

ENGINEERING CODES OF ETHICS: ANALYSIS AND APPLICATIONS**Heinz C. Luegenbiehl and Michael Davis**

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The Public knows that doctors and lawyers are bound to abide by certain recognized **rules** of conduct. Not finding the same character of obligations imposed upon engineers, people have failed to recognize them as members of a **profession**.--A.G. Christie (1922), engineer

With respect to each separate profession we must begin by analyzing the functions it performs in **society**.| A code of ethics must contain a sense of mission, some feeling for the peculiar role of the profession it seeks to regulate.--Lon Fuller (1955), lawyer

1. Introduction: The Challenger Disaster

On the night of January 27, 1986, Robert Lund, vice-president for engineering at Morton Thiokol, had a problem. The Space Center was counting down for a shuttle launch the next morning. Lund had earlier presided at a meeting of **engineers** that unanimously recommended against the **launch**. He had concurred and informed his boss, Jerald Mason. Mason informed the Space Center. Lund had expected the flight to be postponed. The Space Center had a good safety record. It had gotten it by not allowing a launch unless the technical people approved.

Lund had not approved because the temperature at the launch site would be close to freezing at lift-off. The Space Center was worried about the ice already forming here and there on the boosters, but **Lund's** worry was the "O-rings" that sealed the boosters' segments. They had been a great idea, permitting Thiokol to build the huge rocket in Utah and ship it in pieces to the Space Center two thousand miles away. Building in Utah was so **much** more efficient than building on-site that Thiokol had **been** able to underbid the competition. The shuttle contract had earned Thiokol a **\$150** million in profits.' But the O-rings were not perfect. If one failed in flight, the shuttle could explode. Data from previous flights indicated that the rings tended to erode in flight, with the worst erosion occurring on the coldest preceding lift-off. Experimental

evidence was sketchy but ominous. Erosion seemed to increase as the rings lost **their** resiliency and resiliency decreased with temperature. Unfortunately, almost no testing had been done below 40°F. The **engineers had had** to extrapolate. **But**, with the lives of seven astronauts at stake, the decision seemed clear enough: Safety first.

Well, it had seemed clear earlier that day. Now Lund was not sure. The Space Center had been "surprised" and "appalled" by the evidence on which the no-launch recommendation had been based. They wanted to launch. But they would not launch without Thiokol's approval. They urged Mason to reconsider. He had re-examined the evidence and decided the rings **should** hold at the expected temperature. Joseph Kilminster, Thiokol's vice president for shuttle programs, was ready to sign a launch approval, but only if Lund approved. Lund's first response was to repeat his objections. But then Mason had said something that made him think again. Mason had asked him to think like a manager rather than an engineer. Lund did and changed his mind. The next morning the shuttle exploded during lift-off, killing all aboard. An O-ring had failed.'

Should Lund have reversed himself and approved the launch? In retrospect, of course, it seems obvious **that** he should not have. But most problems concerning what we should do would hardly be problems at all if we could foresee all the consequences of what we do. Fairness to Lund requires us to ask whether he should have approved **the** launch given **only** the information actually available. Since **Lund** seems to have reversed himself and approved the launch because he began to think like a manager rather than an engineer, we need to consider whether Lund, an engineer, **should** have thought like a manager rather than an engineer. But, before we can consider that, we need to know what the difference is between thinking like a manager and thinking like an engineer.

One explanation of the difference would stress technical knowledge. Managers are trained to handle people. Engineers are trained to handle things. To think like a manager rather than an engineer is to focus on people rather **than** on things. According to this explanation, Lund was asked to concern himself primarily with how best to handle his boss, the Space Center, and his own engineers. He was to draw upon his

knowledge of engineering only as he might his knowledge of a foreign language, for example, to help him understand what his engineers were saying. He was to act much as he would have had he never earned a degree in engineering.

If that explanation of what **Mason** was asking of Lund seems **implausible**, what is the alternative? If Mason did not mean that Lund should make his knowledge of engineering peripheral (as it seems **Mason**, also an engineer, did not when he earlier re-examined the evidence himself), what **was** he asking Lund to do? What is it to think like an engineer if not simply to use one's **technical** knowledge of engineering? Interestingly, that is a question engineers **have** been asking for almost a century. Answers have often been expressed as a code of ethics. So, it seems, one way to **begin** to answer our question is to learn something about those codes.

II. History of Engineering Codes

The first civilian engineering organization in **the** United States, the Boston Society of Civil Engineers, was founded in 1848. The American Society of Civil Engineers (ASCE) was founded four years later. Though the early leaders of these organizations often referred to **the** "high character and integrity" engineers needed to serve the interests others **committed** to them, the history of codes of ethics really begins a **half** century later. In 1906, the American **Institute** of Electrical Engineers (AIEE) voted to embody in a code the ideas expressed in an **address** by its president, Schuyler S. Wheeler. After much debate and **many** revisions, the AIEE Board of Directors adopted a code in March, 1912. The AIEE Code was adopted (with minor amendments.) by the American Society of Mechanical Engineers (**ASME**) in 1914. Meanwhile, the American Institute of Consulting Engineering, the American Institute of Chemical Engineers (**AIChE**), and ASCE each adopted a code of its **own**. By 1915, every major engineering organization in the United States had a code of ethics.'

These first codes were criticized almost as soon as they were adopted. They were (it was said) **too** concerned with duties to employers and fellow engineers. **An** engineer's duty to the public was merely to educate. For **example**, the AIEE Code (see

Appendix A) required the engineer to "consider the **protection** of a client's or employer's interest his first **professional** obligations, and [to]...avoid every act contrary to this duty (**sec. B.3**)."

An engineer's **duties** to the public were "to assist the public to a fair and correct general understanding of engineering **matters**, to extend generally knowledge of engineering... to discourage the appearance of **untrue**, unfair or exaggerated statements on **engineering** subjects." and otherwise to be careful what one said in public (**sec. D.16-19**). Though they often speak of "employers" as well as of "clients," the early codes seemed designed primarily for the engineer who contracts with many clients and is not dependent on any one of them. "Bench engineers," already numerous, seemed almost forgotten. But perhaps most serious, some codes permitted conduct others forbade. For example, the ASCE Code (Appendix B) forbade an engineer to "accept any remuneration other than his stated charges for services rendered his client" (**sec. 1**), while the AIEE Code (**sec. B.4**) permitted payments to the engineer from **suppliers** or other third parties if the client consented.'

Attempts to respond to such criticism began almost immediately. Among the first was the code (Appendix C) of the American Association of Engineers (AAE), itself an organization intended to include all engineers: None of the **early** attempts achieved much. But, on the eve of World War II, the American Engineering Council (AEC) began a process that almost achieved agreement among engineers on a single code of ethics. The AEC organized a **committee** to develop a code for all engineers. Each major engineering society was represented. When the AEC dissolved, the Engineers Council for Professional **Development** (ECPD) took over sponsorship. The resulting code was a conscious **effort** to synthesize the major provisions of earlier codes.

The ECPD Code was enormously successful at creating at least the appearance of unity among engineers. All eight major engineering organizations either "adopted or assented" to it in 1947. By 1955, it was accepted, at least in large part, by 82 national, state, or local engineering organizations. That was, as one commentator put it, "probably the greatest progress to be made ever before or since toward the realization of a single set of ethical standards for all engineers."

But the ECPD Code was not as successful as at first it seemed. Some

organizations, while "assenting" to the code, retained their own as well to preserve certain detailed provisions that seemed to suit their circumstances better than the corresponding provisions of the ECPD Code. As time went on, these organizations tended to rely more and more on their own code. The ECPD Code slowly lost influence.

The ECPD revised its code in 1963, 1974, and 1977 in an attempt to reverse this trend. Though many of the revisions were substantive, perhaps the most important were structural. Four "fundamental principles" replaced the "Foreword." The 28 "canons" and a long list of "guidelines" was added. These structural changes were intended to allow an organization to adopt the principles, but without the guidelines, if it did not want to accept the whole package. Though the guidelines are supposed to be read in the light of the principles and canons, they are in fact an independent code. (See Appendices D and E.)

The Accreditation Board for Engineering Technology (ABET) replaced the ECPD soon after these revisions were made. The revisions nevertheless gave the ECPD Code new life (though under the new name). The revised code (that is, the fundamental principles and canons) has been adopted, at least in part, by most major engineering organizations in place of their own code. There are, however, two important exceptions.

The National Society of Professional Engineers (NSPE) initially adopted the 1937 version of the ECPD Code but substituted its own code in 1964 and has since revised it several times. Though still having much in common with the original ECPD Code, the NSPE's Code differs somewhat both in structure and content. (See Appendix G.) The NSPE Code is important for two reasons.

First, the NSPE has a "Board of Ethical Review" (BER) which answers ethics questions members of the society submit. While some other engineering societies also have such an advisory committee, the NSPE is alone in publishing the advice. BER "opinions" are printed several times a year in the NSPE's magazine, Professional Engineer. About 200 opinions have been collected and published in four volumes, the last covering the period 1971-75. These opinions constitute a valuable resource on

many questions of engineering ethics.

Second, because professional engineers are licensed by states, the **NSPE--through its** state societies--has a role in the **regulation** of professional engineers much like that state medical societies **have** in the regulation of doctors. The NSPE Code is at least potentially enforceable (though only **against** registered engineers) in a way other codes of engineering ethics are not.

The other independent code, that of the Institute of Electrical and Electronic Engineers (IEEE). is **important** for different reason. The IEEE. with over 300.000 members, is the largest engineering **organization** in **the** United States. Its code, adopted in 1979, represents an alternative to the others. It is much briefer than **the NSPE's** (though significantly longer than the ABET Code without the Guidelines). It applies only to "members" of IEEE. Some of its provisions are unusual as well. For example, "Article **II**" enjoins engineers "to treat fairly all colleagues and co-workers regardless of race, religion, sex, age, or national origin", while "Article **III**" expressly limits what engineers owe employer and client to what is consistent with "**other** parts of this Code." (See Appendix F.)

These three codes (four. counting the ABET Guidelines as separate from the ABET Code) today serve as ethical **benchmarks** for engineers. Several others, including an umbrella code proposed by **the** American Association of Engineering Societies (AAES) and a "**Uniform** Code" proposed by the IEEE, are **being** debated. No doubt. others will follow. (For **the** AAES Code, see Appendix H.)

III. Codes of Ethics Today

Most professions regularly amend their codes of ethics. Many have **undertaken** drastic revisions more than once. But engineering seems to be unique in the number of competing codes proposed and adopted over the **years**. Why has the history of codes been different for engineering? Is engineering, or engineering ethics, itself unique?

Chief among the explanations often advanced for the number of codes is that engineering is simply too diverse for one code of ethics to apply to **all**. Some engineers

are **independent** practitioners. Some ~~are~~ employees of large organizations. Some are managers. Many are closely supervised. Some, whether in large **organizations** or on their own, are more or less their own boss. Engineers (it is said) just do too many different things for the same standards to apply to all. In sum, engineering is not a single profession but a family of historically related professions.

Though much rings true in this explanation of the number of codes of ethics, something rings false as well. If the divisions in engineering were like that, say, between medicine and dentistry, why would **engineers establish** "umbrella" organizations and devote so much time to trying to achieve one code for all engineers? Doctors and dentists have not made similar efforts to write a single code of ethics for their **two** professions. The three-quarters of a century engineers have tried to write a code for all engineers is--like the existence of **schools** of engineering--evidence that engineers all belong to one profession, however **divided and** diverse its membership. Indeed, we might think of the effort to write a single code as an **attempt** to preserve the unity of **the** profession. On this view, the **number** of codes proposed and adopted is an instance of the "**NIH**" (**Not Invented Here**) phenomenon. **The** number of independent professional organizations, not the existence of several engineering professions, explains the number of competing codes⁶

The NIH phenomenon is likely to be strongest when each side has good reasons for its view. Perhaps this is such a case. One side is certainly right to point **out** that a short code, like the Ten Commandments, is easy to remember or consult. It can be conspicuously posted to remind engineers of their obligations. A short code is also easier to get approved because its necessary **generality** automatically obscures disagreement over details of conduct. **But** the **other** side can also point out that a long code can provide much more information. It can take into account special circumstances, make exceptions explicit, and **otherwise** provide more guidance, at least for those willing to take the time to read **it through**. It can make it less likely that engineers who think they agree on standards will suddenly discover that they do not at a moment when the discovery is costly. Some professionals, for example, **lawyers** and accountants, long ago opted for a long code like the **NSPE's** or **ABET's** Guidelines.

Others, for example, doctors and social workers, have opted for a **short** code like the **IEEE's** or **ABET's** fundamental principles and canons. Though the various codes differ in more than length, the other differences also seem to be founded on more than pride of authorship. The NIH phenomenon thus only partly explains why engineers have not been able to agree on a single code.

Whatever the explanation of the **number** of codes, there is no doubt that their variety **could** make it hard for an engineer to know what to do. An engineer who belongs to several organizations might be subject to several codes. Which should she consult? If the codes differ on some point, **which** (if any) **should** she consider binding. **What** should other engineers think of **her** if she chooses to do what one code allows even though another forbids it? **What** should **they** do?

These difficulties are not as serious as they may seem. In general, the various codes are not enforced by the organizations adopting them. Though the language often resembles **that** of statute, codes of ethics are in fact more like guides to conscience or public judgment, that is to say, moral **rules**. An engineer who violates the code of one of the organizations to **which** she belongs is not likely to **be** expelled (or even **formally** censured). **She** is even less likely to have her "license to practice" revoked (since most engineers are not licensed at **all**). Apart from pangs of conscience, the only repercussion she is likely to suffer is **the** bad opinion of those who know her well enough to know what she has done. Her primary concern should be one of justifying her conduct to those concerned, herself included.

But thinking of codes of ethics as moral **rules** rather than legal rules seems to **suggest** new **difficulties**. If codes of ethics are merely moral rules, why worry about them at all? Why should each engineer not let **his** private conscience be his guide? Why should he have to consider what **some** organization of engineers has to say about **what** he should do? What expertise can engineering societies have in morals? Aren't the experts in morals philosophers or clergy rather than engineers? To answer these questions, we shall have to consider the relationship between professions and codes of ethics.

N. Codes and Professions

A code of ethics generally appears when an occupation organizes **itself** into a profession. Why this connection **between** codes of ethics and organized professions? We may distinguish three common explanations.

One, what we might call "definition by paradigm." has would-be professions imitating the forms of widely **recognized** professions. To be a profession is to be like the most respected professions. the paradigms. Since the paradigms--especially law and medicine--require long training, special skills. licensing. and so on, so should any other group that wants to be considered a profession. Since both law and medicine have a code of ethics, engineering would naturally suppose it needed one as well to be a profession.

