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IN THIS ISSUE

Workshop

ENGINEERING IN THE SERVICE OF SOCIETY!

NEW EDUCATION PROGRAMS
August 26-27, 1974 Carnahan House University of Kentucky, Lexington, Kentucky

A two-day, limited attendance, workshop bringing together students, engineers, employers, educators, and social scientists to explore engineering education as related to societal needs. Workshop sponsors include: IEEE Committee on Social Implications of Technology; IEEE Education Group; with the cooperation of the University of Kentucky, College of Engineering; Office of Continuing Education, Technology and Society Division; American Society of Mechanical Engineers, Education Division; American Nuclear Society.

The program encompasses a plenary session, including an address by the Workshop Chairman, John G. Truxal, two half-day workshops, and a summary session. Registration is $30.00; students is $20.00.

PURPOSE: To discuss efforts to make engineering education more responsive to societal needs, and to integrate social implications concepts into the curriculum.

Significant forces for change will cause radical modifications of traditional engineering curricula during the '70's. These forces include declining enrollments, increasing social awareness of the students, and the lessening influence of defense related research. Further, the public is asking why an establishment capable of putting a man on the moon seems incapable of providing sufficient energy, adequate health care, modern transportation, a clean environment, etc. The formal education of the engineer will be discussed within the context of these issues.

Current experimental programs and proposed new programs will be described and discussed from a broad viewpoint including such questions as: is a technocratic society being created; is the social ingredient of any value; which populations should be so educated; etc.

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Regional associate editors and book reviewers are being sought--interested parties please contact the editor.■

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I wish to attend the Workshop:

To present a short paper. Student, faculty, industry, and government presentations are solicited. Please attach abstract.

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August 26-27, 1974
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Ethical Professionals Without Support

A CASE IN POINT BY Roy W. Anderson, PE

Can Professional Engineering Societies, as presently constituted, support and protect engineers who respond to the call of professional ethics in protecting the public health, safety and welfare? If the experiences of the members of the National Society of Professional Engineers (NSPE) Chapter in California, who came to the aid of three fired BART engineers, is any example, the answer probably is no.

NSPE has called the engineering profession to rally to its ranks and join an organization that will "insure that the practice of engineering be carried out in accordance with the highest ethical standards and in a manner in which the integrity of the engineer would be always protected." This call is hollow and may perpetuate on the engineering profession a hoax more supportive of a system of harsh discipline than protection of engineers dissenting in the name of ethics.

I was active in leading an effort to vindicate and reinstate the three engineers fired by the San Francisco Bay Area Rapid Transit District (BART) management and to assure that the public health, safety and welfare were protected.

I was aware, as were many other engineers, that an engineering professional organization never has existed to which a concerned or embattled engineer could appeal in a time of professional crisis. It was that fact, coupled with an apparent and immediate threat to public safety that motivated Mr. Gilbert Verdugo, president of Diablo Chapter, California Society of Professional Engineers and me to accept the challenge offered by a public official.

We felt it was time to make the good fight. It seemed to be a battle, which if carried forward, whether eventually won or not, would provide guidance for future cases. The potential for drawing attention and support from all engineers concerned with "professionalism" appeared to be a good idea whose time had come. Images of NSPE standing as a champion of the ethical engineer, the profession and the public flashed through our minds and strengthened our resolve.

Following the firings in March of 1972, at the first meetings with officers of the state level of the California Society of Professional Engineers (CSPE) and several area chapters, support for the three engineers appeared strong. The CSPE state president, Mr. William Jones, took direct action and contacted the BART general manager who was "unavailable" to discuss the firings. He was then referred to Mr. Hammond, head of operations and engineering for BART, and also a member of CSPE. Mr. Hammond reportedly expressed surprise that CSPE would be concerned with such matters.

Mr. Hammond was unresponsive and stated that BART would talk to CSPE only through BART's own legal counsel.

The Diablo chapter began to gather information to determine if the three engineers' actions, which led to their dismissal, were consonant with acceptable professional conduct. The CSPE Transportation Safety Committee reviewed their testimony to establish if their concern over public safety and alleged misuse of public funds was justifiable. By early April available information suggested that both the charges of the engineers and their professional conduct were reasonable. A meeting with State Senator John Nejedly was arranged. Senator Nejedly cautioned that the current popularity of mass transit might make a legislative investigation difficult. In addition, he pointed out that safety concerns prior to an accident are always difficult to promote. Nonetheless, Senator Nejedly offered his support if CSPE could furnish facts.

Just minutes prior to the meeting with Senator Nejedly CSPE president, Mr. William Jones advised Mr. Verdugo and me that any allegations against BART's Engineering Consultants would be viewed dimly by many society officials and that he personally could not support any actions or charges against the BART consultants. We explained that no action against the consultants was planned, even though they were deeply involved in all aspects of the system development.

At the CSPE annual meeting in May, outgoing President Jones urged full membership support of the effort to vindicate the three engineers. A motion to establish a CSPE legal fund (a first) to support the three engineers was offered and unanimously approved by the CSPE membership present. Such enthusiastic support, plus the annual "President's Award" having been given to the Diablo Chapter, bolstered the spirits of those of us working on behalf of the three engineers and the public safety. The award in part read "In recognition of its outstanding and extensive activities in springing to the defense of members of the Engineering Profession and the interest of the general public . . ."

President Jones, on behalf of CSPE, obtained legal counsel to assist in the legal matters. However, the attorney's apparent disinterest caused an increasing concern on the part of the Diablo Chapter and the Transportation Safety Committee as to the outcome of any negotiations with BART for reinstatement of the engineers. Such concerns were expressed to both outgoing President Jones and newly elected President Robert Kuntz.

An investigation of the charges of the three engineers as to BART's alleged mismanagement was proceeding. Numerous interviews with a large number of individuals in public and private organizations in addition to reviews of various public records led to an unearthing of shocking abuses of the public trust and threats to the public health, safety and welfare.

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The Committee on Transportation Safety's report "The BART Inquiry" was completed and transmitted to Senator Nejedly in late June. This report became a catalyst for numerous investigations by several levels of government and was the first shot fired in the battle between national engineering economic interests and professional ethics.

