of the rights or privileges of membership in the IEEE. Service on committees and boards, at all levels, shall be denied to a person expelled or suspended (during the period of suspension from the IEEE).

APPENDIX

The American Society of Civil Engineers has had for a decade a procedure for handling ethics complaints against members. Their procedure is somewhat simpler than the procedure outlined here. It has resulted in disciplinary action against members of the Society. No legal action has been brought against the Society as the result of such determination.

The American Chemical Society has a procedure at the Board-of-Directors level for expelling a member of the Society. However, such action, until now, has not been taken until the member has been convicted in a court of law of a serious crime related to professional ethics. It believes that this cautious approach is responsible for the avoidance of any legal liability. ■

BOOK REVIEWS

NUCLEAR POWER ISSUES AND CHOICES

Report of the Nuclear Energy Policy Study Group, Sponsored by the Ford Foundation, Administered by the MITRE Corporation, Ballinger Publishing Company (17 Dunster Street, Cambridge, MA 02138), 1977, 418 pages, \$6.95 paper.

Reviewed by: Dr. David Redfield, Chairman, CSIT Working Group on Energy/Environment.

This is an important book for two reasons: (a) it is the most dispassionate and comprehensive treatment of the subject yet written; (b) its recommendations appear to be closely paralleled by policies recently adopted by the Carter administration. It is also lucid and well organized. For all that, however, it by no means ends the controversies in this field any more than will the forthcoming report on the same subject sponsored by The National Research Council.

This book is the report of a blue-ribbon panel of scientists, economists, lawyers, political scientists, etc., who have not previously had any prominent identification with this subject. The idea obviously is to have "experts" without personal stakes or well-developed biases in this field. The study was funded by The Ford Foundation and administered by The Mitre Corporation, whose S. M. Keeny, Jr. chaired the panel. It appears that substantial support was obtained from working groups of specialists who are generally not identified in the book.

To the public, the impact of this study is in its numerous and significant conclusions that are clearly stated and whose justifications are expressed in detail. Whether one agrees or disagrees with the conclusions, there should be little argument as to what is said and why.* The underlying analyses include interesting discussions of energy resources, technologies, health and safety, weapons proliferation, environmental effects, and--above all--economics. There is a concise appendix introducing the elements of nuclear power technology and terminology. Chapter I (following the detailed Overview), "Energy and the Economic Future," is an attempt to survey the role and the importance of energy--all energy--in our national economy. On the basis of computer modeling, two major conclusions are reached: First, the continuous increase in energy costs anticipated over the next half century need not seriously dislocate our "basic social and economic structure nor the economic wherewithal to deal with social problems." (This is expected to hold generally for other industrialized nations, too, but not for developing countries.) Second, the energy cost picture in this century will not be significantly affected by decisions concerning nuclear power.

The conclusions developed in the remainder of this report can usefully be discussed in two groups: those pertaining to the current type of nuclear power plants that "burn" U-235, specifically light water reactors (LWRs); and those pertaining to future nuclear technologies, specifically spent fuel re-

* For an exception to this assertion, see the review following this one.

processing and breeder reactors. Since the panel expects no new energy technologies to become sizable in this century, the issues and choices for electric power for the next generation come down to consideration of just coal and LWRs. Around the year 2020 some new electric technology is hypothesized to become available; it may be an advanced breeder, solar, geothermal, fusion, improved use of coal, or some combination.

Concerning the present nuclear power systems, the report has a number of specific findings. In the areas of social impacts they conclude that:

- "Nuclear wastes and plutonium can be disposed of permanently in a safe manner." [p. 19]
- Public Health effects (illnesses and fatalities) are likely to be less for nuclear than for coal power. This in spite of an increase that the report says is needed in the predicted fatality rate from nuclear power plant accidents of the Rasmussen Report (WASH-1400, "Reactor Safety Study") by a factor of about 500.
- "On balance, ... nuclear power has significantly less adverse environmental impact than coal." [p. 20]
- The potential proliferation of nuclear weapons is "the most serious risk associated with nuclear power." A number of actions and policies are recommended that "would help to control nuclear proliferation in important ways."