Much may be said for this first explanation of why engineering has a code of ethics. For example, the American Bar Association (ABA) adopted its first code of ethics in 1908, that is, four years before **the** first American engineering society did. Engineers certainly did not ignore the ABA's action. (Note, for example, the quotation from A.G. Christie at the beginning of this module.)

Though **much** may be said for this explanation, it seems inadequate for our purposes. The emphasis on imitation does not explain why engineers copied the ABA's adoption of a code of ethics but not the ABA's **enforcement** or licensing requirement. The **emphasis** on imitation also **makes** it hard to understand **why** engineers think **what** the code says important. **After** all, if a profession only needs a code so it can be like other professions, why should **it** matter **much** what the code says? Is it only because the paradigm profession thinks what its code says is important? But perhaps most significant, the emphasis on other professions does not explain why the early American codes were modeled on the code of the **British** Institute of Civil Engineers rather than on some American paradigm like the ABA's.'

One attempt to make up for these inadequacies yields (what we may call) "the contract with **society**" approach to understanding the relation **between** professions and codes of ethics. According to this approach, a code of ethics is one of those things a

group must have before society will recognize it as a professions. The contents of the code are settled by considering what society **would** accept in exchange for such benefits of professionalism as high income and high prestige. A code is a way to win the advantages society grants only to those imposing certain restraints on themselves. A profession has no other interest in **having** a code of ethics.

While this second explanation **may** seem a significant advance over the first, it is still far from adequate. In particular, it gives us little help in answering such questions as the following: Why should **engineers** be so concerned about the details of their code when, it seems, society recognizes engineering as a profession and does not **much care** which of the various codes engineers adopt? Why did the original engineering codes **take** so much space laying down rules about how engineers should **treat** one another when it seems society is likely not to care about such things or (as in the prohibition of supplanting another engineer) to be positively adverse? The inability of the second explanation to help us **answer** such questions suggests **that** we should look for a better one.

A third explanation of **the** relation of profession and codes of ethics seems better than the other two. This explanation views a code as primarily a "contract between professionals." According to this explanation, a profession is a group of persons wanting to cooperate in serving the same ideal better **than** they could if they did not cooperate. Engineers, for example, might be thought to serve the ideal of efficient design, construction, and maintenance of safe and **useful** objects.' A code of ethics would then prescribe how professionals are to pursue their common ideal so that each may do the best he can at minimum cost to himself (and to the **public**--if looking after the public is part of the ideal). The code is to protect each from certain pressures (for example, the pressure to cut corners to save money) by **making** it reasonably likely that most other members of the profession will not take advantage of his good conduct. A code protects members of a profession **from** certain consequences of competition.

According to this explanation, an occupation does not need society's recognition to be a profession. It needs only a practice **among** its members of cooperating to serve a certain ideal. Once an occupation has become a **profession**, society has a reason to

give it special privileges (for example, the sole **right** to do certain kinds of work) if society wants to support serving the ideal in question in the way the profession has chosen to serve it. Otherwise, it may leave the profession unrecognized. So, according to this third explanation, what is wrong with the first two is that they confuse the trappings of profession with the thing itself.¹⁰

If we understand a code of ethics as the way a profession defines relations between those who want to serve a **common** ideal, we may construe the number of different codes of ethics as showing **that** engineers are not yet fully agreed to how they want to pursue their common ideal. Engineering would, in this respect, still be a profession-in-the-making. Thinking of engineering in this way is, under the circumstances, nonetheless consistent with thinking of engineering as a profession. The substantive differences between codes is not great. **The** differences in structure and language are more obvious than important in **the** choice of conduct. Engineers seem to have agreed on all essential terms of their "contract.""

Understanding a code of ethics as a contract between professionals, we can explain why engineers should not depend on mere private conscience when choosing how to practice their profession, why **they** should take into account what an **organization** of engineers has to say about what engineers should do. What others expect of us is part of what we **should** take into account in choosing what to do, especially if the expectation is reasonable. A code **provides** a guide to **what** engineers may reasonably expect of one another, what (more or less) "the rules of the game" are. Just **as** we must know the rules of baseball to know what to do with the ball, so we must know engineering ethics to **know**, for example, whether, as engineers, we should merely weigh safety against the wishes of **our** employer or instead give safety preference over those wishes. A code of ethics should also provide a **guide** to **what** we may expect other members of our profession to help us do. If, for example, **part** of being an engineer is putting safety **first**, then **Lund's** engineers had a **right** to expect his support. When **Lund's** boss asked him to **think** like a manager rather than an engineer, he should, as an engineer, have responded, "Sorry, if you wanted a vice president who would think like a manager rather than an engineer, you should not have hired an engineer."

If Lund had so responded, he would have responded as the "rules of the engineering game" require. But **would** he have done the right thing, not simply according to those **rules** but really? This is not an empty question. Even games can be irrational or immoral. (Think, for example, of a game in which you **score** points by cutting off your fingers or by shooting people **who** happen to pass in the street below.) People are not merely members of **this** or **that** profession. They are also persons with responsibilities beyond their **profession**, persons who cannot escape pangs of conscience, criticism, blame, or punishment just by **showing** that **they** did **what** they did because their profession told them to. While **we** have now explained why an engineer **should**, as engineer, take account of her profession's code of ethics, we have not explained why anyone should be an engineer in the relevant sense.

We may put this point more dramatically. Suppose Lund's boss had responded in this way to what we just imagined Lund to have said to him: "Yes. we hired an engineer, but--we supposed--an engineer with common sense, one who understood just how much weight a rational **person** gives a code of ethics in decisions of this kind. Be reasonable. Your job and mine are on **the** line. The future of Thiokol is also on the line. Safety counts a lot. But other **things** do too. If we block this launch, the Space Center will **start** looking for someone more agreeable to supply boosters." If doing as one's professional code says is really justified, we should be able to explain to Lund (and his boss) why, as a rational **person**, Lund should support his profession's code as a guide for all engineers and why, under **the circumstances**, he could not rationally expect **others** to treat him as an exception.

V. Why Obey Your **Profession's** Code?

We might begin our answer by dismissing **two** alternatives some people find plausible. One is **that** Lund should do as his profession requires because he "promised," for example, by joining an engineering society having a code of ethics. We **must** dismiss this answer because it is at least possible that Lund never did anything we could plausibly characterize as promising to follow a code. Lund could, for example, have

refused to join any professional **association** having a code. Yet, **it** seems such a refusal would not excuse him from conducting himself as an engineer should. The obligations of an engineer do not seem to rest **on** anything so contingent as a promise, oath, or vow. **The** "contract" between **professionals** of which we spoke cannot literally be a contract. It seems more like a "contract implied in law," that is, an obligation resting on what it is fair to require of someone given that she has **benefitted** in a certain way by some action of hers (for example, by claiming to be an engineer).

Another plausible answer we may quickly dismiss is that Lund should do as his profession requires **because** "society" says he should. We may dismiss **this** answer in part because it is not clear that **society** does say that. One way society has of saying things is through law. No law binds all engineers to abide by their profession's code of ethics (**as the law** does bind all **lawyers**). Of course, society has other ways of saying things than by law, for example, by **public** opinion. But **it** seems doubtful **that** the public knows enough about engineering ethics to have **an** opinion on the questions we are considering. More important, it is not clear **why** public opinion or law should decide what it is rational or moral to do. Certainly there have been both irrational laws (for example, those requiring **use** of outmoded techniques) and immoral laws (for example, those recognizing slavery). The public opinion **supporting** those laws could not have been less irrational or immoral than the laws themselves.

The two answers we have now dismissed **share** one notable feature. Either would, if defensible, provide a reason to do as one's profession says that is independent of what in **particular** the **profession** happens to say. **The** answers do not take **account** of the **contents** of the code of ethics. They are "formal." The answer we shall now give is **not formal**. We shall show that **it** is rational to support a code of ethics having a certain content by showing that it is rational to support codes having a content of **that** sort.

Consider the ABET Code (Appendix D). The Code is divided into "**fundamental** principles" and "fundamental canons." The **fundamental** principles simply describe in general terms an ideal of service. Engineers "uphold and advance the **integrity**, honor and dignity of the engineering profession by: I. **using** their knowledge and skill for the enhancement of human welfare. II. being **honest** and impartial, and serving with fidelity

the public, their employers and clients [and so on]." What rational person could object to other people with her skills trying to achieve that ideal? (Or at least, what rational person could object so long as their **doing** so did not interfere with what she was doing?) Surely **every** engineer, indeed, every member of society, is likely to be better off overall if engineers uphold and advance the integrity, honor, and dignity of engineering in this way.

The **fundamental** canons **lay** down general duties. For example, engineers are required to "hold paramount the safety, **health** and welfare of the public." to "issue public statements only in an objective and truthful manner." to "act in professional matters for each employer or client as faithful agents and trustees." and to "avoid all conflicts of interest." Each engineer stands to benefit from these requirements both as ordinary person and as engineer. As ordinary person, an engineer is likely to be safer, healthier, and **otherwise** better off if engineers only make **truthful** public statements. and so on. Explaining how engineers stand to benefit as engineers requires a thought experiment.

Imagine what engineering would be like if engineers did not generally act as the canons require. If, for example, engineers did not generally hold paramount the safety, health, and welfare of the public, what would it be like to be an engineer? The day-to-day work would, of course, be much the same. But every now and then an engineer might be asked to do **something** which, though profitable to her employer or client, would put other people at risk. some perhaps about **whom she** cared a great deal. Without a professional code, an engineer **could** not object as an eneineer. An engineer could, of course, still object "personally" and refuse to do **the** job. But, if she did, she would risk being replaced by an engineer who would not object. An employer or client might rightly **treat** an engineer's personal **qualms** as a disability much like a **tendency** to make errors. The engineer would be under tremendous pressure to keep her "personal opinions" to herself and get on with the job. Her interests as an engineer would conflict with her interests as a person: her conscience, with her self-interest.

The only way--apart from law--to prevent such conflicts is to make it part of **being** an engineer that the public safety, health, and welfare come first. Preventing such

conflicts is, it seems. sufficient reason for any engineer, including Lund, to want engineers generally to adhere to (something like) the ABET Code. But why should an engineer adhere to it himself **when**, as in Lund's case, it seems he **stands** to benefit by departing from it? The answer should be obvious. Lund would have to justify his departure from the Code by appeal to such considerations **as** the welfare of **Thiokol** and his own self-interest. Appeal to such considerations is just what Lund could not incorporate **into** a code of ethics for engineers or generally allow **other** engineers in defense of what they did. Lund **could** not let such an exception be incorporated into the code because its incorporation would defeat the purpose of the code. A code is **necessary** in large part because, without it, the self-interest of individual engineers would lead them to do what would harm everyone overall. Lund **could** not allow other engineers to defend what they did by appeal to their **own** interests or that of their employer for much the same reason. To allow such appeals **would** be to contribute to the breakdown of a practice Lund has good reason to support.

We are, of course, assuming that engineers do in **fact** generally act in accordance with the ABET Code (whether or not **they** know it exists). If **that** assumption were mistaken, Lund would **have** no professional reason to do as the Code says. **The** Code would be a dead letter, not a living practice. It would have **much** the same status as a "model statute" no government **ever** adopted, or **the** rules of a cooperative game no one was playing. Lund **would** have to rely on private judgment. But relying on private judgment is not necessary here. Lund's **engineers seem to have** recommended as **they** did because they thought the safety of the public, including the astronauta, paramount. They did what (according to **the** ABET Code) engineers are supposed to do. Their recommendation is itself evidence that the Code corresponds to a living practice.

So, when Lund's boss asked **him** to think like a manager rather **than** an engineer, what he was in effect asking Lund to do is to think in a way that Lund must consider unjustified for engineers generally and for which Lund can provide no rationally defensible principle making himself an exception. When **Lund** did as his boss asked (supposing he did), he in effect let down all **those** engineers **who** helped to build **the** practice that today allows engineers to say "no" in such **circumstances with** reasonable

hope that their client or employer will defer to "professional judgment" and that other **members** of their profession will **aid** them if the client or employer **does** not defer.

Lund could, of course, explain how his action served his own **interests** and those of **Thiokol** (or, rather, how they **seemed** to at the time). He could also thumb his nose at all talk of engineering ethics (though **that** may lead to the government barring him from work on any project it funds, to **fellow** engineers refusing to have anything to do **with** him, and to his **employer** coming to **view** him as an embarrassment). What he cannot do is show **that** what he did was right, all **things** considered.

VI. Using a **Code** of Ethics

So far, we have assumed that Lund did as **his** boss asked, that is, that he thought like a manager rather **than** an engineer. Assuming **that** allowed us to provide a relatively clear explanation of what was wrong with what **Lund** did. What was wrong was that Lund acted like a manager when he was an engineer and **should** have acted like one.

We must, however, now **put** that assumption aside and consider whether engineering ethics actually forbids Lund to do what it seems he did. that is, weigh his own interests, his employers, and his clients against the safety of the seven astronauts. Ordinary morality seems to allow **such** weighing. For example, no one would think **you** did something **morally** wrong if you drove **your child** to school, rather **than** letting **him take** the bus, **even** though your being on **the** road increases somewhat the risk that **someone** will be killed in a traffic accident. Morality allows us to give special weight to the interests of those close to us. If engineering ethics allows it too, then--whatever Lund may have thought he **was** doing--he **would** not actually have acted unprofessionally. Let us imagine Lund reading in turn our three (or four) "benchmark" codes. What would they tell him? What could he infer?

Of the seven fundamental canons of the current ABET Code, only two **seem** relevant: 1) "[holding] paramount the safety, health and welfare of the public" and 4) "[acting] in professional matters for each employer or **client** as **faithful** agents or

trustees." What do these provisions tell Lund to do? The answer is not obvious. Does "public" include the seven astronauts? They are, after **all**, employees of Thiokol's client, the Space Center, not part of the public as, say, those ordinary citizens are who watch launches from the beach opposite the Space Center. And **what** is it to be a "faithful agent or **trustee**" of one's client or **employer**? Is it to do as instructed or to do what is in **the** client's or **employer's** interests? And how exactly is one to determine those interests? After all, the actual result of **Lund's** decision was a disaster for both employer and client--but a disaster Lund, his employer, and his client thought themselves justified in risking. And **what** is Lund to do if the public welfare requires what no faithful agent could do? What is it to "**hold paramount**" the public welfare?

The IEEE Code, for all its innovations, is not likely to **help** Lund much (even assuming Lund to be a member of **the** IEEE). Article III.1 more or less repeats the faithful-agent requirement of ABET canon 4. Article IV.1 more or less repeats the **requirement** of the ABET canon 1 (though **without** declaring the public interest "paramount"). Members of the IEEE are supposed to "protect **the** safety, health and welfare of **the** public and speak out **against** abuses in these areas affecting the public interest." **The** duties of a **faithful** agent are, however, limited by other provisions of the code while the duty to protect **the** public is not. **The** public welfare takes **precedence** whenever it conflicts with **the** duties of a faithful agent. The IEEE Code thus provides a plausible interpretation of "hold paramount." This would be **helpful** if we knew what **was included** in the **public** safety, health, and welfare. **Unfortunately**, the IEEE Code (like **ABET's**) tells us nothing about that.