The report, pinpointing areas of concern in both financial and technical matters, implicates both the BART management and its consulting engineers. An important finding of the report was that "the safety and reliability of the transit system is in question. Lack of systems engineering and poor quality control have caused excessive delays, excessive costs and a system many years overdue. No date for automatic safe and reliable service can be accurately predicted while the system remains under the control of the existing management. Major technical problems still exist." (1)

With the report in hand Senator Nejedly began to contact area legislators to seek support for legislative probe of BART. In addition, a petition campaign prior to his next meeting with area legislators was initiated by the Diablo Chapter, petitions were printed and press releases activated for the following Sunday newspapers.

These combined efforts culminated in a July announcement that all state legislators representing the area containing the BART district voted to request the legislative analyst, Mr. Post, to conduct an investigation of charges made by the CSPE report.

Post's report published November 9, 1972 substantiated and supported most of the CSPE concerns and additionally highlighted a considerably broader spectrum of problems. The report was followed by public hearings of the Legislature.

The following year was punctuated by reports from technical consultants to the Legislature, BART's own special safety consultant, a special study by the National Transportation Safety Board, additional hearings by the Legislature and another report by the Legislative Analyst in October of 1973. All questioned the system's safety.

The Legislative Analyst's second report of October 23, 1973, one year and seven months after the firing of the engineers, stated ". . . the continuing problem of train detection has reached a critical point, and it is evident that transbay service may be delayed for an indefinite period. . . ." It stated further that " . . . Public controversy over the failure of BART to perform as expected has generated a deepening loss of confidence in BART within the Bay Area counties and a corresponding loss of credibility for rapid transit in general." The analyst's report went on to emphasize ". . . It would be a mistake not to fully recognize that BART management and its engineerig consultant (PBTB) have failed to respond to the complex demands of starting up and 'running the railroad'.

They failed to marshall their total resources to deal effectively with the problems and to demand and receive reasonable performance from one of their major contractors, Westinghouse."(2)

The legislative report also expressed great concern about the effects of the numerous system failures and delays to its patrons on the systems future financial condition, "... a highly potent factor will be the transit user's reaction, particularly peak hour users, if reliability of the system is not greatly improved. Unless the system offers a service that is considered by users as reliable, the district will most certainly experience a sharp decline in future operating revenues." (3)

While the tide of public and official attitude seemed to be turning within the state, the federal government moves steadfastly to support the demonstrated incapacities of BART to design, construct and operate a transit system. In November, 1973 the deputy administrator for the Urban Mass Transit administration in announcing additional funding was quoted, "Washington is very impressed with the BART system and is very supportive of it" and further "If we felt there was serious management problems, I don't think we'd be putting another 34 million into the area." (4)

In spite of the extra time and money expended, the safety and reliability of BART seemed no more assured of resolution than the positions of the three engineers who first cared to raise possible questions of deficiencies and irresponsibility, to the BART Board of Directors.

In June 1972, the newly installed CSPE President, Mr. Kuntz, expressed apparent enthusiastic support for the ideals we were pursuing for both the public interest and the three engineers although he would never agree that CSPE general funds could be used to defend basic professional rights and responsibilities even in landmark cases. Mr. Kuntz's support soon paled in the face of the fire storm brought on by several consulting engineers as a result of the Diablo Chapter's petition campaign intended to persuade the Legislature to investigate.

The Diablo Chapter's petition asked for a legislative investigation of BART and specifically listed several items of interest. Two of those items were directly related to BART's consulting engineering services. The events that followed raised serious questions as to the fitness of certain NSPE/CSPE officers to hold office and NSPE's ability to properly serve its total membership.

A series of events were sparked by a letter dated July 17, 1972 to a member of the CSPE's Golden Gate Chapter (San Francisco) from the project director of BART's consultant, Parsons, Brickerhoff, Tudor and Bechtel (PBTB). The writer noted "... it is extremely strange that a national professional society of engineers should allow a relatively small chapter of their organization to take this position without clearance from either the state organization or the national." (5) The Golden Gate Chapter, without the knowledge of the Diablo members, began a movement to discredit the Diablo Chapter efforts. It wasn't until the CSPE Board of Directors' meeting on August 19 that any CSPE unified discontent was voiced. Much to the shock of Diablo president Verdugo the recommendation to censure the Diablo Chapter for its activities was made to the Board of Directors by the CSPE Executive Committee. The Executive Committee, which consists of the elected officers of CSPE, had met on Aug. 12 and had passed the motion to censure with but a single dissenting vote.

The Executive Committee had given no notice to Diablo Chapter of either the intended discussion on August 12 or of the recommendation to the Board for the censure on August 19. No evidence was requested or opportunity to defend a position was offered. If Mr. Verdugo had not been present at the Board Meeting the censure vote could have taken place without the knowledge of or information from the Diablo Chapter. Through Mr. Verdugo's appeal to various Directors for reasonable consideration and fairness the subject of censure was deferred.

The irony of one of the charges in the censure move was that the Diablo Chapter had not given the BART consulting engineers adequate opportunity to discuss their position with regard to the charges made by the petition.

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The Golden Gate Chapter spearheaded the censure move. That Chapter's president, Mr. Edward Walker, had on several occasions urged Mr. Verdugo and myself not to pursue any action on behalf of the three engineers or any investigation into the BART management. He urged us to talk to the PBTB management. In April, 1972 we had agreed to meet with PBTB if he would arrange the meeting. He was apparently unable to gain any interest for such a meeting. The Golden Gate Chapter was a logical liaison with BART as the BART chief engineer, Mr. Hammond, was a member as were various employees of PBTB.

Some insight into the philosophies of Mr. Walker, himself a consulting engineer, can be seen in excerpts from a letter to the editor of CSPE's California Professional Engineer. "CSPE is NOT a labor organization, hence cannot represent the fired 'engineers' without even stronger support for BART management who happen to be Registered Professional Engineers and members of CSPE." The fact that the letter was in the 1973 May/June CPE subsequent to the publication of numerous technical studies supporting the "engineers" and Diablo contentions, makes the next excerpt seem somewhat incredible. "You also neglected to mention that the action of these three men to 'protect the public' was in large measure their judgement as opposed to the judgement of the Registered Professional Engineers in the BART management." Finally, Mr. Walker " . . . asks that CSPE refrain from filing an 'amicus curiae' on behalf of the three men who were fired from BART." (6)

Mr. Jones, 1972 state president of CSPE, who later actively supported censure of Diablo, stated on June 18, 1972 that CSPE was "organized for the welfare of its members" and "not organized to protect the public interest." (7)

An ad hoc committee to hear and make recommendations on the charges against Diablo was appointed by CSPE President Kuntz. On November 9, 1972 the hearing was held in San Francisco before the four member committee.