The economics of coal and nuclear power receive detailed analysis that includes fuel cycle costs (with safety and pollution-control measures) as well as capital costs. A principal finding is that "the trade-off between coal and nuclear on direct economic grounds is a close one, with many uncertainties, and will vary with local conditions..." It is largely as a consequence of the coal option (including considerations of its availability and transportation) that the panel believes that "nuclear power choices have limited bearing on [our] larger social and economic conditions." Even if, for non-economic reasons (which this panel finds unpersuasive), the U.S. decides to delay the growth of nuclear power for about 15 years, "the extra costs... would not be significant in this century," and may be about 1% of GNP in the next century.

In reviewing all these issues concerning current nuclear power, the authors conclude that a mix of LWRs and coal-fired power plants is desirable as a hedge against unforeseen environmental (or other) problems with either technology. They anticipate that, because of the large regional variations in the delivered price of coal, "economic forces may be expected to produce such a mix of coal and nuclear plants."

In treating future nuclear fission technologies--the liquid metal fast breeder reactor (LMFBR) and the reprocessing and recycling of spent fuel--the report is more apprehensive. The concerns over nuclear weapons proliferation that seem manageable with existing technology grow to unacceptable risks in the face of the world-wide plutonium economy that would accompany LMFBRs and/or plutonium recycle. Moreover, the report estimates the potential economic benefits of these technologies to be negligible until well into the 21st century. In

consequence, the report recommends about a 15-year delay in the commercial deployment of LMFBRs and reprocessing plants, during which time spent fuel from LWRs would be stored retrievably. The proposed delay time should be used (1) to develop alternative energy technologies, (2) to develop an improved breeder, possibly employing a thorium/U-233 fuel cycle, and (3) to develop anti-proliferation measures for the future. Nevertheless, the panel believes that:

"The breeder option should be preserved, since the cost of uranium will eventually rise, coal may eventually be found to have adverse consequences that cannot be avoided, and other alternative energy sources may prove to be very expensive. . . . It is important to continue work on the breeder, with a longer time horizon and an emphasis on its role as insurance." [pp. 359, 363]

The report's conclusions regarding LMFBR economics differ from those of the Energy Research and Development Administration (e.g., ERDA-1535), primarily as a result of (1) Nuclear Power Issues and Choices' higher estimate of uranium reserves and resources, (2) its lower estimate of future electricity demand, and (3) its higher estimate of breeder fuel cycle and capital costs. The report notes that, although the expected value of uranium resources is quite large, the uncertainties in current estimates are also large. The authors believe that accurate uranium estimates are essential to the formulation of a sound energy policy, and they recommend reorienting and intensifying the government's uranium resource evaluation program to provide this information.

The authors believe that a delay in the deployment of commercial breeder reactors would buy time to develop political and technical measures to control nuclear weapons proliferation. Although a unilateral deferral decision by the U.S. would not necessarily convince all other countries to defer export or acquisition of such facilities, the authors believe that "it probably would convince some and would seriously influence the thinking of all countries." They note that current optimistic expectations regarding nuclear power are largely the legacy of the promotional efforts of the U.S. Atoms For Peace program; they suggest that "Expectations as to the merits and imminence of plutonium recycle, the breeder, and PNEs [peaceful nuclear explosives]. . . need a stiff dose of realism." They emphasize, however, that:

"A strategy to constrain proliferation must be complex and comprehensive. U.S. nuclear power policies can be shaped to support such a strategy, but they can be only partially effective unless they are meshed with broader political actions and international arrangements." [p. 23]

The report presents a comprehensive set of recommendations for dealing with the proliferation problem.

For the longer term, the report regards the energy problem as one of rising real energy costs rather than one of absolute limitations on energy availability. While the authors are pessimistic about the near-term economic prospects of solar, geothermal, and fusion, they emphasize that:

"...the potential availability of these alternative energy sources is indeed central to our conclusion that mankind faces no long-term shortage of energy." [p. 129]

To develop these options for the longer term--and to provide a hedge against possible unforeseen problems with coal and

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nuclear power--the report calls for a vigorous, balanced research and development effort, giving equal weight to advanced nuclear technologies and to the alternative replenishable energy sources.