Though the NSPE Code is much more detailed than the other two, its details are only somewhat more helpful here. The first "**rule** of practice" simply repeats the language of ABET canon 1, **while** the fourth rule does the same for canon 4. Rule 1a follows the IEEE Code in giving priority to **the** public **safety**, health, and welfare over **all** **other** considerations but gives more content to how one should "speak out." If **overruling** Lund's judgment were to endanger the public "safety, health, **property**, or welfare." **then**, according to Rule 1a, Lund would have a positive duty to bring the matter to **the** attention of "the appropriate authority." **The** appropriate authority **might**

be someone other than the client or employer. **Rule 1b** partially defines "safe for public health, property, and welfare" in **terms** of conformity to "accepted standards." That would **be** helpful if the problem that Concerned Lund were conventional enough for certain standards to have won acceptance. **Unfortunately**, the use of O-rings in question here was so new that **there** was no **manual** of "safety specs" to which an engineer could turn. That was part of Lund's problem.

The NSPE Code illustrates ~~the~~ advantage of detailed provisions. The more detailed a code, the more guidance **it** is likely to provide on **just the** question an engineer is worried about. The current NSPE code could, for example, have contained a provision like canon 11 of the NSPE Code of 1954: "[The engineer) will guard against conditions that are dangerous or **threatening** to life, limb or property on work for **which** he is responsible..." **That would have** made **Lund's** duty clear. Unfortunately, it does not contain such a provision. Why? One possibility is **that the** drafters of the current code thought the provision redundant given the duty to hold the public safety **paramount**. Another possibility is that **the** NSPE Code--and **ABET Guidelines**--**now** require engineers to be concerned only for **the public** safety, health, and welfare rather than, as canon 11 seems to do, everyone's. Perhaps, **after** due consideration, the drafters of the various codes decided it was too **much** to ask engineers to worry about **the** safety of their client's or employer's **employees** as well as **the** safety of the public. How is an engineer to understand a code of ethics if (as often happens) it does not clearly address a problem?

That question will be surprisingly easy to answer if we keep in mind the connection between professions and codes of **ethics**. The language of any document must be interpreted in light of what it is reasonable to suppose its authors to intend. For example, if "bachelor" appears **undefined** in a **marriage statute**, we interpret it as referring to single males, but if the same word appears undefined in directions for a college's **graduation** ceremony, we instead interpret it as referring to all students getting their baccalaureate, whether male or female, single or married. That is the reasonable interpretation because we know **that** marriages usually involve single males (as well as single females) **rather than** people with baccalaureates while just **the** reverse is true of

graduation ceremonies. So, once we figure out what it is reasonable to suppose engineers to intend by declaring the "public" safety, health, and welfare "paramount," we should be able to decide **whether** interpreting "**public**" so **that** it includes "employees" is what they intend (or, at least, what, as rational persons, **they** should intend).

The "authors" of a code of engineering ethics (both those who originally drafted or approved it and those who now **give** it their support) are all more or less rational agents. They differ from **most** other **rational** agents only in knowing what engineers must know to be engineers and in performing duties they could not **perform** (or could not perform as well) but for **that** knowledge. It is therefore reasonable to suppose that **their** code of ethics would not require engineers to risk their **own** safety, **health**, or welfare, or that of anyone for whom they care, except for some substantial good (for example, high pay, easy application of the code, or service to some ideal to which they are committed). It also seems reasonable to suppose no code they "authored" would include anything people generally consider immoral. Whatever a rational engineer might do in private, she could not expect an immoral provision to win **much** public support from other engineers.

We already have a pretty good idea why a code of engineering ethics would make public safety an engineer's paramount duty (that is, a duty taking precedence over all others). Rational engineers would want to avoid situations in which only their private qualms stood between them and a use of professional knowledge they considered wrong or otherwise undesirable. Each would (as we saw) want to be reasonably sure **the** others' **knowledge** would serve the public even **when** the interests of the public conflicted with those of **employer** or client. **Given this** purpose, what must "**public**" mean?

We might interpret "public" as equivalent to "everyone" (in the society, locale, or whatever). On this interpretation, the "**public safety**" **would** mean the safety of everyone more or less equally. **A** danger that struck only children, or only those with bad lungs, or the like, would not endanger "the public." This interpretation must be rejected. Since few dangers are likely to fall upon everyone more or less equally, interpreting "**public**" to mean "everyone" would yield a duty to the public too **weak** to protect most

engineers from having to do things **which** would make life for **them** (and those for whom they care) worse than it **would** otherwise be.

We might also interpret "public" as referring to "anyone" (in the society, locale, or whatever). On this interpretation, the "public **safety**" would be equivalent to the safety of some or all. Holding the public safety **paramount** would mean never putting anyone in danger. If our first interpretation of "public" made provisions protecting the public too **weak**, this second would make such provisions too strong. For example, **it** is hard to **imagine** how we **could** have airplanes, mountain tunnels, or chemical plants without some risk to someone. No rational engineer could endorse a code of ethics that virtually made engineering impossible.

We seem, then, to need an interpretation of "**public**" invoking some relevant feature of **people** (rather than, as we have so far, just their number). We **might**, for example, **think** that what makes people a public is their relative "**innocence**," "helplessness," or "passivity." On **this** interpretation, "**public**" **would refer** to those persons whose lack of **information**, technical knowledge, or time for deliberation renders them more or less **vulnerable** to the powers an engineer wields on behalf of **his** client or employer. An engineer should hold paramount the public safety, health, and welfare to **assure** that engineers will not be forced to give less regard to the welfare of **these** "innocents" than simple decency requires.

On this interpretation, someone might be part of the public in one respect but not in another. For example, the astronauts **would** be part of the public in respect of the O-rings because, not **knowing** of the danger, they were in **no** position to abort the launch because of the danger. **The astronauts** would, in contrast, not be part of the public in respect of the ice forming on the boosters **because**, having been fully informed of that danger, they were in a position to abort **the launch** if they were unwilling to take that risk. On this third **interpretation**, "**public**" does **not** seem to create the difficulties it did on the two preceding interpretations. We now seem to have a sense of "holding the public safety paramount" we may reasonably suppose rational engineers to endorse.

On **this** interpretation, all three codes of ethics would require Lund either to refuse to authorize the launch or to **insist** instead that the astronauts be briefed to get

their informed consent to **the** risk. **Refusing** authorization would protect the "public" by holding the safety of the astronauts paramount. Insisting that the astronauts be briefed and decide for themselves would hold the **safety** of the "public" paramount by transferring the astronauts from the category of member of the public to that of **informed** participant in the decision. **Either** way, Lund would not, under the circumstances, have had to treat his own interests, those of **his** employer Thiokol, or those of his client the Space Center, as comparable to those of the public.

Is this the **right** answer? It is if we **have** taken every relevant consideration into account. Have we? How are we to know we have? We can, of course, go through a check list. But how are we to know **that the check** is complete? Past experience is an indication, but now and then something unprecedented occurs. So, what are we to do? In engineering ethics, as in the rest of engineering, it is **often** easier to demonstrate the fault of alternatives than to demonstrate that this or **that** answer must be right. This is such a case. While we cannot demonstrate **that** our third interpretation is the right one, we **can** demonstrate that the only obvious alternative remaining is wrong.

That alternative is that "**public**" refers to all "innocents" except employees of the client or employer in question. Employees are to be excluded because (it might be said) they are paid to take the risks associated with their line of work. On **this** interpretation, Lund would not have to hold the safety of the astronauts paramount. They would not be part **of the** public.

What is wrong with this fourth alternative? Consider **how** we understood "innocents." These are persons whose lack of information, training, or time for **deliberations** renders **them** vulnerable to the powers an engineer wields on behalf of **his** client or employer. An employee who takes a job knowing the risks (and being able to avoid them) might be able to **insist** on **being** paid **enough** to compensate for them. She could certainly be said to be paid to take those risks. **But** she would, on our third interpretation, also not be part of the public to which an engineer **owed** a paramount duty. She would have given informed consent to the risk in **question**. **On** the other hand, if the employee lacked information to evaluate the risk, she would be in no position to insist on compensation. She would, in other words, be as innocent of, as

vulnerable to, and as unpaid for, the risks in question as anyone in the public. Nothing prevents an engineer, or someone for whom an engineer cares, from being the employee unknowingly at risk. So, rational engineers have as much reason to want to protect such employees as to protect the public in general. "Public" should be interpreted accordingly.

VII. Some Rules of Thumb

If we look back at what we did to decide whether Lund's conduct was unprofessional, we can identify five steps in our deliberation. Characterizing these steps should provide rules of thumb for approaching other problems of engineering ethics.

1. Identify Ethical Issues. Not all engineering decisions have an ethical dimension. But a surprising number do. How is one to know? One useful test is to ask whether anyone but the engineer in question would suffer or be put at risk by the conduct in question. Another is to ask whether the engineer would like a world in which most engineers conducted themselves as the engineer is contemplating (and whether that world would differ from this one). A third test is to ask whether the engineer would want what he is doing to be widely known. The first test tends to pick out problems of human welfare; the second, problems of fairness; and the third, problems of honesty.

These tests must, of course, be applied using all relevant information available and only information available. We should not ignore inconvenient facts or treat mere possibilities as if they were more than that. Information is relevant if it might affect a rational person's decision. It is available if the decision-maker has it or can easily get it in time to decide.

2. Distinguish Issues of Professional Ethics. Should any of the above tests give a positive result, the next step is to consider what kind of ethical problem has been identified. Not all ethical problems are professional problems. For example, committing adultery with a fellow engineer after hours in a motel raises ethical issues without raising any professional ones. How is one to know? One indication that professional ethics is involved is that the conduct is expressly discussed in a code of

engineering ethics. (Notice that adultery is not.) But, as we have seen, not all matters of professional ethics are expressly **discussed** in ethics codes. Much is **left** to interpretation. So, we need another test. Our discussion of **Lund** **suggests** it. We knew **that Lund's** conduct raised a question of engineering ethics because it involved using knowledge of engineering or using some power he had (in part) because he was an engineer.

3. Formulate Options. Formulating some options is implicit in steps 1 and 2. (You do not have an ethical problem until you have some options.) Often, however, the initial list of options will be incomplete in an **important** way. (Perhaps, for example, had Lund suggested **it**, Lund's boss **would have** been only too happy to brief **the** astronauts on the O-ring risk and let **them** decide whether to postpone lift-off.) Not all ethical issues are as hard as they seem at first (though many are as hard or harder). So, it is worth asking whether any serious options have been omitted. One source of options is a code of ethics, especially if it is as dewiled as the **NSPE's** (or ABET's Guidelines). Other sources are biographies of engineers, case studies of particular engineering problems, and imaginative fiction about engineers in ethical dilemmas. These can, of course, only be used if there is time to refer to them--or if one has read them in advance.

4. Evaluate Options. There are **two** possibilities. Sometimes the relevant code of ethics, especially a dewiled one like the **NSPE's** will contain a provision which expressly states that one (or more) of **the** options available is professionally required. **When** the relevant code is "on point", the professionally proper decision is clear. More often, provisions will have to be interpreted to determine **what** the code requires. **Interpretation** requires a) identifying **all** potentially relevant provisions of the code, b) trying to make them fit together so that they give directions a rational engineer would want every other engineer to follow even if that means having to follow them too, and c) determining what those directions require in the case in question.

What if this process leads you to conclude that the relevant code requires something morally wrong? This is a hard question but, fortunately, one not likely to arise. No actual code today **includes** a provision immoral on its **face** (and, given the

origin of engineering codes. it is unlikely that any **would**). Any immoral **conclusion** would have to rest on an interpretation of the code. In general, however, it is unreasonable to suppose engineers **would require** members of their profession to do anything immoral. So, any time you conclude **that** you are professionally required to do something morally wrong, you **have** almost certainly made **a** mistake.

Almost certainly, but not certainly. Truly hard cases. that is, cases where no available option is morally right, cannot be absolutely ruled **out**. What then is an **engineer** to do when she **confronts** a truly hard case? The **answer** seems obvious. Morally bad actions are seldom all equal. Some **may** be less harmful, less **unfair**, or less dishonest, than **others**. In circumstances allowing no morally right action, an engineer could still hold the public interest paramount. maintain **the** integrity of her profession, and the like **by** doing the least harm possible, by being as fair as possible, and by otherwise keeping wrongdoing to a minimum. That certainly seems to be how each rational engineer would **want** others to conduct **themselves**. Any code of ethics should be interpreted accordingly.

Deciding what to do in **this way** **should** always yield **conduct** rational engineers would support as a general practice, since **each** engineer stands to benefit if other engineers generally decide on conduct in **this way**. Just as important perhaps, deciding in this way should also yield conduct of which the **public would** approve, since it stands to benefit from **the useful** products of engineering **without** sacrifice of its safety, **health**, or welfare. So, an engineer who chooses professional conduct in **this way** **should** be able to convince any rational person concerned, to **endorse his** principles and his reasoning. He should. in **other** words, be fully able to justify his conduct.

5. Review. Having thus reached a **tentative** answer, you ought to review your reasoning. One way to do **that** is to imagine yourself on a "board of ethical review" (or a Senate committee investigating **your** decision **when things** did **not** go as you expected). Would your reasoning still convince you if you did not **think** of it as yours? No justification of conduct is professionally defensible if **its** appeal to you is largely dependent on interests you do not **share with engineers** generally or with the public. Putting yourself in the place of your profession or the public is a good way to make

yourself think impartially.

Another **way** to catch errors is to put your problem before engineers not involved in **it**, especially those with experience and a reputation for good judgement. If such persons generally agree with your reasoning (and choice of option), you are probably right. You must, however, be careful not to reveal **confidential** information when seeking advice (and, of course, you must have time to make **such** inquiries--as often you will not).

VIII. Sample Application of Rules of Thumb

The following case and comment are intended to provide a model for application of our rules of thumb to the cases for discussion in Section IX.