The charges against the Diablo Chapter previously outlined in Mr. Walker's letter of August 17 were presented by Mr. Jones along with arguments of why censure was necessary. The Diablo Chapter's actions were defended by Mr. Verdugo and myself along with support by other chapters and CSPE officers. Substantial impact on the hearings was made by the presentation of the Legislature's report, released that day, which offered unqualified independent proof of the validity of the concerns expressed by Diablo. The BART train accident in October also was a matter of record.

The ad hoc committee, with two of its four members owners of consulting firms, unanimously voted that the Chapter did not violate the Code of Ethics in its pursuits. The Committee, in its November 17 report, stated ". . . after listening to the discussions presented by the Diablo chapter and reviewing the information prepared by them, the Committee feels that the members of Diablo Chapter were indeed motivated by a strong sense of duty to public welfare, for which they should be commended," and further ". . . it is the finding of this Committee that action of the Diablo Chapter was in accord with the spirit of Section 2a of Ethics for Engineers." (8)

The ad hoc committee report was subsequently transmitted by President Kuntz to NSPE President James F. Shivler on November 28, 1972, with the reminder ". . . there was some concern expressed by yourself and Bob Nichols with the action of our Diablo Chapter in connection with circulation of a public petition asking for a legislative investigation of BART."(9)

Mr. Nichols was the chairman of NSPE's Professional Engineers in Private Practice (PEPP). In his letter to the Diablo Chapter in September, Mr. Nichols expressed his distress over the Chapter's activities. "This matter was discussed at our recent NSPE/PEPP Ececutive Board meeting with considerable concern. It is very distressing that a Chapter within NSPE has seen fit to raise such serious questions concerning an area of practice of engineering." (10)

The charges against Diablo were seen by the chapter officers as a tactic to discredit all efforts by the chapter both to defend the three engineers legally and to protect the public interest. The actions did diffuse a concerted effort for support by CSPE for legal action. A continuing stalemate prevents NSPE/CSPE from supporting the three engineers.

In view of the difficulty of moving forward with any legal action, I moved in November, 1972 to find legal counsel for the three engineers. In cooperation with Mr. Justin Roberts, reporter for the Contra Costa Times, an attorney from the Bay Area who agreed to act as counsel for the engineers was found and a subsequent suit was filed. A small retainer was requested and an effort was made by Diablo to gain release of the CSPE Legal Fund to the attorney. Even though the Legal Fund was established in May for that purpose and funds had been donated, no release could be obtained.

In early August, 1972, in a visit to Washington, D.C., I discussed the firing of the BART engineers and CSPE activities with NSPE attorney, Mr. Milton Lunch, and the editor of NSPE's publication Professional Engineer, Mr. John Kane.

Mr. Lunch suggested that there were NSPE funds in the potential amount of $5,000 that could be used if CSPE would make a request. He was quite receptive to the events and offered his cooperation. Due to subsequent pressures on CSPE, the funds were never requested.

Mr. Kane was extremely interested in the three engineer's plight and urged me to submit an article for the Professional Engineer. Although the article was submitted in November, it was never published.

In February, 1973, eleven months after the firing of the three engineers and three months after the Legislative report, a short article did appear in the PE. The article noted that ". . . after a three month study of charges brought by three former BART engineers, the chapter submitted a 400 page report to Bay Area state legislators who then requested the legisative analyst's investigation of the transit system". (11) It further cited the resulting Legislative report of November 9. The significance of the article, in addition to its tardiness, was that the three engineers were referred to as "former BART engineers" without any comment on why they were no longer working for BART.

In June, 1973, the NSPE officers and Washington staff were confronted with another crisis. The Diablo Chapter in January had submitted Mr. Justin Roberts' name for the NSPE journalism award. Mr. Roberts, also nominated for a Pulitzer Prize for his investigative reporting of the BART issue, was awarded the NSPE first prize by a committee of engineering and journalism school deans. NSPE members read for the first time in an article concerning Mr. Roberts' reports on the BART firings, sixteen months after the fact, that a NSPE member had been fired for supporting the NSPE Code of Ethics.

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It is of considerable interest to note that in the February, 1973 issue of PE, in which the first BART article appeared, a full page discussion of the Justice Department's suit against NSPE also appeared. The suit concerns provisions in the NSPE Code of Ethics making competitive bidding by consulting engineers unethical. Disastrous effects on the public health, safety and welfare were forecast. The discussion also noted that a task force had been appointed and had prepared a paper "In the Public Interest". A legal firm also had been retained to argue the suit.

A legal fund also was announced. The antitrust suit has been touted in many of the PE publications as well as the promoting of a national publicity campaign by the NSPE organization. We were told in January of 1974 that the case will be carried to the Supreme Court if necessary.

If individual engineers want changes which help to protect their financial wellbeing as well as professional ethics, then they must act. Only a grass roots invlovement in the professional organizations can bring about change. The economic interest or other selfish motives of a few will control all organizational activities to their own individual benefit.

It is unlikely that we will soon see another case where so much evidence, supporting acts in the public interest by employed engineers, will be so well documented by professional engineers and public authorities. Yet, we have seen the issues subverted and cover-up occurred through unethical acts of other engineers How often ethics are subverted with harmful effects on individual engineers and the public is unknown. I know of no professional engineering organization that actively encourages their members to register complaints based on ethics and then follows through with investigation and action.

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(9) Robert J. Kuntz, President CSPE, Letter to James F. Shivler, November 28, 1972.