The LMFBR program currently consumes the largest share of the U.S. government's energy R&D budget (\$656 million for the LMFBR vs. \$80 million for other breeders/converters and \$290 million for solar, wind, ocean-thermal, biomass, etc. in 1977). The breeder program is expected to cost the U.S. government a total of \$12 billion. Nuclear Power Issues and Choices makes the following observations and recommendations concerning the program:

. "...a breeder program with restructured goals should be pursued as insurance against very high energy costs in the future." [p. 33]

. "The ultimate success of the breeder may...be compromised by telescoping development stages to meet an early deadline, freezing technology prematurely. We believe therefore that the breeder program should deemphasize early commercialization and emphasize a more flexible approach to basic technology." [p. 33]

. "A broader program might involve thorium technologies, gas-cooled designs, molten salt reactors, and other possibilities. . . . Some of the research presently being done on physics, materials, chemistry, and so forth could be extended to lay a basis for alternate reactor concepts at a cost small compared with that of the present program. Construction of experimental prototypes could also be inexpensive when compared with commercial-scale demonstration projects like the Clinch River breeder. It is at the commercial development and demonstration phase that large program budgets are involved." [p. 360]

. "...the Clinch River project, a prototype demonstration reactor costing \$2 billion, is unnecessary and could be canceled without harming the long-term prospects of breeders. In fact, premature demonstration of a clearly noncompetitive breeder could be detrimental to its ultimate prospects." [p. 33]

. "The transition from federally supported programs to unsubsidized commercial use can be achieved only if the private sector finds investment in plants economically attractive. . . . If the demonstration takes place before it is economically justified, the government may have to subsidize the program at a high level for a long time after demonstration, and the ultimate product may also be inferior to that which would have resulted from continued development." [p. 335]

Apart from the substantive issues and conclusions, this book is laced through with interesting facts and figures. For example, disposal of reprocessed fuel wastes is considerably more complicated than sometimes recognized, in part because the heat content of the waste is not much reduced by reprocessing; "Considerable technical progress must be made. . . " to extend current reprocessing technology to make it serve for LMFBRs; land requirements for mining, milling, and storage of tailings for fuel for the 30-year expected life of a 1000 MWe nuclear plant will be about five square miles. An index for a book of this type would thus add considerably to its reference value. Otherwise, a technically-oriented reader may be surprised at the degree of emphasis on economics and may be permitted to wonder why capital charges are 15% on p. 131 and 12% on p. 346. But there can be no doubt that this provocative and informative book will become a leading reference in the field. ■

[Ed. note: The following review is of a pamphlet attacking the above-reviewed book. The pamphlet has received some limited distribution by the IEEE, and it was included as an enclosure in a letter to all members of the U.S. Congress from Mr. Frank Jenkins, President of the IEEE Power Engineering Society, on the subject of U.S. breeder policies. It was given a "plug" in the PES Newsletter (July 1977, page 11).]

THE BREEDER REACTOR DECISION— MAKING PLUTONIUM A SOVIET MONOPOLY

by Petr Beckmann, 1977, 20 pages. \$10.00 per 100 copies. U.S. Industrial Council, P.O. Box 2686, Nashville, TN 37219.

Reviewed by: Dr. David Redfield, Chairman, CSIT Working Group on Energy/Environment.

Because of the style in which this pamphlet is written, it is necessary to read it twice: once to get through its strident polemics, and then to seek the substance of its attack on the Ford-Mitre report reviewed above (NPI&C). Although it is difficult to characterize this paper, it is easy to say what it is not. Surely no one will direct at it the charge it makes of NPI&C as having "the semblance of cool objectivity"; the paper accuses NPI&C of "technological ostrichism" and of being "at best, sloppy, but quite possibly dishonest."

At the second reading, the diligent reader will begin to penetrate beyond the political rhetoric to the specifics of breeder reactor issues. Dr. Beckmann (Professor of Electrical Engineering at the University of Colorado) attacks NPI&C's treatment of three of these issues: economics, the threat of terrorism, and the threat of nuclear proliferation. Beckmann suggests that NPI&C's economic analysis be discarded in favor of a pocket calculator. To NPI&C's contention that "the early economic potential of the breeder has been significantly overstated" Beckmann replies:

"The stockpile of uranium tailings already stored and ready for use as fertile breeder fuel, if valued at the price of an equivalent amount of coal, represents a fuel asset of \$20 trillion." [p. 12]

On terrorism, Beckmann criticizes NPI&C for omitting what he considers to be a far more credible scenario than the theft of nuclear materials--namely, that the Soviet Union might covertly provide terrorist organizations with "nuclear expertise or raw materials, if not with a complete weapon."