Jade Glitz is serving a term **on her** engineering society's national executive board. During an evening reception after one of the board's semi-annual **meetings**, **she** chats with **the** society's president. Harold Takumm. Between drinks, Takumm casually **mentions** that **firms** in his state commonly provide local government officials with "walking-around money" to influence the award of **contracts**. When Glitz, not used to such practice in **her** own state, expresses surprise. **Takumm**, who runs an engineering consulting **firm**, admits **that** he can see nothing wrong with the practice and has even engaged in it himself in order to stay in business. Mistaking her surprised silence for interest, he becomes **more** specific. He tells her how he got his **start** by paying off a state official and how he has been paying off one or **another** ever since (**though** he does not name anyone). Finally, he tells why he thinks he has done nothing wrong: **With** a little **digging**, a trained investigator could, he says, **uncover** proof enough to implicate most engineering **consultants** in the state, himself included. But no one has cared enough to **make the** investigation, not even the press,

Increasingly uncomfortable **hearing** these revelations. Glitz finally breaks off the conversation and **returns** to her hotel room. There, over a glass of **Maalox**, she wonders **whether what** she has heard **is** true, whether it could be proved, and whether **she has** any responsibility to do anything with what she has heard. **Though** she likes **Takumm** personally, she no longer feels **comfortable with** him in her professional society or, indeed, in her profession.

Ethical Issues? Because Takumm's activities are illegal, he certainly would not want them made public. Revelation **might** ruin **him**. Glitz, too, has reasons not to want **Takumm's payments** made public. Though she has lost **respect** for him, she still likes him enough not to want **him** harmed. She should also be concerned for her professional society. **What** would such revelations do to **its** reputation? On **the** other hand, Glitz **should** not want it **known** that **she** knew what **Takumm** was doing and did nothing. **That would turn what** might have seemed local corruption **into** a **national** scandal. Clearly, Glitz's problem is ethical.

Professional Issues? If Glitz were now to refer to **ABET's** Code of Ethics, she would find (beside canon 1's familiar injunction to hold the public safety, health, and welfare paramount) only canon 6 at all relevant to her situation: "Engineers shall act in such manner **as** to uphold and enhance the honor, integrity and dignity of **the** profession." **What** could she conclude **from** this provision? Takumm's regular bribing of public officials in his state does not seem consistent **with** upholding the honor, integrity, and dignity of **engineering**. **But** should Glitz do **anything about** it? Would she be upholding and enhancing the honor of her profession by accusing **Takumm** publicly? By accusing him in secret? Or by keeping silent? Would reporting **Takumm** do anything for the public safety, **health**, or welfare?

If Glitz were now to consult **the** ABET Guidelines, she might be surprised to find specific guidance. According to **Id**, engineers "with knowledge or reason to believe that another **person** or **firm** may be in violation of any provision of these Guidelines...[arc to] present **such** information to the proper authority in writing..."

While Glitz does not have "knowledge", she certainly has "reason to believe" Takumm has been engaged in bribery. So, if Takumm's bribing is in violation of some provision of the Guidelines. Glitz has a professional **duty** to report her conversation to "the proper authority."

If Glitz **continued** her examination of **the** Guidelines, she would eventually find section **5a**: "Engineers shall not pay or offer to pay, either directly or indirectly, any commission, political contribution, ~~or~~ gift, or other consideration in order to secure work, exclusive of securing salaried **positions** through employment agencies." Takumm said he had directly made gifts to **secure** work (and **the** politicians involved presumably do not qualify as "employment agencies"). So, if **what** he said was true, he has violated a provision of the Guidelines and. **under the** Guidelines, Glitz has no choice but to report her conversation to the proper authority.

Options? Glitz seems to have four professionally recognized options: (1) report her information **about** Takumm to the proper authority. (2) protect the public interest in some way and speak out. (3) not report or speak out but do something else to protect the public and the honor, integrity, and dignity of **her** profession (for example, cease to associate with Takumm as the **pre-1977** ABET Code required), or (4) do nothing if **that** is consistent **with** holding the public safety, health, and welfare paramount and upholding the honor of her profession. To **these four** options must be added one all **the** codes agree is **unprofessional**: (5) do **nothing** even if doing nothing is against **the** public interest and the profession's. These five options seem to be **more** or less exhaustive. So, what should Glitz do?

Evaluating Ootions. If Glitz's professional society **has** adopted the current ABET Guidelines, she should (as one of its officers) have **little** trouble deciding what to do (though she might still be tempted not to do it). **The** Guidelines would require her to report what she had been told to her society's ethics committee, if it has one, for investigation, and to the appropriate prosecutor's office in **Takumm's** state (presumably, one with which Takumm is unlikely to have done **business**).

Is there anything morally objectionable **about** either act **of** reporting? **Doer** Glitz owe Takumm some duty of confidentiality? It seems not. As an officer of Glitz's

professional society. **Takumm** seems to have **voluntarily** given up any right inconsistent with the **society's** Code of Ethics. So, **assuming** Glitz's professional society adopted the ABET Guidelines, her duty is clear.

If, however, **her** professional **society** had only adopted **the** current ABET, NSPE, or **IEEE code**, **evaluating** her options would be more difficult. She would have to decide whether reporting **Takumm's** conversation would help **protect the** public safety, health, and welfare or enhance the honor, integrity, or dignity of her profession. To decide that, **she** would have to answer **such** questions as these: Does bribery's being illegal mean it threatens the public safety, health, or welfare? Does bribery's being prohibited under her profession's code mean it threatens the public safety, **health**, or welfare? If, as seems unlikely, she were to answer all these questions no, she would have to consider the effect of reporting on her profession. Otherwise, holding the public welfare paramount would exclude considering the honor, integrity, or dignity of her profession.

Glitz could **not**, it seems, conclude that an **activity** necessarily **threatens** the public safety, health, or welfare just because it is against the **law** or **her** profession's code. Both the law and her profession's code could include rules having some purpose other than (though consistent with) the public safety, health, and welfare. Indeed, it is easy to **imagine** laws or professional rules **inconsistent** with the public safety, **health**, and welfare (though it is hard to imagine **people like us** adopting them--except by mistake). So, it seems. Glitz **should** determine directly **whether** bribery threatens **the** public safety, health, or welfare. How is she to do that?

One way to do **that** is to engage in a **thought experiment**. **She** might ask herself what life would be like in a society **much** like this one except that bribing public officials to get engineering contracts was both legal and professionally proper. The result of the experiment does not **seem** in doubt. Contracts **would** not be as likely to go to the most qualified engineer as in a society, like this one, in which the factors determining who gets a job are less likely to include **how much** money an engineer offers the appropriate public official. Since an engineer's professional qualifications are a better indication than his ability to bribe, of how likely he is to serve the public safety, health, and

welfare beuer, choosing engineers in part on the basis of professional qualifications seems likely to increase the risk to the public safety, health, and welfare. This conclusion both explains why all three "benchmark" codes prohibit bribing officials to get contracts and why we should not interpret the failure of the NSPE Code explicitly to require "whistleblowing" as equivalent to its having nothing to say about "whistleblowing" in a case like Takumm's.

Glitz is, however, left free under both the NSPE and the IEEE codes to determine how best to protect the public interest (except for the IEEE's speaking-out requirement). If she could protect the public interest merely by telling Takumm to quit giving bribes if he does not want her to make their conversation public, she may do that. If she can best serve the public interest by forcing Takumm out of office or resigning herself, she may do that. If she can only serve the public interest by reporting her information to appropriate law-enforcement agencies, she should do that. But, when deciding how best to protect the public (how best to hold their interests "paramount"), she cannot, as an engineer, consider how her doing so will serve (or harm) her profession's interests, much less her own or Takumm's. She may take these other considerations into account, if at all, only when she must choose between options all of which would protect the public interest equally well and better than any other alternative.

A minute's thought should, it seems, convince Glitz that she should do exactly what the ABET Guidelines require. She cannot protect the public safety, health, and welfare in Takumm's state unless she uses what she knows to do more than stop Takumm from offering bribes. Takumm's own bribing is a small part of the problem. The only way for her to do more than stop Takumm is for her to report her information to the appropriate law-enforcement officials in Takumm's state, that information including Takumm's name. Only government has the resources to root out the corruption Takumm described."

Another minute's thought is likely to leave Glitz unsure what else the public interest requires. Speaking out (as the IEEE Code requires) seems unnecessary if Glitz can get a thorough investigation without publicly disclosing her charges. The same

seems true about having nothing **further** to do with Takumm. What Glitz heard may, upon investigation, turn out be no more **than** the ravings of a drunk, or of a story teller **with** a passion for shocking listeners, or of a friend on the edge of a nervous breakdown. That leaves her to consider what her profession's interest requires.

Our three benchmark codes **agree** that Glitz must **pol** her profession's honor, integrity, and dignity before her own interests or those of Takumm. But it seems that she may sufficiently protect her profession by alerting the appropriate officers of the society so that they get Takumm out of office as soon as the evidence justifies it. Since it is hard to see how the public safety, **health**, or welfare or **her** profession's honor, integrity, and dignity would be served by **doing** more, it seems that Glitz has no professional duty personally to disassociate **herself** from **Takumm** or to speak out against **him** (unless her professional society has adopted **the IEEE Code**). Any decision personally to disassociate herself from him or to speak **out** would have to rest on ordinary moral considerations (none of which seems relevant here) or upon some personal preference, for example, for open debate.

Review. We leave the review of **this** reasoning to our readers.

IX. More Problems for Discussion

All the problems in **this** section **have** an ethical dimension. But, like **most** practical problems, **they** have other dimensions as well. Considerations of personal loyalty, law, business competitiveness, **and the** like may also be relevant **in** determining what should be done. **Many** of the problems presented here are based on inquiries submitted to the **NSPE's** Board of **Ethical** Review (BER). **They** represent a sample of problems that practicing engineers have found perplexing **enough** to justify seeking outside advice and that the BER found **important** enough to deserve formal answer.

You **may** find the **NSPE's** current Code of Ethics, **ABET's** Code and Guidelines, and the **IEEE's** Code helpful in identifying **relevant** considerations. (See Appendices D through G.) But you should not consider **your** work done until you have found an argument for your resolution that could convince **any** rational person. (**That** this or that

code, or the BER, says **such-and-such** is, of course, not itself such an argument.)

Your preparation of **arguments** may benefit from reading **the** relevant opinions of the BER. These are often thought-provoking and always attuned to the practicalities of engineering. For that reason, all problems drawn from BER opinions include the BER citation. (The number to the **left** of the **hyphen** is the year the inquiry was answered- for example, "86" for "1986"--while the **number** to the **right** indicates the place **that answer** had in the sequence of **answers** issued as formal opinions in that year.) You are, however, cautioned to remember **that** we have **changed the facts of** some problems for editorial reasons. The changes may affect how the **problem** should be resolved. You are also reminded that some of the **opinions** were written under a substantially different code and that the concepts of engineering ethics are not yet so settled that the reasoning of the BER of even **a** few years ago necessarily corresponds to what the BER would (or should) say today.

One **common** criticism of problems like these is that they fail to provide enough information to make a reasoned decision possible. The criticism is often unfair. The BER, for example, has had no **trouble** making reasoned decisions concerning **the** problems drawn **from** their opinions. Of course, that is in part because BER **members** bring to examination of a particular problem **the** common knowledge of their profession (much as we did when analyzing Glitz's problem). You should **feel** free to do the same. provided in doing so you do not make the **problem** trivial. You **could**, for example, have "solved" Glitz's **problem** by assuming **that** Takumm was a well-known liar. But such a "solution" would do nothing to sharpen your professional judgment.

CASE 1: **Saving Fish**. You work as a **chemical** engineer at a refinery releasing toxic wastes into Lake Pachmach. The wastes are **within** legal limits but--by calculations you have **just** done using confidential data **other** corporations along the lake recently provided your employer--you have learned that **the** combined waste of all users substantially exceeds **the** limit which standard ecological works regard as safe for aquatic life. You can find no authoritative standard that would allow you to say whether that **level** of toxin in **the** water would make eating **fish** living there dangerous. That worries

you because **Lake** Pachmach, while too murky for swimming. is still fished in now and then. What should **you** do?

CASE 2: Tricks of the Trade (BER 78-6). Engineers **Agronymous** and **Borshette**, though both engaged in the same specialized field of engineering, work for different firms and, recently, contended against one another for a major contract. Following submission of their respective **qualifications**, the client chose **Borshette** and, after several weeks of negotiation, **entered into** a contract. **Agronymous** thereupon complained to the ethics committee of the state engineering society that **Borshette** had obtained the contract by improper means. **Borshette's** **submission** included the claim that Engineer **Profundi** would be assigned primary responsibility for carrying out the contract, a responsibility for which **Profundi's** qualifications were excellent. **Agronymous** charged that, though the claim that **Profundi** was on **Borshette's** staff was probably decisive in **Borshette's** winning the contract. **Profundi** was **not** in fact on **Borshette's** staff.

The state society's ethics committee conducted a preliminary inquiry, determining a) that at the time **Borshette** submitted the **statement** of qualifications. **Profundi** had orally accepted **Borshette's** offer of employment but had not yet begun to work, b) that **Profundi** changed his mind and so informed **Borshette** before **Borshette** was actually chosen for the project, and c) that **Borshette** did not inform the client either before being chosen for the project or even during the negotiations preceding signing the contract. As a member of the state society's ethics committee, you are to decide whether **Borshette** was unethical, for example, in failing promptly to advise the client of the change in staffing indicated in the original submission.

CASE 3: Free Samples (BER 81-1). The village board of Clunk City invited "proposals" for a contemplated water project. The project, estimated to cost \$400,000 was to be financed in part with money from a federal-aid program. Three engineering firms submitted proposals, one of which (that of Richard Love Associates) included a pre-application study for **submission** to the federal agency. with a feasibility study, a

general system layout, and a cost **estimate**. The other firms submitted proposals containing little more than information relating the project to their background, experience, and qualifications. Love's proposal was accepted, but on condition **that** Love accept a letter of intent for the work **making payment of any** fee contingent on the village securing federal financing. Love agreed. Love thus seems either to have done a good deal of engineering work free or to have entered into a contract making payment contingent on something other than doing the work. Did Love do anything unethical?

CASE 4: Professional Societies (BER 82-7). You have worked as an electrical engineer for **Gargantua Enterprises** for 20 years. During **most** of that time, your supervisors encouraged **you** to participate in **the** activities of **the IEEE**. You have held several board and committee positions over the years. All important appointments were cleared with **your** supervisor in advance. You now hold an important committee office.

Gargantua has recently undergone reorganization because of hard times. Last week your new supervisor, Belle Hammer, also an electrical engineer, told you that she opposes further participation in the **IEEE** except during periods of unpaid leave. You pointed out that **Gargantua's** policy **still allows you** to attend professional meetings on company time provided your **supervisor** permits. Hammer agreed **but** reminded you that the permission you need is hers. She will not, **she** explained, give permission hereafter because your participation in **IEEE** does not benefit **Gargantua**. **She** will give permission only when attendance constitutes "employee training". **You** asked permission to take your request to "higher authority". Hammer flatly **refused**.

A few days later, you were called to the section chief's office on another matter. While there, you **asked** his opinion of attendance and participation in professional society meetings by engineers. You did not tell **him** what Hammer said. He reaffirmed the organization's policy with considerable enthusiasm.