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TECHNOLOGY, Its Control and the Engineer

Neil H. Schilmoeller

I. Introduction

Decision making in a technical field continues to be studied as it has since man first traded a pelt for a stone ax. The complexity of today's technology with its rapid developments creates a situation where the control of technology or of a technological industry is being put to a severe test. It appears that as any one field becomes more technical, society is tempted to call in more and more experts for policy decisions. Thus, the general public is moved further and further from the seat of control. This loss of control may be lessened by more study along old lines of thinking but newer points of view are required to reverse this trend.

Technology is variously defined, but may be described as the application of scientific knowledge to the solution of socially or economically defined problems, that is, the utilization of scientific knowledge for social purposes (2). LaPorte goes on to point out some problems which have developed in our great earnestness to apply the technical Band-Aid to each social and economic woe. Increased capacity to control physical items such as nuclear fission has not been paralleled by an increased ability to control social and political events. Greater complexity resulting from utilizing technical potential broadens a given corporation's need for resources and results in demands for a linking with similar organizations to form webs of interdependence. All of this contributes to an increasing overall feeling of uncertainty as to who really controls what and from where. Technology has become the driver and many feel (3) that societal control will be lost, if it is not already lost, especially if major changes, such as a shortage of energy, were to occur.

The technical complexity of a nuclear power plant will serve here as an example to illustrate this dual problem of understanding and control. How can the public guard its safety and well being in a nuclear age? Who is responsible to see that this well being is properly represented in corporate America? Various answers have been offered such as use of a social audit or of a cost-benefit analysis. Steinfels (1) suggests that these and other new dimensions to the decision process will take on increasing importance as shortages of various kinds bring their burden to bear. How society operating in an energy crisis makes current decisions about nuclear power, for example, could have lasting and very long range implications.

This increase in capacity, complexity and uncertainty (2), contributes to a situation where federal, state and local governments have a decreasing ability to know the results of their own actions. The driving force behind this increase in technical complexity has been the modern corporation while the technical know-how for this development has come primarily from the engineering profession. As such, the understanding of the corporate decision process should be of prime importance to the engineer and to his professional societies.

I would like to propose that engineers and engineering societies are legitimate and logical arms of a troubled society trying to control its technology and that the engineer must become more active in corporate decision processing. Perhaps the new point of view may really be an enlightened understanding of an older societal responsibility which has always been part of an engineer's role but with the panorama of considerations broadened.

II. Nuclear Power as an Example of Modern Technology.

The Modern nuclear power plant offers an ideal example to illustrate the problems of societal value application and societal control. The broad dimensions of the decision problems associated with a modern nuclear power plant may be appreciated through a short review of some of the technical and economic characteristics involved in the installation of nuclear power facilities.

A) The demand projection: All power companies develop their long range (8-15 years) plans around projected demand for electric energy. Projecting demand is a precarious process at best. Over the past 25 years the national trend has been followed by a doubling every 8-10 years. However, in local areas the rate of increase may vary from 5 to 15 percent per year. The addition of one large plant to a modern power network may add 3 to 10 percent to the total power of that system. An example is the addition of the 2200 megawatt (10^6 watt per megawatt) Donald Cook Nuclear Station on the Indiana and Michigan Electric Company system of over 30,000 megawatts. The demand projection is used to decide to construct such a nuclear plant which will take about eight years to deliver the first watt-hour of energy. Because of the time involved and the size of these units electric companies work hard to see that demand projections made 5 to 10 years ago are met. This and the utilization of off-peak period capacity are the major means of increasing utility earnings. Thus, the demand projection appears to be self fulfilling.

B) Licensing procedures: The nuclear industry is one of the most tightly regulated technical fields in today's economy. In most states 20 or more licensing applications are part of the regulatory and review process (4). This process begins with the Atomic Energy Commission on the national level and continues to local building and zoning laws. Kaufman (4) describes this process and what it has meant for New York State residents. The quandary is not only the involved process but the unpredictability of the length of time required to secure an operating license. This makes planning difficult at best. In addition, licensing is not a control of nuclear power expansion or of electric energy consumption.

C) Nuclear vs. fossil fueled plants: The application for a license to construct a nuclear power station must include a comparison of energy source types using a cost-benefit analysis approach (5). This analysis procedure is supposed to include social and ecological factors through a process of apparent costs for each effect considered. Most engineers are not used to assigning costs to items and procedures which cannot be sold. For example, how does one measure long term effects of radiation products? To date these procedures have not been effective as a tool for regulating development of nuclear of fossil stations wherever and whenever they were proposed. The cost-benefit approach has, however, helped decide changes on proposed systems. A major weakness of the cost-benefit approach is that no analysis is made of who gets the extra costs or extra benefits.

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D) Siting of a power plant: The nuclear plant requires about 200 acres for the plant and facilities plus right-of-way for power lines. The site must have water for cooling in amounts ranging in the millions of gallons per hour. Sufficient area for cooling the water is required. The Dresden Nuclear Power Station southwest of Chicago uses the entire flow of the Kankakee River in times of high power output in hot weather to cool its three generators. The A.E.C. hearings on the Palisades Nuclear Plant at South Haven, Michigan, demonstrated the length to which society can legally go today in its concern for environmental problems. That hearing was terminated when the Consumers Power Co. agreed to build cooling towers thus reducing the electric capacity and the efficiency of the plant.

E) Capital requirements: The Donald Cook Nuclear Plant will cost over $600 million before it is on line producing power. Collecting such large sums required a complex credit system. Projections over the expected 30 to 40 years life of a nuclear plant are required to justify the original investment and yet the unpredictability over that period makes these calculations complex and uncertain at best (6).

On top of this high level of capacity, complexity and uncertainty we are now told that the modern light water reactors (using uranium 235) are limited in number because of the amount of uranium available. Therefore, the liquid metal fast breeder reactor (LMFBR) must be developed immediately (6). These units have their own level of safety problems due in part to using sodium as a coolant and in part to the large inventory of plutonium available in any one nuclear core.

III. The General Problem.

The dichotomy suggested by LaPorte (2) of increasing procedures but loss of control is, thus, established. A free society has increasingly to turn to experts to make its decisions and in the process is losing its ability to control the very technology which is part of it. Because of our present dependence on this complex technology for existence, man must find better ways to effect rational and thoughtful decisions compatible with long range objectives.