Beckmann begins his discussion of nuclear proliferation with the statement:

"Proliferation is, of course, a purely political problem and the [NPI&C] authors' political viewpoint is naive to an extent that borders on the humorous. (But the laughter dies in one's throat on remembering that one of the signers, Harold Brown, has since become Secretary of Defense.)" [p. 15]

This is amplified at length with charges that NPI&C recommends "appeasement, retreat, and capitulation"; "unilateral disarmament"; "cringing from leadership and responsibility";

and placing the world's energy future "in the trustworthy hands of the Soviet Politbureau." We are told that the U.S. "has, for many years now, walked the Chamberlainesque path of appeasement." According to Beckmann, the real cause of the threat of proliferation is "the softness and defeatism of the West; in particular, the abdication from leadership and global retreat of the United States." Needless to say, Beckmann rejects NPI&C's contention that deferral of plutonium recycle by the U.S. would reduce the likelihood of nuclear proliferation.

Stripped of its invective, this tract still contains substantive misstatements and misrepresentations of fact. The opening sentence charges NPI&C with "recommending the abandonment of the nuclear breeder reactor program" (emphasis added). This is refuted clearly by quotations from NPI&C in the foregoing review. We are also told by Beckmann, "a commercial Allied Chemical plant at Barnwell, SC, now stands ready and waiting to do the job" of fuel reprocessing. But it is well known that Allied has requested hundreds of millions of dollars from the U.S. government to complete the plant that is unlikely to operate before 1983. Then we find twice the accusation that NPI&C does "not mention the thorium cycle at all" as an alternative to the plutonium breeder. But this topic is discussed explicitly on p. 337 of NPI&C, and the thorium cycle receives rather favorable comment. In fact, one of the arguments given by NPI&C (pp. 33, 360) against premature commercialization of the plutonium breeder is that this is likely to freeze out alternative breeder technologies (the thorium fuel cycle and the molten salt breeder reactor are cited as examples) that might prove to be superior.

Thus when we read here "one must charitably assume that physicists Brown and Panofsky [members of the NPI&C panel] signed the report without carefully reading it" we, too, must be moved to the same charitable assumption concerning Beckmann. But we must also wonder if those within the IEEE who are promoting and disseminating this pamphlet under IEEE/PES auspices have really read it or NPI&C. ■

"In most management schools or courses, a considerable amount of time is spent emphasizing the fact that a manager must be prepared to say no to his or her manager. What many managers fail to recognize is that programmers in turn have a right to say no, particularly when they are placed in a position of compromising their own ethics, such as asking them to deliver a software system when they are fairly certain that it still contains critical errors, or asking them to meet an unreasonable schedule that compromises the quality of their work. One should also realize that programmers may belong to professional organizations such as the ACM, IEEE, or ACPA that have codes of ethics for their members, and that occasionally these codes of ethics conflict with organizational objectives. If you are a manager do you understand the codes of ethics of these professional organizations?"

--Glenford J. Myers, Software Reliability, p. 273. Copyright 1976 by John Wiley & Sons, Inc., New York; reprinted with permission.

READERS' VIEWS ON CARTER ENERGY PROGRAM

The seventy-seven responses to the reader questionnaire on President Carter's proposed energy program [T&S, June 1977, p. 9] are tabulated below. Write-in responses are indicated in brackets []. Since multiple answers were allowed, the totals for most questions will exceed 100%. A summary of readers' comments follows the tabulation.

I apologize for the lateness of the June issue; I have tabulated all the responses received as of August 21. I thank the readers who took the time to respond, and I believe the results and comments will be of considerable interest. It should be noted that the results represent the views of seventy-seven readers of TECHNOLOGY AND SOCIETY, not of any scientifically-selected sample of the members of IEEE.