Today you prepared a travel request for the upcoming **IEEE** meeting and handed it to Hammer who would ordinarily submit it to the section **chief** with favorable or unfavorable recommendation. **Hammer** looked **at** the request and **then**, looking at you again, said, "This request dies here. You work for me. I'm the one who has to answer

to the section chief for the efficiency **of** the office. Don't step out of line again."

Was it ethical for you to discuss participation in professional societies with the section chief without first notifying **Hammer**? Was it ethical for Hammer to block your efforts to obtain excused leave to **attend** professional meetings? Was **there** anything professionally improper in your **conduct** or Hammer's?

CASE 5: When Research Becomes Somethings Else (BER 75-11). Some years ago you published a paper in an **engineering** magazine on **the** relative safety of certain time-delay steam boiler gauges. **The** paper was based on your original research. Recently, engineer Hydra published an article on the same subject in another engineering magazine. Much of the article is yours word-for-word. You wrote Hydra for an explanation. He responded **that** he had submitted his article with **a** list of six references, one of which was your article, but the editor inadvertently omitted the list --- for which error he (Hydra) is, he said, profoundly sorry. Did Hydra do anything unprofessional? If he did, what should you do?

CASE 6: Patent Ownership (BER 74-11). You are an expert in food processing machinery. A patent attorney has retained you (**by verbal agreement**) to serve as expert witness for her client, a manufacturing company **suing** another such company for patent infringement. Your assignment is a) to study the machines in question, b) to determine whether, in your opinion, the **patent** has been infringed, and c) to testify accordingly should you find an infringement.

When studying the machine, you get an idea you believe to be **patentable**. That **is**, you conceive of a machine which, in your opinion, would constitute an advance in the design of the particular food processing **machinery** involved in the pending lawsuit. You submit the idea to the patent attorney and the manufacturer. You wait three months. You hear nothing. So, you request the **patent** attorney and **the** manufacturer to advise within a reasonable time whether they **have** any interest in **the** improvement. They apparently take this request as an attempt to pressure **them** into paying you more than originally agreed for your work in the lawsuit. The patent attorney writes you

demanding that you immediately **sign over** to the **manufacturer** all the rights to your idea. She pointedly gives no assurance of compensation for **your** idea beyond what you have already been paid for your **study** and testimony. Indeed, she suggests that your conduct has been improper. **Has** it? What should **you** do now?

CASE 7: Participating in a Strike (BER 74-3). The law in your state **permits** state employees to organize unions, to engage in collective bargaining for the purpose of seeking improvements in wages, hours, and working conditions, and to strike if consistent with maintaining "vital **services**." You are an **engineer** in the state highway department which the law does not regard as providing a vital service.

Some time ago **the** nonprofessional employees in your department, acting according to law, sought an election for recognition of the department as a collective bargaining unit. The engineers filed for a separate vote, but their petition was disallowed by the state employee relations board because **the** law did not authorize separate **units** (or separate votes) for professional employees. A majority of all state highway **employees** eligible for collective bargaining eventually approved **recognition** and chose the largest of the state employee **unions** to represent the unit in collective bargaining. There being no separate vote for the professional employees, no one knows how they voted. You voted against unionization.

The union **soon** signed an agreement with **the** department management. The agreement included an "agency shop". No **one** had to **join** the union, but all employees in the bargaining unit had to pay either union dues or a "service fee" for the benefits of representation. The "service fee" differs **from** union dues only in not conferring **the** rights (or duties) of membership in the union.

Near expiration of the first **agreement**, the union **began** negotiating a new agreement. Among the union's demands was a 60 percent pay increase. The state offered much **less**. Negotiations were long but futile. When the first agreement expired, the union voted to strike.

You wonder whether it **would** be professionally proper for you, an engineer, to participate in the strike actively (for example, by serving on **the** picket line) or even

passively (that is, by simply not appearing for work). You **hesitate** not to participate at all in part **because you** think the **nonprofessional** workers are justified in striking, in part because you have never liked **crossing** a union picket line, and in part because you don't like thinking of yourself as a "**scab**". **But** you also hesitate because you are worried about what your relations with the union would be **after** the strike if you continued to work. What should you do?

CASE 8: Professional Society in Politics (BER 73-9). The state highway department proposed routing a new **highway** through a part of your city commonly known as **Pinktown**. Residents organized to block the project and employed you to study the proposed route. You **concluded** the highway could be built more cheaply, more safely, and probably more quickly if, instead, it were **routed** through the **former** neighborhood of the state highway department's chief engineer. You so reported.

The report so outraged one of **your** partners that she went before the local chapter of **the** state engineering society of which she, you, and the **highway** department's **chief** engineer are members, explained the project, and **answered** all questions asked of her, and then asked the chapter to endorse publicly the alternate route you proposed. Was it ethical for your partner to request the local chapter to endorse a project in which her firm was directly involved? **Would it** be ethical for the chapter to take a public position on a controversial question in which members of the chapter are directly involved?

CASE 9: Political Contributions (BER 73-6). Engineers A, B and C made legal political contributions in the sums of \$150, \$1000 and **\$5000**, respectively, to a candidate for governor of the state in **which** they practice. The candidate won. Over the next three years, the firms in **which** A, B and C are principals received state contracts for engineering **services** with total fees ranging from **\$75,000** (for **A**) to **\$4** million (for C). A local newspaper having uncovered these facts, has charged that the engineers acted unethically. Was the political contribution of **A**, B and C unethical? Did either A, B or C act unethically in taking a state contract after making **the** contribution in question?

CASE 10: Restrictive Employment Agreement (BER 72-5). Cranberry Associates, an engineering consulting firm, requires all its employees to sign the following agreement as a condition for employment:

The undersigned hereby agrees, on the date and place mentioned above for the sum of One Dollar (\$1.00) and other considerations, that Two Years (2) after leaving the employ of Cranberry Associates he/she will not become engaged in, directly, or indirectly, as an Owner, Partner, Proprietor, or Principal, in any business, trade, or occupation providing Architectural, Engineering, or Planning services within a One Hundred Mile (100) radius of any office operated by Cranberry Associates at the time of his/her termination.

Is it ethical for the engineers running Cranberry to require engineers they employ to sign such an agreement? Is it ethical for an engineer to sign it?

CASE 11: Indigent Clients (BER 67-8). Harlan Snooky, having lost a thumb in a metal press he was operating, filed a claim with the state worker's compensation board. His claim rests on what turns out to be a technical detail relating to proper operation of the press. Snooky has asked you to appear before the board as an expert witness. Though you would like to help Snooky and are certainly qualified to give the testimony, you wonder whether you should. Snooky cannot afford to pay your usual fee. You would either have to make payment contingent on winning his claim or give your services free. What should you do?

CASE 12: Disclosing Previous Work (BER 65-2). You worked for almost ten years as an engineer for a federal agency during which you studied computer programming methods to determine whether any might help make extraction of certain metals from ore more economical. Your study included a very extensive search of the literature and several months of experimentation. The resulting report contained detailed recommendations on a large number of methods. Your superiors thought the

report valuable enough to publish. It is now available **as** a **department** report for **\$42.50** to anyone who might find it useful.

Soon after you completed the **report**, Congress cut your department's funding in half and you were let go. You then started a private **consulting** firm. You have not done badly during **the** first year, **though** it is certainly too soon to say you are a success. Still, you have gotten some good jobs and have prospects of better. For example, you have just been contacted by an important commercial mining company with a problem similar in scope and content to one you solved as part of the study you did **while** working for the government. Your first thought is that **it** is a good thing that they don't know **about your** report since, if they did, they probably could solve the **problem** for little more than **\$42.50**. But your second thought is that it **might** be improper for you not to tell the company of the report during negotiations. You have, **after** all, already been paid for that work once. What **should** you do?

CASE 13: Secrets. Jamile Mobile, a chemical engineer, quit one huge feed company, Porcine Products, where **she** seemed to have been a victim of discrimination for a similar job at a bigger feed company, Cornborn Feed, with a **better** reputation for treatment of women. Her new boss, also a woman, made it clear at their initial meeting **that she** had been hired for her skills, not for what she knew about Porcine. Yet, it was hardly a **month** before a problem **she had** been assigned caused her to wonder whether skills can be so easily **separated** from knowledge. Though **the** problem initially looked unrelated to what she did for Porcine, it turned out that **the** best way to solve it was to use a **process** she had developed there. one **she** suspects Porcine considers a trade secret. Mobile thinks of just calling up Porcine and asking. But she can't do **that**. Her question might give Porcine **information** about Cornborn's product plans. For similar reasons, she cannot tell her boss much about what is bothering her. There must, of course, be **other** solutions to the problem. But it will take her a while to find one and it might not be as good. What should you do?

CASE 14: Working the Data Over. Winslow Fendrucker is a junior engineer at

Grimco. His job is analyzing test data. One day his supervisor calls him into her office, closes the door, and quietly, very **quietly**, tells him that she would like his analysis of the latest tests of a certain juicing device "**improved**". Perhaps reading the surprise on his face, **she** makes **it** clear that she is not asking him to falsify data or anything like that. But, she points out, though **both** she **and** he think the device in question has great long-term potential, the likely effect of **Fendrucker's** analysis is, as it stands, that work on the device will be stopped before it has a chance to prove itself. All she is asking **Fendrucker** to do is to "**work** the data over" until it properly reflects their high hopes for the device. Is that so **unreasonable**?

CASE 15: Two Sides. Flabia **Maccadamia** is an engineer at Deep Hole, a mining company. **She** lives in Ravenous Canyon and has been an inactive member of its local environmental society for some years. The society was originally organized to prevent the Canyon from becoming a **water** reservoir for Denver. But now it has a new concern. The Canyon abuts federal land **on** three sides, and the **government** proposes to open for mining. The **society** opposes all mining on land close to the Canyon but **has** not been able to win support for its position **from** people outside the Canyon. The society has therefore come to Flabia **to** ask for help. They think **that** if she could draft an environmental impact **statement showing that** mining near the Canyon would be dangerous, both to its natural **beauty** and its **habitability**, they might be able to win over more important environmental groups. **They have come** to Flabia **because** they do **not** have the money to hire an outside **consultant**. They are **asking her** to contribute her time "for the **cause**". She is, she believes, competent to do **the** statement. **She** could, with some help from others she **knows**, do a competent statement in her spare **time**. And she would like to do something more for the society than just send it a \$25 check once a year. Still, she is not sure. The grapevine at work has been humming with stories that Deep Hole is planning a big mine near Denver. One story placed **the** mine within a few miles of Ravenous Canyon. Can Flabia Maccadamia ethically do the environmental impact **statement**.

NOTES

1. Sanger (1986, p. 8).
2. The exact words seem to have been "take off your engineering hat and put on your management hat." **Roger's** Commission (1986). v. I, p. 94). The preceding narrative is based on **testimony** contained in that volume (esp. pp. 82-103).
3. Wisely (1977, p. 55-56).
4. See, for example. Christie (1922, pp. 99-100).
5. Wisely (1983, p. 83).
6. **Oldenquist** and Slowter (1979. pp. 8-11).
7. See, for example, **Cooke** (1922, p. 70).
8. Compare this with the famous **definition** offered by the British Institution of Civil Engineers in 1818: "[The] profession of civil engineer [is] the art of directing the great sources of power in nature for the use and convenience of man." Cited in Christie (1922. p. 98).
9. For a more extensive defense of this explanation. see Davis (1986).
10. Some evidence for **this** claim Will be presented in sections **VI** and **VIII** in the course of applying the **various** codes to particular cases.
11. Should Glitz check the facts before reporting what **she** knows to proper authority? Let us first assume **that** Glitz is sure **that** **she** was told pretty much what she remembers being told. **The** question then is whether **she** should check the truth of Takumm's story. The answer seems to be that she need not unless (as seems unlikely) she may do so easily. To ask her to go out of her way to confirm Takumm's story seems unreasonable. She is an engineer, not **a** journalist or public prosecutory. If, **however**, we assume instead **that** next morning Glitz is not sure **she** has Takumm's story pretty much right, then it seems that she should at least ask **Takumm** whether he said what she remembers him saying (asking in a way not likely to put **him** on **his** guard). She should exercise reasonable care in going to the authorities. Resolving any doubt about essential facts is certainly part of exercising reasonable care.

BIBLIOGRAPHY (to *be* included later)

Appendix A
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
Adopted March 8, 1912:
CODE OF PRINCIPLES OF PROFESSIONAL CONDUCT

While the following principles express, generally, the engineer's relations to client, employer, the public, and **the** engineering fraternity, it is not presumed that they define all of the engineer's duties and obligations.

ENGINEERING

A. General Principles

1. In all of his relations the **engineer** should be guided by **the** highest principles of honor.

2. It is the duty of the engineer to satisfy himself to **the** best of his ability that the enterprises with which he **becomes** identified are of legitimate character. If **after** becoming associated **with** an enterprise he finds it to be of questionable character, he should sever his connections with it as soon as practicable.

B. The Engineer's Relations to Client or Employer

3. **The** engineer should consider the protection of a client's or employer's interests his first professional obligation, and therefore should avoid every act contrary to **this** duty. If any other considerations, **such** as professional obligations or restrictions, interfere with his **meeting** the legitimate expectation of a client or **employer, the** engineer should inform him of the situation.

4. An engineer can not **honorably** accept **compensation**, financial or **otherwise**, from more than one interested party, without the consent of all parties. The engineer, whether consulting, designing, installing or operating, **must** not accept **commissions**, directly or indirectly, from parties dealing with his client or employer.

5. An engineer called upon to decide on **the** use of inventions, apparatus, or anything in which he has a financial interest, **should** make his status in the matter clearly understood before engagement.

6. An engineer in independent practice may be employed by more than one

party, when the interests of the **several** parties do not conflict; and it should be understood that he is not expected to **devote** his entire time to the work of one, but is **free** to carry out other engagements. A consulting engineer permanently retained by a party, should **notify** others of this **affiliation** before entering into relations with them, if in his opinion. the interests might conflict.

7. An engineer should **consider** it **his** duty to make every effort to remedy dangerous defects in apparatus or structures or dangerous conditions of operation, and should bring these to the **attention of his** client or employer.

C. Ownership of Engineering Records and Data

8. It is desirable that an engineer undertaking for others work in connection with **which** he **may** make improvements, inventions, plans, designs or other records should enter into an agreement **regarding** their ownership.

9. If an engineer uses information **which** is not **common** knowledge or public property, but which he obtains from a client or employer, the results in the form of plans, designs, or other records should not be regarded as his property, but the property of his client or employer.

10. If an engineer uses only his own knowledge, or information **which** by prior **publication**, or **otherwise**, is public property and obtains no engineering data from a client or employer, except performance specifications or routine information: then in **the** absence of an **agreement** to the contrary the **results in the** form of inventions, plans, designs, or other records, **should** be regarded as **the** property of **the** engineer, and **the** client or employer should be entitled **to** their use only in **the** case for which the engineer was retained.