At present corporations appear to say, "Let the government do it.", while vocal groups in society have increasingly challenged the corporate system to be responsive to human and societal needs and values. The increasing complexity with increasing interdependence between corporations and even between countries make this marriage between social and economic factors very difficult at best.

Several ideas have been suggested to accomplish this mix. Milton Friedman, the economist from Chicago representing the strict constructionist point of view, says that the only object of a corporation is to make money and in the process it will do the best it can for society. In this case the government provides control and application of value. Burck(7), on the other hand, has suggested that corporations have a direct interest in society and its welfare and that decisions ought to be made using information on the response of society to corporate decisions. The notion that companies and businessmen should use the resources of their operation for social purposes has gained many fans but the fact is that such an idea may create some social problems of its own. Burck (7) concludes that social responsibility will drain talent and resources from corporate systems and in the end it is increased productivity which suffers.

Another suggestion is to utilize an outside director on the corporate board to represent societal interests. Legislation on this type of corporate response is being considered and has been pushed by various interest groups. Mace(8) and Melamed and Becker (9) have discussed the liability incurred by such an outside director while Zaleznik (10) has examined the relationship of an outside director to the board chairman and to the company. In general, the director approach always suffers from the slow feedback to an outside board member in the event of a problem.

Others have suggested the idea of a social audit (11) and still others pursue the cost-benefit (5) approach to major corporate decisions including nuclear plants. In both of these methods the problem to date has been to put numbers into the proper places to measure social responsibility. This is the first phase of the process to internalize the hidden costs to truly reflect the social costs involved. Males (5) and Morrison (12) show the problem of applying the benefit-cost analysis to a nuclear facility especially for Illinois (5) and examine some means available to internalize social costs.

Drotning (11) states that corporate executives must and can exercise leadership among their peers in the broad business community to effect long range social policy changes which must occur. But no one has yet drawn up an objective definition of socially responsible behavior and hence, no one has succeeded in measuring it consistently. Therefore, conclusions are difficult to draw at this time.

IV. An Overview of the Problem of Technology Control.

What can corporations do to account for human and societal values? Some have suggested doing nothing but make profits while others suggest methods which admittedly offer only marginal support. The quote from St. Paul to the Ephesians 6:12 seems appropriate.

"For it is not against human enemies that we have to struggle, but against the Sovereignties and the Powers who originate the darkness in this world, the spiritual army of evil in the heavens."

From the usual view of corporate America and using Milton Freidman's strict constructionist view of the corporate responsibility a quote from Ruben Alves (13) appears to sum up the picture. The corporate structure is abroad.

"Structures are not persons. They are not buildings. Not even organizations. Structures are global relations, and relations cannot be seen. They are to the society what the mind is to the body; the controlling logic of behavior. No matter how painfully an executive is aware of the need to humanize the economy by making it responsive to human values, there is nothing he can do to change the logic of profit. For this is the dominant global relationship that governs the rules of his game.---This it seems to me is the qualitatively new element characterizing our modern situations: Rationalized, organized power has become invisible as never before, and has gained the highest degree of efficiency, which borders invulnerability, known in history."

These views have a distinctly negative appeal about them and I for one hold a more positive view of man's effect in the cosmos. The first question is where can we begin? Even in today's situation a few observations can be made as the problem of corporate responsibility and society control is divided and subdivided.

A) Political power is a fact. Anyone wishing to have a wide ranging effect must see the change in a political framework (10). For example, power companies want government

Continued...

regulation in each and every phase of nuclear power since that makes the competition somewhat fair or at least equal while maintaining a reasonable safety margin.

B) There are apparent weaknesses in the regular human decision processes which allow man to drift through decision after decision toward a null point. Any society must recognize this and guard against it perhaps by lending an ear to prophets and other radical voices speaking to this concern. Lonergan (14) says it this way,

"By his own light he selects what he believes is intelligent and reasonable by practical course of action; and as that practically is the root of the trouble, the civilization drifts through successive, less comprehensive syntheses to the sterility of the objectively unintelligible situation and to the coercion of economic pressures, political forces and psychological conditioning."

C) Values held by society must be examined and reevaluated as a regular process. Bremer (15) suggests that rather than the church and the community setting a blend of values for our young people that modern business is setting these values mainly through TV and even through the schools. Drotning (11) suggests the old idea of "Watching what corporations do and not listening too closely to what they say they are doing", is the most appropriate stance.

D) Good management is still highly desirable especially in the application of social responsibility. It can reduce the choices as far as possible using all available technical means. The required element is a broad view of this responsibility and of the assets of a corporation.

The potential answer must lie in some element of the human kind which has a close association with the production of goods and with the technology leading to those goods. Referring to our example of the nuclear power plant the people most in position to make observations on design and operation are the engineers. They have supplied much of the technical information related to the basic decisions required in plant choice, siting, equipment and operation.

If the engineer is to supply proper judgement and perspective to decisions relevant to nuclear power plants, what can be observed about the situation he needs to operate effectively? Through the years many professional magazines have called for more professionalism among engineers. An engineer may be professional in that he can make proper technical analysis but this will not be enough in the future. LaPorte (2) questions what it would be like to use technology applied in creative ways in the direct pursuit of human values. He suggests that we shall not begin to know the answer until we have the resolve to lay upon the men who design and carry out technological change, a range of criteria we simply have not had the wits to demand. In our effort to apply current technology in the nuclear power plant example we touched on several areas of social science, i.e., sociology and psychology. The range of requirements for professional decisions now must cover these and a much wider set of parameters than was originally expected in the socially and economically defined problems facing technology in the past. This standard poses special requirements in the training of an engineer if he is to fill this decision-values gap. Engineers are still the main source of application in most technical fields and are likely to continue in that role.

V. Conclusion.

The nuclear power plant is only one in along series of increasingly complex technical developments. The problems are complex and are philosophical in their basic nature. How should these decisions be made when considering the difficult problems of radioactive materials and the probability, though small, of a rupture of a seam line and subsequent loss of coolant? The loss of coolant accident is not well understood and inconclusive data may be used in some designs. Jacque Ellul (3) writing in "The Technological Society" suggests we are locked into a new universe of our making. We no longer control it and do not yet understand it. Attempting to create a world of plenty through technology, Ellul suggests we have created a dehumanized hell. This is the problem we face without effective control of our technology.