1. On balance, I	75%	12%	13%	Eliminate promotional gas and electric rate structures.
57% favor				
13% am neutral toward				
25% oppose				
5% (no response)				
the President's energy program.				
2. Compared with the magnitude of change needed, the energy program is:	75%	19%	5%	The 40%--25%--\$2000 tax credit to homeowners who install solar equipment.
1% too bold.				
25% about right.				
61% too timid.	68%	18%	14%	Mandate efficiency standards on household appliances beginning 1980.
13% (n.r.)				
3. The energy program should have done relatively more to encourage:	69%	21%	10%	Speed up licensing of standardized reactors.
55% conservation.				
19% oil production.				
21% gas production.	62%	19%	18%	Require scrubbers in all new coal-fired plants.
23% coal production.				
38% nuclear power.	61%	23%	16%	Stricter strip-mining reclamation laws.
38% solar heating.				
48% R&D on (the various forms of) solar energy.	60%	31%	9%	The standby 5-cent-a-year increase in the gasoline tax.
35% R&D on breeders.	60%	32%	8%	Excise taxes or rebates on new automobiles according to m.p.g.
4. We should rely primarily on	34%	40%	26%	Tax on industrial use of oil and gas.
58% conservation				
52% (the various forms of) solar	30%	45%	25%	The energy program's crude oil pricing policies.
27% breeder reactor				
23% fusion	32%	55%	13%	Cancel construction of Clinch River breeder reactor.
9% [coal]				
9% other: [including: geothermal; tides; gas & oil]	18%	58%	23%	The energy program's natural gas pricing policies.
3% (n.r.)				
to meet our long-term energy needs.				
5. The energy program				
55% does				
31% does not				
14% (n.r.)				
entail needless federal bureaucracy and red tape.				
6. The energy program should have relied more heavily on				
39% deregulation of energy prices.				
21% ending all [or most] forms of government intervention.				
22% energy sales taxes.				
14% tax credits.				

36% mandatory measures (e.g., rationing, building codes, end-use restrictions, etc.).
5% [promoting energy R&D.]
8% other: [including: tax incentives to reduce birth rate; easing environmental standards; subsidy to poor to offset higher energy prices].
13% (the energy program's mix of methods is satisfactory.)
4% (n.r.)

7. through 19.

The readers' verdict on specific measures in President Carter's energy program is as follows:

favor oppose n.r.

75%	12%	13%	Eliminate promotional gas and electric rate structures.
77%	18%	5%	The 25%--15%--\$410 tax credit to homeowners who weatherize their homes.
75%	19%	5%	The 40%--25%--\$2000 tax credit to homeowners who install solar equipment.
68%	18%	14%	Mandate efficiency standards on household appliances beginning 1980.
69%	21%	10%	Speed up licensing of standardized reactors.
62%	19%	18%	Require scrubbers in all new coal-fired plants.
61%	23%	16%	Stricter strip-mining reclamation laws.
60%	31%	9%	The standby 5-cent-a-year increase in the gasoline tax.
60%	32%	8%	Excise taxes or rebates on new automobiles according to m.p.g.
34%	40%	26%	Tax on industrial use of oil and gas.
30%	45%	25%	The energy program's crude oil pricing policies.
32%	55%	13%	Cancel construction of Clinch River breeder reactor.
18%	58%	23%	The energy program's natural gas pricing policies.

20. Compared with existing policy, the proposed energy program will have a substantial adverse impact on:

38% inflation.
23% unemployment.
27% real gross national product.
26% quality of life.
12% environmental quality.
34% none of the above.
7% other: [including: size of government; growth in energy supplies; reward for work].
7% (n.r.)

21. The energy program is:
55% basically fair to most Americans.
10% unfair to: [everyone; most Americans].
10% unfair to: [motorists; average consumers; energy producers; electric utilities; those who conserve; apartment dwellers].
7% unfair to: [poor; elderly].
9% unfair to: unspecified.
9% (n.r.)

22. The best approach to reducing unemployment and poverty in the U.S. is to:

29% expand energy production.
36% develop a more labor-intensive economy.
14% redistribute wealth and income.
13% shorten the work week.
16% have the government provide jobs to the unemployed.
7% [reduce welfare and/or minimum wage.]
23% other: [including: government projects (mass transit, space, rebuild rail system); expansion of private sector; reduce government interference into business; job training; universal peace-corps-type conscription; change national attitude; make being unemployed less attractive; eliminate working mothers; include only long-term unemployed in statistics; accept 7% unemployment].
7% (n.r.)

23. Reducing unemployment and poverty:
14% should be one of the main goals of U.S. energy policy.
79% should be done independently of energy policy.
14% should not be done by the federal government.
5% (n.r.)

24. Continued growth in U.S. energy consumption:
19% is necessary to provide an adequate quality of life.
18% will be beneficial to the American people.
22% entails social costs (e.g., degradation of environment) that would outweigh the benefits.
60% will no longer produce any real benefits; even neglecting pollution, we'd be better off if we adopted a gentler, less energy-intensive lifestyle.
5% (n.r.)

25. The most promising means for improving the quality of life of our generation and of future generations is through:
53% technology.
66% change in values and lifestyles.
21% change in social organization and decision-making (e.g., more centralization, less centralization, communes, etc.).
16% change in economic policy (e.g., laissez-faire, welfare state, etc.).
1% continuing existing policies.
4% other: [educate the public about what lies ahead; change in moral values; replace income tax with value-added tax].
5% (n.r.)