11. All work and results accomplished by the engineer in the form of inventions, plans, designs, or other records, that are outside of **the** field of engineering for which a client or employer **has** retained him, should be regarded as the engineer's property unless there is an agreement to the **contrary**.

12. When an engineer or **manufacturer** builds apparatus from designs supplied to him by a customer, the designs remain **the** property of the customer and should not be duplicated by the engineer or **manuafclurer** for others without express permission.

When the engineer or manufacturer and a customer jointly work out designs and plans or develop inventions a clear understanding should be reached before **the** beginning of the work regarding the respective **rights** of ownership in any inventions, designs, or matters of similar character, that may **result**.

13. Any engineering data or information **which** an engineer obtains from his client or employer, or which he creates as a result of **such** information, may be considered confidential by the engineer: and **while he** is justified in using such data or information in his own practice **as forming** part of his professional experience, **its** publication without express permission is improper.

14. Designs, data, records and notes made by an employee and referring exclusively to his employer's work, should be regarded as his employer's property.

15. A customer, in buying apparatus, does not acquire any right in its design but only **the** use of the **apparatus** purchased. A client does not acquire any right to the plans made by a consulting engineer except for the specific case for which they **were made**.

D. **The Engineer's Relationship to the Public**

16. The engineer should endeavor to assist the public to a fair and correct general **understanding** of engineering matters, to extend the general knowledge of engineering. and to discourage the appearance of untrue, unfair or exaggerated statements on engineering subjects in the press or elsewhere, especially if these statements **may** lead to, or are made for the **purpose** of, inducing the public to participate in unworthy enterprises.

17. Technical discussions and criticisms of engineering subjects should not be conducted in the public press, but before **engineering** societies, or in the **technical** press.

18. It is desirable that first publication concerning inventions or other engineering advances should not be made through the public press, but before engineering societies or **through** technical publications.

19. It is unprofessional to give an opinion on a subject without **being fully**

informed as to all the facts relating thereto and as to the purposes for which the information is asked. The opinion should contain a full statement of the conditions under which it applies.

E. The Engineer's Relations to **the Engineering Fraternity**

20. The engineer should take **an** interest in and assist his fellow engineers by exchange of general information and experience, by instruction and similar aid, through the engineering societies or by other means. He should endeavor to protect all reputable engineers from **misrepresentation**.

21. The engineer should take care that credit for engineering work is attributed to those who, so far as his knowledge of the matter goes, are the real authors of **such** work.

22. An engineer in responsible charge of work should not permit non-technical persons to overrule his engineering judgments on **purely** engineering grounds.

APPENDIX B
CODE OF **ETHICS** OF THE **AMERICAN SOCIETY OF CIVIL ENGINEERS**
Adopted, September 2, 1914

It shall be considered **unprofessional** and inconsistent **with** honorable and dignified bearing for any member of the American Society of Civil Engineers:

1. To act for his clients in professional matters otherwise than as a faithful agent or trustee, or to accept any remuneration other than his stated charges for services rendered his **clients**.

2. **To** attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects, or business, of another-Engineer.

3. To attempt to **supplant another** Engineer after definite steps have been taken toward his employment.

4. To compete with another Engineer for employment on the basis of professional charges. by reducing **his** usual charges and in this manner attempting to underbid after being informed **of the** charges named **by** another.

5. To review the work of another Engineer for the same client, except with the **knowledge or consent** of such Engineer, or unless the connection of **such** Engineer **with** the work has been terminated.

6. To advertise in self-laudatory language, or in any other manner derogatory to the dignity of the Profession.

[Annals of American Academy (1922). pp. 273-374]

APPENDIX C
AMERICAN ASSOCIATION OF ENGINEERS

Specific Principles of Good Professional Conduct¹

The compilation consists of **four parts** as follows:

- Part I. Relations of the Engineer to the Public.
- Part II. Relations of the Engineer to the Clients and Employers.
- Part III. Relations of the Engineer to Employees.
- Part IV. Relations of the Engineer to **other** Engineers.

Part I

Relations of the Engineer to the **Public**

- 1. The Engineer should regard his **duty** to the public welfare as paramount to all other obligations.
- 2. He should not use his professional standing as a means of sponsoring or promoting commercial or other undertakings of a speculative character.
- 3. He should scrupulously avoid connection, by act or omission, with any illegal or questionable undertaking or participation in any enterprise inimical to the public **welfare**.
- 4. He **should** not advertise in self-laudatory **language** or in any other manner derogatory to the dignity of the profession.
- 5. He should avoid any publicity giving **the impression that technical matters** can be dispensed with; or that technical proficiency along any line is easy of acquisition:

¹ Specific Principles of Good Professional Conduct was compiled **by** the Practice Committee of the **American Association** of Engineers, under the chairmanship of E. E. Carpenter (1923), **codified** by Dr. D. B. Steinman (Chairman, 1924-25), and adopted **by** the Board of Directors in 1924.

or that exaggerated returns **may** be expected from any limited course of technical instruction.

6. He should avoid any questionable statements or any statements couched in language that would convey a **false** impression, in any of his reports, advertisements, or articles.
7. He should avoid contingent fees as tending to prejudice the quality of the service which he renders; when retained to report on a property or project he **should** scrupulously careful to make no business arrangement for compensation or otherwise that might tend to bias his report.
8. The Engineer should strive to give a full measure of **service** for the best interests of his client and of the public, and **should** charge fair and adequate fees for such service. He should maintain the professional attitude in negotiations for his services: and he should avoid all practices which have a tendency to affect adversely the amount, quality or disinterested nature of professional services, such as charging inadequate fees, competing on a price basis where (as in almost invariably the case) the **service** to be rendered or the character of its proper performance cannot be precisely defined, spending large amounts of money securing business, or consenting to furnish monetary guarantees of cost estimates.
9. **The** Engineer should **use** every care to make his estimates accurate and reliable, and in particular should guard against allowing self-interest to lead **him into** making an inadequate estimate.
10. He should refrain from using any improper or questionable methods of soliciting professional work.
11. He should participate in clean politics and should strive to be a force to assist in the cleansing of the politics.
12. He should take an active interest in the public welfare in behalf of which he should ever stand ready to volunteer his special knowledge, skill and training for the use and benefit of mankind.

Pall II

Relations of the Engineers to Clients and Employers

The Engineer should pursue his professional work in a spirit of strict fidelity and full loyalty to his clients and employers.

He should inform a client or employer of any business connections, interests or affiliations which might tend to influence his judgement or impair the disinterested quality of his services.

He should accept compensation for his services in connection with any work from one source only, except with the full knowledge and consent of all the interested parties.

He should hold as confidential such information relating to the business or technical affairs of a client or employer as the latter regards or may be presumed to regard as personal or proprietary.

He should not engage in any outside work without the full knowledge and consent of his employer.

When connected with any work, he should not accept commissions, outside employment, promise of employment or any other consideration from a contractor engaged upon that work.

He should not have no business dealings or connections with any client of his employer without the full knowledge and approval of his employer.

He should not entertain no offers of employment or other considerations from a third party, when such may in any way influence his actions or decisions with respect to the relations which may exist between such third party and the Engineer's employer or client.

9. He should not accept commissions or other considerations for specifying or recommending supplies, equipment or services.
10. He should not pay commissions to others for recommending his services to prospective clients.

11. He should have no interest direct or indirect in any materials, supplies or equipment used in the construction work of his client or in any firms receiving contracts for his client's work without informing his client in advance of the nature of such interest and obtaining sanction.
12. He **should** not engage in the **independent** practice of engineering without the knowledge and sanction of his employer, and under no circumstances should he compete with his employer on **the** basis of lower fees.

Part III

Relations of the Engineer to Employees

The Engineer should treat his employees or subordinates in a spirit of fairness. with due regard and consideration for their personal welfare and professional advancement.

There should be a professional bond **between** employer and employee when both are engineers. which will **dictate** and impel reciprocal interest and mutual consideration.

The Engineer should pay adequate salaries **commensurate with** the importance and responsibility involved in the service.

He should **encourage** the professional pride of his employees or subordinates in their work and should offer them every means of protecting their reputations and **the** quality of the work entrusted to them by not interfering with the proper performance of the duties for **which** they are responsible.

He should recognize the freedom of his employees to change employment and should in no way hinder **employees** or subordinates on bettering their condition. He should not discharge an employee, nor withhold employment from him, nor discriminate against him in any way on account of his affiliations or activities in any professional, political, or religious organization.

He should respect his employee's right of freedom of thought, speech, and

outside activity as long as the same does not **impair** the efficiency and value of the employee's **service**.

8. He should see that his employee is adequately covered by insurance against risk of casualty arising from his work.
9. In advertising or offering employment, he should refrain from any **misrepresentation** as to the conditions and permanency of such employment.
10. If in public employ, he should assume the responsibility of consistently protecting the interests of his subordinates.
11. He should make every effort to provide steady employment for his employees and when forced to discharge an employee he should give the most generous notice possible and exert every reasonable effort to assist the employee in finding another position.

Pan IV

The Engineer's **Relations** to Other **Engineers**

The Engineer should not by word, act or omission, injure falsely or maliciously, directly or indirectly, the professional reputation, prospects or business of another Engineer.

He should not **attempt** to supplant another Engineer after definite steps have been taken toward his employment.

If employed in conjunction with another Engineer, and by the same client, he should not review and comment conclusively upon the work of the other Engineer except with the **full knowledge** and consent or unless the connection of such other Engineer to the work has been previously terminated.

He should not use unfair means to effect his professional advancement or to injure the chances of another Engineer to secure and hold employment.

He should not attempt to **inject** his services into a project at the expense of another Engineer who has been active in developing it.

He should **not** interpose **between** other Engineers and their **clients** when unsolicited. When solicited, he should avoid any **possibility** of doing a brother Engineer an injustice.

7. He should not seek or solicit a position occupied by another Engineer.
 8. He should not attempt to secure work on the basis of lower salaries or fees.
 9. He should be courteous, fair, considerate in his dealing with other Engineers.
 10. He should conduct any **necessary** comment on or criticism of the work of other Engineer **with** careful regard for **the good** name and dignity of the engineering profession, and he should scrupulously refrain from criticism to personal advantage, as in negotiating for an engagement.
 11. He should not commercialize, his affiliations with, or official position in, any technical organization.
 12. He should not use his professional **affiliations** to secure the confidence of other Engineers in speculative **commercial** enterprises.
 13. As a member of any professional organization, he should avoid any act tending to promote his own interest at the expense of the dignity and standing of the organization.
 14. As an **officer** of a **professional** organization, he should sedulously avoid **any** appearance of **using** his position for personal advertising.
 15. He should cooperate in **upbuilding** the engineering profession by exchanging professional **information** and experience with his fellow engineers and students of engineering, and **by contributing** to the work of engineering societies, schools of applied science, and the technical press.
- He should regard himself as a debtor to **his** profession and should dedicate himself to **its** advancement.

[Annals of American Academy of Political Science (1955), pp 53-56]

APPENDIX D
ACCREDITATION BOARD FOR ENGINEERING AND TECHNOLOGY*
Code of Ethics of Engineering

The Fundamental Principles

Engineers *uphold and advance the integrity, honor and dignity of the engineering profession by:*

- I, using their knowledge and skill for the **enhancement** of human welfare;
- II. being honest and impartial, and serving with fidelity the public, their employers and clients;
- III. striving to increase the competence and **prestige** of the engineering profession;^a and
- IV. supporting the professional and technical societies of their disciplines.

The Fundamental Canons

1. Engineers shall hold paramount the safety, health and welfare of the public in the performance of **their** professional duties.
2. Engineers **shall** perform **services** only in the areas of **their** competence.
3. Engineers shall **issue** public statements only in an objective and truthful manner.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their **services** and shall not compete unfairly **with** others.
6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity and dignity of the profession.
7. Engineers shall continue **their professional** development through their careers and shall provide opportunities for the professional development of those engineers under their supervision.

'Formerly Engineers' Council for Professional Development. (Approved by the ECPD Board of Directors, October 5, 1977)

APPENDIX E
ACCREDITATION BOARD FOR ENGINEERING AND TECHNOLOGY
Suggested
Guidelines for Use with the **Fundamental** Canons of Ethics

1. Engineers shall hold **paramount** the safety, health and welfare of the public in the performance of their **professional** duties.
 - a. Engineers shall recognize that the lives, safety, health and welfare of **the** general public are dependent upon engineering **judgments**, decisions, and practices incorporated into structures, **machines**, products, processes and devices.
 - b. Engineers shall **not approve** nor seal plans **and/or** specifications that are not of a design safe to **the** public health and welfare and in conformity with **accepted** engineering standards
 - c. **Should** the Engineers' professional judgment be overruled under circumstances where the safety, health, and welfare of the **public** are endangered, the Engineers shall inform their clients of employers of the possible consequences and notify other proper authority of the situation, **as** may be appropriate.
 - (c.1) Engineers shall do whatever possible to provide published standards, test codes and quality control procedures **that** will enable the public to understand **the** degrees of safety or life expectancy associated with the **use** of the design, products and **systems** for which they are responsible.
 - (c.2) Engineers will conduct reviews of the safety and reliability of the design, products or systems for which they are responsible before giving their approval to **the plans** for the design.
 - (c.3) Should Engineers observe conditions which they believe will endanger public safety or health, they **shall** inform the proper authority of the **situation**.

- d. Should Engineers have knowledge or reason to believe that another person or firm may be in violation of any of **the** provisions of these Guidelines, they shall present such **information** to **the** proper authority in writing and **shall** cooperate with the proper **authority** in furnishing such further information or assistance as may be required.
 - (d.1) They shall advise proper authority if an adequate review of the safety and reliability of the products or systems has not been made or when the **design** imposes hazards to the public through **its** use.
 - (d.2) They shall withhold **approval** of products or systems when changes or modifications are made which **would affect** adversely its performance insofar as safety and reliability are concerned.
 - e. Engineers should seek opportunities to be of constructive service in civic affairs and work for **the** advancement of the safety, health and well-being of their communities.
 - f. Engineers should be committed to improving the **environment** to enhance the quality of life.
2. Engineers **shall** perform services only in areas of **their** competence.
- a. Engineers shall undertake to perform engineering assignments only **when** qualified **by** education or experience in the specific technical field of engineering involved.
 - b. Engineers may **accept** an assignment **requiring** education or experience outside of their own fields of competence, but only to the extent that their services are restricted to **those phases** of **the** project in which they are **qualified**. All other phases of such project shall be performed by qualified **associates**, consultants, or employees.
 - c. Engineers shall not **affix** their signatures **and/or** seals to any engineering plan or document dealing with **subject matter** in which they lack competence by virtue of education or experience, **nor** to any such plan or document not prepared under their direct **supervisory** control.
3. Engineers shall issue public statements only in an objective and truthful manner.