Professional societies and forward looking corporate executives are the most appropriate prospects to set up definitions and job descriptions within which the engineer can carry out this role of social responsibility. A method of participatory decision making has been suggested and is being used with some success to account for wider dimensions of technical problems. The interesting aspects of this participatory system are the side effects of reduced production costs and greatly improved quality of the work (16). A difficult point in such a system is the leadership representing the management which is not comfortable with any challenge of its perogatives for total authority. In our example of the nuclear power plant engineers must exercise their analysis of the salient features through reports and through participation in relevant decision processes. Whether the social audit or the cost-benefit approach can be refined sufficiently to be effective in corporate management decisions remains to be seen. The exact mechanism of this participation might be suggested by the professional societies such as the American Nuclear Society and The American Society of Mechanical Engineers as well as the IEEE and others (17).

The legal and political arena cannot be overlooked because of the potential it offers for uniform application of socially responsible decisions. The recent New York City Bar Association Study of "Electricity and the Environment" (18) suggests a number of changes which help develop legal tools for the public to use against corporations and agencies. These should help to eliminate some of the suspicion caused by secret procedures common in some of these units. More can be expected from this field in the future.

Finally, Bremer (15) suggested a number of points for professionalism in business which might be translated for engineers today as follows:

1. Recognize that analysis of problems indicating social dimensions may be correct. These areas being new there is always a temptation to avoid decisions of this type.

2. Think of social responsibility as an integral part of each problem and as an internal concern of the corporation. Application of values within the company must be recognized in addition to the more usual volunteer work outside the company by corporate executives, engineers and others.

3. Increase the ability to recognize the social consequences in engineering and management decisions. This may require extensive educational efforts including expanded undergraduate experiences and diversified educational opportunities for current professionals. Other experimental devices especially as provided by the professional societies may be required to raise this consciousness.

4. As the engineer moves into management he needs to develop a sense for setting social goals. This is an important function as reasonable goals are important for motivation and for proper functioning human organization.

Continued...

If the premise that technology is slipping out of control at present is correct and as a result the public is loosing its hold more and more, then the engineers and their professional societies have a real gap to fill. This is a big responsibility and the task will not be easy in this uncharted and vague area. During this period of scarcity the problems will be more acute and the opportunities to compromise will be more difficult to overcome. The stakes are high but the goal is worth the special effort. Can the engineering profession meet this challenge?

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Letters

Dear Editor:

In the December CSIT Newsletter you ask whether "the underpinnings of most IEEE activities are commercial".

I would answer with an emphatic 'yes'. IEEE activities are underpinned by companies in terms of money when they treat conference travel, accommodation, and fees as recoverable expenses; in terms of time when they permit staff to take part in IEEE committees, meetings, and other activities in working hours; and in kind when we use company shorthand, typing, copying and mailing facilities, to say nothing of stationery, to conduct IEEE business.

If we need any reminder how dependent the IEEE is on industry, we need look no further than SPECTRUM's difficulties when advertising revenue fell off, and the loss on the Annual Convention when the depression in the electronics industry produced a large and sudden drop in the number of delegates.

Of course the IEEE benefits industry, by maintaining the standards of electrical engineering education and of the electrical engineering profession, by providing the opportunity for companies to make their work known in IEEE publications and for electrical engineers to keep up dated by these same publications and by attendance at meetings and conferences which the IEEE organises.

So companies provide support for the IEEE in return for IEEE services from which the companies benefit, and these, in my opinion, are the essential elements of a commercial transaction. Let us recognise, therefore, that the IEEE is underpinned by commercial activities and not feel irrationally uncomfortable whenever this proposition is suggested.

Yours sincerely,

Robert Winton
London UK

Dear Editor:

In issue 6 of the CSIT Newsletter is an article by W.L. Elden, which implies that only P.E.'s are ethical and care about safegaurding the public interest. As a non P.E., I consider this an insult and an example of the kind of writing that does more to divide Engineers and keep a Code of Ethics for ALL Engineers from being developed.

Sincerely,

Marc T. Apter
Sterling, VA

Mr. Elden replies:

My article in issue 6 of the CSIT Newsletter was not intended to imply that only P.E.'s are ethical, but rather to bringout that while P.E.'s are the only engineers legally bound to a code of ethics, in an industrial situation where they are employees they are caught in a dilemma, without much help to back up their decisions. The real message was that if P.E.'s are caught in a dilemma the non-P.E.'s are in a worse situation by not being licensed. I feel in the long run it will be in the best interest of every employed engineer to become licensed and to have one day the State and the NSPE or some other mechanism to come to the side of the ethical engineer who takes a professionally responsible stand.

To show Mr. Apter that I do consider non-P.E.'s to be ethical, in my article I asked for national support of the 3-ex-BART engineers whom I feel acted ethically and set the example which several BART management P.E.'s should have done themselves. I recently wrote the CSPE Executive Director and asked what action was taken against the BART management P.E.'s who did nothing when they were informed of safety problems by the 3 ex-BART non-P.E.'s.

Continued...

Dear Editor:

.....It bothers me that the committee (CSIT) has not yet addressed the strictly international implications of the impact of technology on society - at least, not so far as I can tell. Indeed, two of the committee's nine working groups have the (to me, redundant) adjective "National" in their titles. Yet the IEEE is, surely, very much an international organization (or "transnational", as the past-President preferred to call it), by both policy and intent.

My suggestion, which I will word as a proposal, is that an additional IEEE - CSIT Working Group on International Implications be formed.

The international dimension is, I presume you agree, inescapable- witness the world-wide nature of the energy crisis, of communications systems (especially satellite systems), and so on. On the more local, but still international, North American scene, there is the Great Lakes pollution issue, the Alaska pipeline, and several other obvious situations of concern to the international (U.S. - Canadian, in the case of the above two examples) society.

I would be interested to hear the committee's reaction to my suggestion.

Sincerely yours,

Basil R. Myers
Orono, Me.