26. In the U.S. the quality of life will be highest if population:

3% increases.
36% remains the same.
51% decreases.
10% (n.r.)

Many readers who favor the Carter energy program nevertheless characterized it as "only a beginning" and "better than nothing"--not as "the moral equivalent of war." One reader thought it to be the boldest program that is politically feasible at present because Congress' awareness of the energy problem was inadequate--and lagged even that of the general public. He believed that inflation and unemployment were unavoidable results of energy scarcity, but that these problems would hit us even harder in the future if we put off dealing with the energy problem. Another felt that the news media should do a much better job of informing the public about energy issues.

Several readers opposed the rebate provisions of the "gas-guzzler tax," the gasoline tax, and the crude-oil tax. One, who opposed the whole tax plan, characterized the taxes as "another step toward socialism" and asserted that, for every dollar taken by the federal government for transfer payments, only 5 or 10 cents gets back to the public. Most of those who opposed the taxes favored rationing of energy supplies, especially gasoline. Some believed rationing to be the only measure that would achieve conservation and be fair to people with low incomes. Some suggested making additional energy, for luxury use, available at a much higher price.

Several favored a higher gasoline tax to reduce consumption, and one of them suggested using all revenues so generated to finance mass transit, especially urban and intercity rail systems. One reader suggested that strict nationwide enforcement of the 55 m.p.h. speed limit would effect a significant energy saving.

A few felt that the tax credit for solar heating would be wasteful at present because solar technology was not developed sufficiently. However, another reader provided data on passive solar heating which indicated that it was already the most economical method for space heating. He added that, although nuclear reactor hazards could be reduced through remote siting, the only nuclear reactor that was sufficiently remote to be "safe enough" was the sun.

One reader cited the NYC blackout as evidence of the need for rapid expansion of nuclear generating capacity and development of the breeder reactor. He asserted that: conservation would not work; solar was inadequate; we could not move the volume of coal needed to replace the oil and gas now used to generate electricity; and we needed all of our remaining oil and gas for transportation and petrochemicals. He warned that, if we did not move fast on nuclear power in 1977, the lead time would be gone, the USA would gradually come to a standstill, and the looting would start.

Some favored energy price deregulation and opposed energy sales taxes or other government intervention. They felt that the marketplace could do a better job of bringing energy supply and demand into balance and providing an appropriate lifestyle. One reader criticized the CSIT Position Paper on the Application of Systems Engineering to Societal Problems [T&S, June 1977, p. 10] in the same vein. He cited an astronaut's comment on applying the technology that placed him on the moon toward solving society's problems. The astronaut said that it could solve the problems but that he wouldn't want to live in such a society.

Several readers criticized the trend toward large centralized energy systems, horizontal integration of energy companies, and concentration of political power. They favored an ap-

propriate mix of large-, medium-, and small-scale energy technologies. Some criticized the American conception of "progress," which they said, equates GNP with "quality of life" and accords profits and power higher priority than human life and happiness. They called for fundamental changes in the "American way" of thinking and living.

One reader suggested more complete utilization of available energy resources. He noted that hydropower on the Merrimack River, which once powered much of New England's textile industry, was now largely unused. For the longer term, he proposed hydrogen-powered internal combustion engines using hydrogen produced by ocean-thermal power plants, and he opposed the burning of "fuels" that are more valuable as a source of petrochemicals. He also proposed that skyscrapers build in "wind tunnel" effects to power integral banks of wind turbines.

Another reader believed overpopulation to be the major cause of shortages of resources, and he favored tax credits to discourage large families and provide incentives for not producing children.

Readers are invited to continue sending in their informal comments on energy issues. TECHNOLOGY AND SOCIETY will continue to publish summaries of these comments. ■

Frank Kotasek Jr.

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Frank Kotasek Jr., Ed.

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The next meeting of CSIT will be held on Saturday, Nov. 5, 10am to 3pm, at the Engineers Club, 32 West 40th Street, New York, NY. CSIT meetings are open to all IEEE members, and we hope you will take this opportunity to become better acquainted with us and with our activities. Light lunch will be provided. If you plan to attend, please notify Ms. Joan Breslin, IEEE, 345 East 47th Street, New York, NY 10017, (212) 644-7887.

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