- a. Engineers shall endeavor to extend public knowledge, and to prevent misunderstandings of the achievements of engineering.
 - b. Engineers shall be completely objective and truthful in all professional reports, statements, or testimony.
 - c. Engineers, when serving as expert or technical witnesses before any court commission, or other tribunal, shall express an engineering opinion only when it is founded upon adequate knowledge of the facts in issue, upon a background of technical competence in the subject matter, and upon honest conviction of the accuracy and propriety of their testimony.
 - d. Engineers shall issue no statements, criticisms, nor arguments on engineering matters which are inspired or paid for by an interested party, or parties, unless they have prefaced their comments by explicitly identifying themselves, by disclosing the identities of the party or parties on whose behalf they are speaking, and by revealing the existence of any pecuniary interest they may have in the instant matters.
 - e. Engineers shall be dignified and modest in explaining their work and merit, and will avoid any act tending to promote their own interests at the expense of the integrity, honor and dignity of the profession.
4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
- a. Engineers shall avoid all known conflicts of interest with their employers or clients and shall promptly inform their employers or clients of any business association, interests, or circumstances which could influence their judgment or the quality of their services.
 - b. Engineers shall not knowingly undertake any assignments which would knowingly create a potential conflict of interest between themselves and their clients or their employers.
 - c. Engineers shall not accept compensation, financial or otherwise, from more than one party for services on the same project, nor for services pertaining to the same project, unless the circumstances are fully disclosed

to, and agreed to, by **all** interested parties.

- d. Engineers shall not **solicit** nor accept **financial** or other valuable considerations, **including** free **engineering** designs, from material or equipment suppliers for specifying their products.
- e. Engineers shall not **solicit** nor accept gratuities, directly or indirectly, from contractors, their agents, or other parties dealing with their clients or employers in connection with work for which they are responsible.
- f. When in public service as members, advisors, or employees of a governmental body or department, Engineers shall not participate in considerations or actions **with** respect to services provided by them or their organization in private or product engineering practice.
- g. Engineers shall **not solicit** nor accept an engineering contract from a governmental body on which a principal, officer or employee of their organization serves as a member.
- h. When, as a result of their studies, Engineers believe a project will not be successful, they shall **so advise** their employer or client.
- i. Engineers shall treat information **coming** to them in the course of their **assignments** as confidential, and shall not use such information as a means of making personal profit if such action is adverse to the interests of their clients, their employers, or the public.
 - (i.1) They will not disclose confidential **information** nor findings of any **commission** or board of which they **are** members.
 - (i.2) When they use designs supplied to **them** by clients, these designs shall not be duplicated by the Engineers for others without express permission.
 - (i.4) While in the employ of others, Engineers will not enter **promotional** efforts or negotiations for work or make arrangements for other **employment** as principals or to practice in connection **with** specific projects for which they have gained particular and specialized knowledge without the consent of all interested parties.

- j. The Engineer shall act with fairness and justice to all parties when administering a construction (or other contract).
- k. Before undertaking work for others in which Engineers may make **improvements**, plans, designs, inventions, or other records which may justify copyrights or patents, **they** shall enter into a positive agreement regarding ownership.
- l. Engineers shall admit and accept their own errors when proven wrong and refrain from distorting or altering the facts to justify their decisions.
- m. Engineers shall not **accept** professional **employment** outside of their regular work or **interest** without the knowledge of their employers.
- n. Engineers shall not **attempt** to attract an employee from another employer by false or misleading **representations**.
- o. Engineers shall not review **the** work of **other** Engineers except with the knowledge of such Engineers, or unless the **assignments/or** contractual agreements for **the work** have been **terminated**.
 - (o.1) Engineers in **governmental**, industrial or educational employment are entitled to review and **evaluate the work** of other engineers when so required by their duties.
 - (o.2) Engineers in sales or industrial **employment** are entitled to make engineering comparisons of their products with products of other suppliers.
 - (o.3) Engineers in sales employment shall not offer nor give engineering **consultation** or designs or advice other **than** specifically applying to equipment, materials or systems being sold or offered for sale by them.
- 5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
 - a. Engineers shall not pay nor offer to pay, either directly or indirectly, any **commission**, political contribution, or a gift, or other consideration in order to secure work, exclusive of securing salaried

positions through **employment** agencies.

- b. Engineers **should** negotiate contracts for professional services fairly and only on the basis of demonstrated competence and qualifications for the type of professional service required.
- c. Engineer should negotiate a method and **rate of compensation** commensurate with the agreed **upon scope** of services. A meeting of the minds of the **parties** to the contract is essential to mutual confidence. **The public interest** requires that the cost of engineering **services** be fair and reasonable, but not the controlling **consideration** in selection of individuals or firms to provide these services.
 - (c.1) These principles shall be applied by Engineers in obtaining the services of other professionals.
- d. Engineers shall **not attempt** to supplant **other** Engineers in a particular **employment** after becoming aware that definite steps **have** been taken toward the others' employment or after they have been employed.
 - (d.1) They shall not solicit employment from clients who already **have** Engineers **under** contract for **the same** work.
 - (d.2) **They** shall not **accept employment from** clients who already have Engineers for the same work not yet completed or not yet paid for unless **the** performance or **payment requirements** in the contract are being litigated or the contracted Engineers' **services have** been terminated in writing by **either** party
 - (d.3) In case of **termination** of litigation, the prospective Engineers before accepting the assignment shall advise the Engineers **begin** terminated or involved in litigation.
- e. Engineering shall not **request**, propose nor accept professional commissions on a contingent basis under circumstances **under which** their

professional judgments ~~may~~ be compromised, or when a contingency provision is used as a device for promoting or securing a professional commission.

- f. Engineers shall not falsify nor permit **misrepresentation** of their, or their associates', academic or **professional qualifications**. They shall not misrepresent nor exaggerate their degree of responsibility in or for the subject matter of prior **assignments**. Brochures or other presentations incident to the solicitation of **employment** shall not misrepresent pertinent **facts** concerning employers, **employees**, associates, joint ventures, or their past accomplishments with the **intent** and purpose of enhancing their **qualifications** and work.
- g. Engineers may advertise professional services only as a means of identification and limited to **the following**:
 - (g.1) Professional **cards** and listings in recognized and dignified publications, provided they are consistent in size and are in a section of the **publication** **regularly** devoted to **such** professional cards and listings. The information displayed must be restricted to firm name, address, telephone **number**, appropriate symbol, names of principal **participants** and **the** fields of practice in which the firm is qualified.
 - (g.2) Signs on equipment, offices and at **the** site of projects for which they render services, limited to **firm** name, address, telephone number and type of **services**, as appropriate.
 - (g.3) Brochures, business cards, letterheads and other factual representations of experience, facilities, personnel and capacity to render service, providing the **same** are not misleading relative to the **extent** of participation in the projects cited and are not indiscriminately distributed.
 - (g.4) Listings in the classified section of telephone directories, limited to name, address, telephone number and specialties in which the firm

is qualified **without** resorting to special or bold type.

- b. Engineers may use **display** advertising in recognized dignified business and professional **publications**, providing it is factual, and related only to engineering, is free from ostentation, contains no laudatory expressions or implication, is not **misleading with** respect to the Engineers' extent of participation in the **services** or projects **described**.
- I. Engineers may prepare articles for the lay or technical press which are factual, dignified and **free** from ostentation or laudatory implications. Such **articles** shall not **imply other** than their direct **participation** in the work described unless credit is **given** to others for their share of **the** work.
- I. Engineers may extend permission for their names to be used in commercial **advertisements, such** as may be published by manufacturers, contractors, materials **suppliers, etc.**, only by means of a modest dignified **notation** acknowledging their participation and the scope thereof in the project or produce described. Such permission **shall** not include public endorsement of proprietary products.
- k. Engineers may advertise for **recruitment** of personnel in appropriate publications or by special **distribution**. **The** information presented must be displayed in a **dignified manner**, restricted to firm name, address, telephone number, appropriate symbol, names of **the** firm is qualified and **factual** descriptions of positions available, qualifications required and benefits available.
- I. Engineers shall not enter competitions for designs for the purpose of obtaining commissions for specific projects, unless provision is made for reasonable **compensation** for all designs submitted.
- m. Engineers shall not maliciously or falsely, directly or indirectly, injure the professional reputation, prospects, practice or employment of another engineer, nor shall they indiscriminately criticize another's work.
- n. Engineers shall not **undertake** nor agree to perform any engineering service on a free basis, except professional services which are advisory in

- nature for civic, charitable, **religious** or **non-profit** organizations. When serving as members of **such** organizations, engineers are entitled to utilize their personal engineering knowledge in the service of these organizations.
- o. Engineers shall not **use** **equipment**, supplies, laboratory nor office facilities of their employers to carry on outside private practice without consent.
 - p. In case of tax-free or tax-aided facilities, engineers should not use student services at less than rates of **other** employees of **comparable** competence. including fringe benefits.
6. Engineers shall **act** in **such** a manner as to **uphold** and enhance the honor, integrity and dignity of the profession.
- a. Engineers shall **not knowingly** associate with nor permit the use of their named nor firm names in business ventures by any person or firm which they know, or have reason to believe, are engaging in business or professional practices of a **fraudulent** or **dishonest** nature.
 - b. Engineers shall not use association with non-engineers, corporations, nor partnerships as 'cloaks for unethical acts.
7. Engineers shall continue their professional **development** throughout their careers. and shall provide opportunities for the professional development of those engineers under **their** supervision.
- s. Engineers shall encourage their **engineering** employees to further **their** education.
 - b. Engineers **should** encourage their engineering employees to become registered at the earliest possible date.
 - c. Engineers should encourage engineering employees to attend and present papers at professional and technical society meetings.
 - d. Engineers should **support** the professional and technical societies of their disciplines.
 - e. Engineers shall give proper credit for engineering work to those to whom credit is due, and recognize the proprietary interests of **others**. Whenever possible, they shall name the persons or persons **who** may be responsible

- for designs, inventions, ~~writings~~ or other accomplishments.
- f. Engineers shall **endeavor** to extend the public knowledge of engineering, and shall not participate in the dissemination of untrue, unfair or exaggerated statements regarding engineering.
 - g. Engineers shall uphold the principle of appropriate and adequate compensation for those engaged in engineering work.
 - h. Engineers should assign professional engineers duties of a **nature** which will utilize their full training and experience insofar as possible, and delegate lesser **functions** to subprofessionals or to technicians.
 - i. Engineers shall provide prospective engineering employees with complete information on working conditions and **their** proposed status of **employment**, and after **employment** shall keep them informed of any changes.

Accreditation **Board for Engineering** and Technology
345 East 47th **Street**
New York, **NY** 10017

APPENDIX E
IEEE Code of Ethics (1979-1990)

Preamble *Engineers, scientists and technologists affect the quality of life for all people in our complex technological society. In the pursuit of their profession, therefore, it is vital that IEEE members conduct their work in an ethical manner so that they merit the confidence of colleagues, employers, clients and the public. The IEEE Code of Ethics represents such a standard of professional conduct for IEEE members in the discharge of their responsibilities to employers, to clients, to the community and to their colleagues in this Institute and other professional societies.*

Article I *Members shall maintain high standards of diligence, creativity and productivity, and shall:*

1. Accept responsibility for their actions;
2. Be honest and realistic in stating claims or estimates from available data;
3. Undertake technological tasks and **accept** responsibility only if qualified by training or experience, or after full disclosure to their employers or clients of pertinent qualifications;
4. Maintain their professional skills at the level of the state of the art, and recognize the importance of current events in their work;
5. Advance the integrity and prestige of the profession by practicing in a dignified manner and for adequate compensation.

Article II *Members shall, in their work:*

1. Treat fairly all colleagues and co-workers, regardless of race, religion, sex, age or national origin;
2. Report, publish and disseminate freely information to others, subject to legal and proprietary restraints;
3. Encourage colleagues and co-workers to act in accord with this Code and support them **when** they do so;
4. Seek, accept and offer honest criticism of work, and properly credit

the contributionsof others:

5. **Support and participate in the** activities of **their** professional societies:
6. Assist colleagues and co-workers in **their** professional development.

Article III *Members shall, in their relations with employers nnd clients:*

1. Act as faithful agents or **trustees** for their employers or clients in professional and business **matters**, provided such actions conform with other parts of **this** Code;
2. Keep **information on the** business affairs or technical processes of an employer or client in confidence while employed, and later, until such **information;is** properly released, provided **such** actions conform with other parts of this Code;
3. **Inform** their employers, **clients**, professional societies or public agencies or private agencies of which **they** are members or to **which** they **may make** presentations, of any **circumstance** that **could** lead to a **conflict of interest**;
4. Neither give noraccept, directly or indirectly, any gift, payment or service of more **than** nominal value to or from those having business relationships **with** their employers or clients;
5. **Assist and advise** tlieir **employers** or clients in anticipnting the possible consequences, direct and indirect, immediate or remote, of the projects, work or plans of which they have knowledge.

Article IV *Members shall, in fulfilling their responsibilities lo the community:*

1. Protect the safety, health and welfare of the public and speak out against abuses in these areas affecting **the public** interest:
2. Contribute professional advice, as appropriate. to civic, charitable or other nonprofit organizations:
3. Seek to **extend** public knowledge and appreciation of the profession and its achievements.

*Approved February 18, 1979, by the Board of Directors of the
Institute of Electrical ond Electronics Engineers, Inc.*

APPENDIX F
NATIONAL SOCIETY FOR PROFESSIONAL ENGINEERS
CODES OF ETHICS
For Engineers

Preamble

Engineering is an important and learned profession. ~~The~~ members of the profession recognize ~~that~~ their work has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness and **equity**, and ~~must~~ be dedicated to ~~the~~ protection of ~~the~~ public health, safety and welfare. In the practice of their profession, engineers must perform under a standard of professional behavior which requires adherence to the highest principles of ethical conduct on behalf of the public, clients, employers and the profession.

I. Fundamental Canons

Engineers, in ~~the fulfillment~~ of their professional duties shall:

1. Hold paramount the safety, health and welfare of the public in the performance of their **professional** duties.
2. Perform services only in areas of ~~their~~ competence.
3. **Issue** public ~~statements~~, only in an **objective** and truthful manner.
4. Act in professional maners for each employer or client as faithful **agents** Or trustees
5. Avoid deceptive acts in ~~the~~ solicitation of professional employment.

II. Rules of **Practice**

1. Engineers shall hold paramount the safety, health and welfare of the public in the **performance** of their professional duties.
 - a. Engineers shall at all times recognize ~~that~~ their primary obligation is to protect the safety, health, property and welfare of the **public**.