Dear Editor:

In regards to the IEEE CSIT Newsletter article "The Engineer and Military Technology," would you please request the Secretary of Defense to have an article written to state the detailed, official position on questions discussed. I am most concerned about this matter. For if they are correct we should reduce the armed forces. If they are wrong it appears that W W III is simply around the corner because we have reduced our forces too much already. It appears the current inbetween course is incorrect.

Sincerely,

Clarence S. Summers, Jr.
Alexandria, VA

Dear Editor:

The statement on page 3, reference 4, of the March CSIT Newsletter is in error. Your statement reads: "Officials may request that a Newsletter reprint an article written by a corporate manager in an area of interest to his company."

This article by Mr. Ross was a part of the Proceedings of the "Conference on Research for the Electric Power Industry", held by the IEEE Power Engineering Society in Washington, DC, December 11 - 14, 1972. It was an invited paper.

The impact of the paper in this Conference was so great, and it was judged so informative, that the leaders of the Conference requested that it be made available through the Newsletter to the many engineers who could not attend the Research Conference. Every copy of that Power Newsletter has been distributed, and there have been demands for more, one from a first rate engineering college (40 copies) for classroom use.

The pressure to reprint the article did not come from Mr. Ross employer. In fact, I had to obtain permission from Mr. Ross, and his company, to reprint it.

Sincerely,

E. W. Morris, Editor
IEEE Power Engineering Society Newsletter,
and Transactions on Power Apparatus and Systems

The Editor Replies:

The offending sentence is corroborated, not contradicted, by the response ("... leaders of the conference requested..."). At no point did the editorial imply that pressure to reprint came from the corporation.

While it is perfectly appropriate for an individual (official or otherwise) to request an organization to publish informative material and for an editor to exercise discretion over what is printed (or reprinted) the story does not end here. There happen to be areas of controversy within engineering in general and electrical engineering in particular, where the airing of a spectrum of views would enhance informed reader judgements. An editorial policy discouraging divergent views whether in article or letter form can only result in a selective journal and a poorly informed readership - this was the point of the editorial.

CSIT Activities

Working Group on Systems Engineering and Public Technology (WG-SEPT) -- A Report and an Invitation

In organizing the Working Group on Systems Engineering and Public Technology (it was initially called Working Group on Applications of Systems Engineering), we first had to address the question of the purpose of such a group. The present answer for WG-SEPT is as follows:

To address significant questions in the area of the application of systems engineering to societal problems, where there is a prospect of making a worthwhile contribution.

To choose programs which require and stimulate the participation of interested members of various capabilities.

The initial project chosen includes a study of ways to help interested IEEE members get into the field of public technology, assistance in drafting an IEEE position paper on public technology, and delineating measures that IEEE could take promote member participation in public technology.

As a result of considerable correspondence among members of the committee (which presently number its members from widely distributed parts of the United States), we have been able to divide this project into the tasks listed below, and are now seeking volunteers to undertake specific assignments (including references to be examined). The tasks are:

(1) To define systems engineering, and to point out where systems engineering has application to societal problems.

(2) To describe past efforts to employ aerospace engineers and scientists in local governments.

(3) To describe job-man matching systems which have been used in the past, in order to determine whether such a system can be established for interested IEEE members with respect to public technology.

(4) To compile a detailed list of government agencies, which are or might be in the public technology field. Such a list might be
- (a) made available to IEEE members interested in paid or volunteer work in public technology
- (b) used in setting up a job-man matching system.

(5) Used to determine which additional education might be offered to engineers to make them better qualified for public technology.

A topic which attracted considerable interest is Urban Technology/Transportation. CSIT has now recommended that this area be incorporated into WG-SEPT. Readers interested in this area are hence invited to join WG-SEPT. Suggestions on projects that the working group could undertake in this area are particularly welcome.

WG-SEPT needs additional members in all of its areas and at all levels of experience. Readers interested in participating should contact the WG-SEPT chairman.

Gerald Rabow, Chairman, WG-SEPT
309 Grant Ave. , Nutley, N.J. 07110 (201) 235 1978

IEEE CSIT Working Group on Energy/Environment

CSIT has recently formed a working group on Energy/Environment. This group will address both national and international energy requirements, alternative energy sources (coal, solar, geothermal, wind, fusion, etc.), more efficient uses of existing energy resources and their impacts on the environment. Related articles and position papers for IEEE publications will also be prepared.

The group currently has about thirty members. Periodic newsletters and meetings are planned both to discuss projects and plan strategy. Contact and cooperation with groups having overlapping interests will be maintained. These groups include, among others, the IEEE Power Engineering Society, the CSIT working groups on Systems Engineering and Public Technology and on Communications, and Ralph Nader's Center for Science in the Public Interest.

Those interested in participating in this working group's activites, please contact:

Paul M. Russo
RCA Laboratories
Princeton, NJ 08540
(609) 452-2700, ext, 3231

EFFECTS OF AUTOMATION ON WORK

A CSIT Working Group on Applications of Computers and Automation to the Humanization of Work, is being formed. Those interested should contact M. Kutcher, IBM Systems Products Division, Neighborhood Road, Kingston, New York 12401.

NUCLEAR SCIENCE SYMPOSIUM

The 1974 Nuclear Science Symposium will be held in Washington, D.C., December 11-13. Of potential interest to those concerned with social implications of technology, will be sessions on safeguarding for nuclear fuels, environmental monitoring, and a one-day tutorial session on instrumental aspects of air and water pollution monitoring.

Those requiring further information may contact G. L. Miller, 1D-462 Bell Laboratories, Murray Hill, New Jersey 07974.

NELCON '74

The eleventh New Zealand National Electronics and Geophysics Convention will be held at the Mathematics and Physical Sciences Building, University of Auckland, New Zealand, Aug. 26-30, 1974. Discussions will include Computers in Medicine and in Law, and Safety in Medicine. For futher information, contact Nelcon '74, Centre for Continuing Education, University of Auckland, Auckland, New Zealand.

SIAM

The Society for Industrial and Applied Mathematics (SIAM) in January 1973 formally established and incorporated the SIAM Institute for Mathematics and Society (SIMS). SIMS' goals are to:

. Develop, promote, support and maintain research in the application of mathematics to the social sciences,

. encourage the involvement of mathematicians in the study and solution of societal problems,

. foster education in the applications of mathematics to societal problems.