If their professional **judgment** is overruled under circumstances **where** the safety, health, property or welfare of the public are endangered, **they** shall notify their employer or client and such other authority as may be appropriate.

- b. Engineers shall approve only those engineering documents which are safe for public health, property and welfare in conformity with accepted standards.

Engineers shall not reveal facts, data or information obtained in a professional capacity **without the** prior consent of the client or employer except as **authorized** or required by law or **this Code**.

Engineers shall **not permit** the use of their name or firm name nor associate in business ventures with any person or firm which they have reason to believe is engaging in fraudulent or dishonest business or professional practices.

Engineers having knowledge of any alleged violation of this Code shall cooperate **with the** proper authorities in **furnishing** such information or **assistance** as may be required.

- 2. Engirleers shall perform services only in the areas of **their** competence:

- a. Engineers shall undertake assignments only when qualified by education or experience in **the** specific technical fields **involved**.
- b. Engineers shall not affix their signatures to any plans or documents dealing with subject matter in which they lack competence, nor to any plan or document not prepared **under** their direction and control.

Engineers may accept assignments and **assume** responsibility for coordination of an entire project and sign and seal the engineering documents for the entire project, provided that each technical segment is signed and sealed only by the qualified engineers who prepared the **segment**.

3. Engineers shall issue public statements only in an objective and **truthful** manner.
 - a. Engineers shall be objective and truthful in professional reports. subjects only **when** that opinion is founded upon adequate knowledge of **the** facts and competence in the subject matter.
 - b. Engineers may express **publicly** a professional opinion on technical subjects only **when** the opinion is founded upon adequate knowledge of **the** facts and competence in the subject matter.
 - c. Engineers **shall issue** no statements, **criticisms** or arguments on technical matters, which are **inspired** or paid for by interested parties, unless **they have** prefaced their comments by explicitly identifying the interested parties on **whose** behalf they are speaking. and by **revealing** **the** existence of any interest the engineer may have in **the** matters.
4. Engineers shall act in professional matters for each employer or client as faithful agents or **trustees**.
 - a. Engineers shall disclose all known or potential conflicts of interest to **their** employers or clients by promptly informing them of any business association, interest, or other circumstances which could influence or appear to influence their judgment or the quality of their services.
 - b. Engineers shall **not** accept compensation, financial or otherwise, from more than one party for services on **the** same project. or for services pertaining to the same project, unless the **circumstances** are fully disclosed to, and agreed to by, all interested parties.
 - c. Engineers shall **not** solicit or accept financial or other valuable consideration, directly or indirectly, **from** contractors, their agents, or other parties in connection with work for employers or clients for which they are responsible.

- d. Engineers in public **service** as members, advisors or employees of a governmental body or department shall not participate in decisions with respect to professional services solicited or provided by them or their **organizations** in private or public engineering practice.
 - e. Engineers **shall not** solicit or accept a professional contract from a governmental body on which a principal or officer of their organization serves as a member.
5. Engineers shall avoid **deceptive** acts in the solicitation of professional **employment**.
- a. Engineers shall not falsely or permit misrepresentation of their, or their associates', academic or professional **qualifications**. ~~They~~ shall not ~~misrepresent~~~~or exaggerate~~ their degree of responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment. associates. joint venturers or past **accomplishments** with the intent and purpose of enhancing their **qualifications** and their work.
 - b. Engineers shall not offer, give, solicit or receive, either directly or indirectly, any political contribution in an **amount** intended to influence the award of a contract by public authority, or **which** may be reasonably construed by the public of having **the** effect or intent to influence the award of a contract. They **shall** not offer any gift. or other **valuable** consideration in order to secure work. They shall not pay a commission, percentage or brokerage fee in order to secure work except to a bona fide **employee** or bona ~~fide~~ established commercial or **marketing** agencies retained by them.

III. Professional Obligations

- 1. Engineers shall be guided in all their professional relations by **the highest** standards of integrity.
 - a. Engineers shall **admit** and accept their own errors **when** proven

- wrong and refrain from distorting or altering the **facts** in an attempt to justify their **decisions**.
- b. Engineers shall advise their **clients** or employers when **they** believe a project will not be **successful**.
 - c. **Engineers** shall not accept outside employment to **the** detriment of their regular work or interest. Before accepting any outside employment, they will notify **their** employers.
 - d. Engineers shall ~~not~~ attempt to attract an engineer from another employer by false or misleading **pretenses**.
 - e. Engineers shall not actively participate in strikes, picket lines, or other collective coercive **action**.
 - f. Engineers shall avoid any act tending to promote **their** own interest **at** the expense of the dignity and integrity of the profession.
2. Engineers shall at all **times** strive to **serve** the **public** interest.
- a. Engineers shall seek opportunities to be of constructive service in civic affairs and work for the advancement of **the** safety, health and well-being of their community.
 - b. Engineers shall **not** complete, sign, or seal plans **and/or** specifications that are not of a design safe to the **public** health and welfare and in **conformity** with **accepted** engineering standards. If **the** client or employer insists on such unprofessional conduct, they shall notify the proper authorities and withdraw from further **service** on **the** project.
 - c. Engineers shall endeavor to extend public knowledge and appreciation of engineering and its achievements and to protect the engineering profession from misrepresentation and misunderstanding.
3. Engineers shall avoid all **conduct** or practice which is likely to discredit the profession or deceive **the** public.
- a. Engineers shall avoid **the** use of statements containing a material

misrepresentation of fact or **omitting** a material fact necessary to keep statements **from** being misleading or intended or likely to create an **unjustified** expectation; statements containing prediction of future success; **statements containing** an opinion as the quality of the Engineers' services; or **statements** intended or likely to attract clients by **the** use of **showmanship**, puffery, or self-laudation. including the use of slogans, jingles, or sensational language or **format**.

- b. Consistent **with** the foregoing. Engineers may **advertise** for **recruitment** of **personnel**.
 - c. Consistent **with the** foregoing. Engineering may prepare articles for the lay or technical press, **but such articles shall** not imply credit to the **author** for work performed by others.
4. Engineers shall not disclose confidential **information** concerning the business affairs or technical **processes** of any present or former **client** or employer without his consent.
- a. Engineers in the employ of **others** shall **not without** the consent of all interested parties **enter promotional** efforts or **negotiations** for work or make **arrangements** for other **employment** as a principal or to practice **in** connection **with** a specific project for which the Engineer has gained particular **and** specialized knowledge.
 - b. Engineers **shall** not, without the consent of all interested parties. participate in or represent an adversary interest in connection with a specific project or proceeding in which the Engineer has gained particular and specialized knowledge on behalf of a former client or employer.
5. Engineers shall not be influenced in **their** professional duties by conflicting interests.
- a. Engineers shall not accept financial or **other** considerations. **including** free engineering designs. from **material** or equipment

suppliers for specifying their product.

- b. Engineering **shall** not accept commissions or allowances, directly or indirectly, from contractors or other parties dealing with **clients** or employers of the Engineer in connection with work for **which** the Engineer is responsible.
- 6. Engineers shall uphold **the** principle of appropriate and adequate compensation for **those** **engaged** in engineering work.
 - a. Engineers shall **not** accept remuneration from either an employee or **employment** agency for giving **employment**.
 - b. Engineers, when employing other engineers, **shall** offer a salary according to professional qualifications.
- 7. Engineers shall **not attempt** to obtain employment or advancement or professional engagements by **untruthfully** criticizing other engineers. or by other improper or questionable **methods**.
 - a. Engineers **shall** not request propose, or accept a professional commission on a contingent basis under circumstances **in** which their professional judgment may be compromised.
 - b. Engineers in salaried positions **shall** accept part-time engineering work only to **the** **extent** consistent with policies of the employer and in accordance with ethical **consideration**.
 - c. Engineers **shall** not **use** equipment. supplies, laboratory, or office facilities of an **employer** to carry on **outside** private practice without consent.
- 8. Engineers shall **not attempt** to injure. **maliciously** or **falsely**. directly or indirectly. the professional reputation, prospects, practice or employment of other engineers. **nor** **untruthfully** criticize **other** engineers' work. Engineers who believe **others** are **guilty** of unethical or illegal practice shall present **such information** to the proper authority for action.
 - a. Engineers in private practice shall not review the work of another engineer for **the** same client, except with the knowledge of **such**

- engineer, or unless the connection of such engineer with the work has been terminated.
- b. Engineers in **governmental**, industrial or educational employ are entitled to review and evaluate the work of other engineers when so required by their employment duties.
 - c. Engineers in sales or industrial employ are entitled to make engineering comparisons of represented products with products of other suppliers.
9. Engineers shall accept responsibility for their professional activities: provided, however, that, Engineers may seek indemnification for professional **services** arising **out** of their practice for **other than** gross negligence, where the **Engineer's** interests cannot **otherwise** be protected.
- a. Engineers shall conform with state registration laws in the practice of engineering.
 - b. Engineers shall not use association with a nonengineer, a corporation, or partnership, as a "cloak" for unethical acts. but must accept personal responsibility for all professional acts.
10. Engineers shall give credit for engineering work to those to whom credit is due, and will **recognize** the proprietary interests of others.
- a. Engineers shall, **whenever possible**, name the person or persons who may be individually responsible for designs, inventions, writings, or other accomplishments.
 - b. Engineers using **designs** supplied by a **client** recognize that the designs remain the property of the client and may not be duplicated by the Engineer for others without express permission.
 - c. Engineers, before undertaking work for others in connection with which the Engineer may make improvements, plans, designs, inventions, or other records **which** may justify copyrights or patents, **should** enter into a positive agreement regarding ownership.
11. Engineers shall cooperate in **extending the** effectiveness of the profession

by interchanging information and experience **with** other engineers and students, and will endeavor to provide **opportunity** for the professional development and advancement of engineers under their supervision,

- a. Engineers shall encourage engineering employees' efforts to improve their education.
- b. Engineers shall encourage engineering employees to **attend** and present **papers at** professional and technical society meetings.
- c. Engineers shall urge engineering employees to become registered at the earliest possible date.
- d. Engineers shall assign a professional engineer duties of a **nature** to utilize full training and experience, insofar as possible, and delegate lesser functions to subprofessionals or to technicians.
- e. Engineers shall provide a prospective engineering employee with complete information on working conditions and proposed status of employment, **and** after **employment** will keep employees informed of any changes.

"By order of the United States District Court for the District of Columbia.

former Section 11(c) of the NSPE Code of Ethics prohibiting competitive bidding, and all policy statements, opinions, **rulings** or other **guidelines** interpreting its scope, have been rescinded as **unlawfully** interfering **with** the legal **right** of engineers. protected under the **antitrust** laws, to provide price information to prospective **clients**; accordingly. **nothing** contained in the NSPE Code of **Ethics**, policy statements, opinions, rulings or other guidelines prohibits the **submission** of price **quotations** of competitive bids for engineering services at any time or in any amount."

Statement by NSPE Executive **Committee**

In order to correct misunderstandings which have been indicated in some instances since the issuance of the Supreme Court decision and the entry of the Final Judgment, it is noted **that** in its decision of April 25, 1978, **the** Supreme Court of the

United States declared: "The **Sherman** Act does not require competitive bidding."

It is further noted that as made clear in **the Supreme** Court decision:

1. Engineers and firms may individually **refuse** to bid for engineering services.
2. Clients are not required to seek bids for engineering services.
3. Federal, state and local laws governing procedures to procure engineering services are not affected, and remain in full force and effect.
4. State societies and **local** chapters are free to actively and aggressively seek legislation for **professional** selection and negotiation procedures by public agencies.
5. State **registration** board rules of professional conduct, including **rules** prohibiting competitive bidding for engineering services, are not affected and remain in full force and effect. State registration boards **with** authority to adopt **rules** of professional conduct may adopt rules governing procedures to obtain engineering services.
6. **As** noted by the **Supreme** Court. "nothing in the judgment prevents **NSPE** and its members from attempting to influence governmental action..."

Note:

In regard to the question of application of **the** Code to corporations **vis-a-vis** real persons, business **form** or type **should** not negate nor influence conformance of individuals to the Code. The Code deals with professional services, which services must be performed by real persons. Real persons in turn **establish** and implements policies within business structures. The Code is clearly written to apply to the Engineer and it is **incumbent** on a member of NSPE to endeavor to live up to its provisions. **This** applies to **all** pertinent sections of the Code.

NSPE **Publication** No. 1102 as revised **January** 1987

APPENDIX G
MODEL GUIDE FOR PROFESSIONAL CONDUCT
AMERICAN **ASSOCIATION** OF ENGINEERING SOCIETIES

Preamble

Engineers recognize that the practice of engineering has a direct and vital influence on the quality of life for all people. **Therefore**, engineers **should** exhibit high standards of competency, honesty and impartiality; be fair **and** equitable; and accept a **personal** responsibility for adherence to **applicable laws**, the protection of the public health, and maintenance of safety in **their** professional actions **and** behavior. These principles govern professional conduct in **serving** the interests of **the public**, clients, employers, colleagues and the profession.

The **Fundamental** Principle

The engineer as a professional is dedicated to improving competence, **service**, fairness and the exercise of well-founded judgment **in the** practice of **engineering** for the public employers and clients with **fundamental** concern for the public **health** and safety in the pursuit of this practice.

Canons of **Professional** Conduct

Engineers offer services in the areas of their **competence** and experience, affording **full** disclosure of **their** qualifications

Engineers consider the **consequences** of their work and societal issues pertinent to it and seek to extend public **understanding** of those relationships.

Engineers are honest, **truthful** and fair in presenting information and in making **public** statements reflecting on **professional matters and** their professional role.

Engineers engage in **professional** relationships **without** bias because of race, religion, sex, age, national origin or handicap.

Engineers **act** in professional matters for **each** employer or client as faithful agents or trustees, disclosing nothing of a proprietary **nature** concerning the business affairs or technical processes of any present or former client or employer without specific consent.

Engineers disclose to affected parties known or **potential** conflicts of interest or other circumstances **which might** influence—or appear to influence—judgment or impair the fairness or **quality** of their **performance**

Engineers are responsible for enhancing their professional **competence** throughout **their** careers and for encouraging similar actions by their colleagues.

Engineers accept responsibility for **their** actions: seek and acknowledge criticism of **their** work; offer honest **criticism** of the work of others. properly credit the contributions of others: and do not accept credit for work not theirs.

Engineers perceiving a **consequence** of their professional duties to adversely affect the present or Future public **health and** safety **shall** formally advise their employers or clients and, if warranted, **consider** further disclosure.

Engineers act in accordance with all applicable **laws** and the _____¹ rules of **conduct**, and lend support to others who strive to do **likewise**.

¹AAES Member Societies are urged to make reference **here** to **the** appropriate code of

conduct to which their members will be bound. Approved by AAES Board of
Governors 12/13/84