During its first year SIMS has implemented two major activities in keeping with these goals. The Transplant Program has been started with the purpose of moving experienced mathematicians into interdisciplinary centers concerned with societal problems. The minimum residency for a "transplant" mathematician has been set at two years in order to make sure that he or she will really become deeply involved in one or more aspects of the projects of the host center; the thesis is that to be a consultant is in most instances just not enough. An important objective of the Program is to ensure that results applicable to the benefit of society are made available as quickly as possible -- particularly those which have both immediate and long range policy implications.

news, notes, & comments

All investigations in process and planned in the Transplant Program rely heavily on computing as an indispensable and integral aid. Societal problems generally do not lend themselves to the elegance often associated with mathematical research. Often large quantities of data are generated which require ingenious analysis and probing with the use of both mathematical and computing science techniques.

In addition to the Transplant Program, SIMS when appropriate holds special conferences, seminars, and workshops. SIMS 1973 Societal Conference at Sterling Forest surveyed the use of mathematics in five societal fields: ecosystems, environment, natural resources allocation, sociology, and urban services. A Health Care Workshop was held at the Harvard School of Public Health in November 1973. An in depth review of urban services was presented during a two and a half day Seminar jointly presented by the New York City Rand Institute and SIMS in January of this year. Next July SIMS plans two five-day Research Application Conferences at Alta, Utah; one conference will be concerned with ecosystems and the second with epidemiology.

SIMS participates in professional meetings by assisting in the organization of special programs and panels. The Panel "Mathematics and Society" at the winter mathematics meetings in San Francisco in January drew over 400 in attendance and made headlines in the San Francisco Examiner two days in a row. A similar Panel "Computing and Mathematics in Society" is scheduled for the NCC in Chicago in May. The theme of SIAM's National Meeting in June at Caltech is on societal problems and SIMS is helping to organize the program for the meeting; Dr. Alfred J. Eggers, Jr., Assistant Director for Research Applications (RANN) at NSF will be the keynote speaker.

The Transplant Program and the various meetings and conferences in which SIMS has been involved naturally complement one another in SIMS' efforts to attain the three goals noted above. And the strides made in 1973 toward these goals would not have been possible without the support and enthusiasm of many who have helped and participated in SIMS' various activities." -Don Thomas

(From the American Federation for Information Processing Newsletter)

A course in TECHNOLOGY ASSESSMENT is to be held at The University of Michigan, July 29 - August 2, 1974.

Technology assessment is a policy/action-oriented, systematic study of societal impacts which may occur when a technology is introduced, extended or modified. Emphasis is on higher-order impacts, that is, those that are unintended, indirect and/or delayed. This course presents the methodologies and analysis techniques required for technology assessment. For further information, contact Prof. K. Chen, Dept. of EE, University of Michigan, Rm 2501, East Engrg. Bldg., Ann Arbor, Michigan 48104.

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EDUCATION

(Vacant)

meetings of interest

CONFERENCE: July 14-19
Power Engineering Society Summer Meeting & Energy Resources Conference
LOCATION: Disneyland Hotel and Anaheim Comvention Center, Anaheim, California
SPONSORS: S-PE
GENERAL CHAIRMAN OR INFORMATION CONTACT:
C.J. Essel, Los Angeles Dept. of Water and Power, POB 111, Los Angeles, California 90054
PROGRAM CHAIRMAN: S.H. Gold, Southern California Edison Co., POB 800, Rosemead, California 91770

CONFERENCE: July 15-18
Nuclear and Space Radiation Effects Conference
LOCATION: Colorado State University, Fort Collins, Colorado
SPONSORS: S-NAP
GENERAL CHAIRMAN OR INFORMATION CONTACT:
E.A. Burke, AF Cambridge, Research Labs., Code LQR/ Stop 30, Hanscom Field, Bedford, Massachusetts 01730
PROGRAM CHAIRMAN: R.H. Stahl, Intercom Rad. POB 80817, San Diego, California 92138

CONFERENCE: July 15-19
International Conference on Fronteirs in Education
LOCATION: City University, London, England
SPONSORS: G-EDUCATION, IEEE UKRI Section, IEE, ASEE et al
GENERAL CHAIRMAN OR INFORMATION CONTACT:
R.C.G. Williams, County Consultancy Services, 8 The Flower Walk, Guildford, Surrey GU2 5HH England
PROGRAM CHAIRMAN: 1974 Frontier in Education, Secretariat, IEE, Savoy Pl., London, WC2R OBL, England

CONFERENCE: August 21-23
Engineering in the Ocean Environment International Conference
LOCATION: Nova Scotian Hotel, Halifax, Nova Scotia
SPONSORS: IEEE Oceanography Committee, Canadian Atlantic Section
GENERAL CHAIRMAN OR INFORMATION CONTACT:
O.K. Gashus, Nova Scotia Tech. College, POB/1000, Halifax, N.S., Canada
PROGRAM CHAIRMAN: J. Brooke, Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Canada

CONFERENCE: August 26-30
National Elec Conference, New Zealand (NELCON NZ)
LOCATION: University of Auckland, Auckland, New Zealand
SPONSORS: New Zealand Section, New Zealand National Soc., et al
PROGRAM CHAIRMAN: D.R. Hutt, IEEE N.Z. Section POB 6291, Auckland, New Zealand

CONFERENCE: September 10-12
Earth Environment and Resources Conference
LOCATION: Marriott Motor Hotel, Philadelphia, Pennsylvania
SPONSORS: IEE EQC, Piladelphia Section, USERC
GENERAL CHAIRMAN OR INFORMATION CONTACT:
M.S. Corrington, RCA Corp., Bldg. 10-8-1, Camden, New Jersey 08102
PROGRAM CHAIRMAN: E.P. Mercanti, 12415 Shelter Lane, Bowie, Md. 20715

CONFERENCE: October 6-10
Engineering in Medicine and Biology Conference
LOCATION: Marriott Motor Hotel, Philadelphia, Pennsylvania
SPONSORS: G-EMB, AEMB
GENERAL CHAIRMAN OR INFORMATION CONTACT:
Hun Sun, Drexel University, Philadelphia, Pennsylvania 19104

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