

# Engineering Ethics

## 1.0 Introduction

*Ethics* is the study of the characteristics of morals, and involves the moral choices made by individuals as they interact with other persons. Engineers need to be aware of ethics as they make choices during their professional practice of engineering. *Engineering ethics* will be defined as the rules and standards governing the conduct of engineers in their roles as professionals [1].

Most engineering educational institutions include discussion of ethics in their curriculum; in fact the Accreditation Board of Engineering and Technology (ABET) has mandated that engineering educational programs include ethics in their undergraduate curriculum. Some institutions require a specific course in engineering ethics; others require their students to take a Humanities course (such as Philosophy) on ethics and morals. Our MAE department at MU has decided to focus on engineering ethics in two courses: MAE 1000 (Introduction to Mechanical Engineering), which is primarily a freshman course; and MAE 4980 (Capstone Design), which is a senior course taken in the student's final semester. Engineering ethics is also discussed in other courses throughout the MAE curriculum.

It is important for engineering students to study engineering ethics so that they will be prepared to make (sometimes difficult) ethical decisions during their professional careers. As you read this handbook, you will note that many case studies in engineering ethics do not have a single clear-cut correct answer, but may have many correct solutions, where some solutions are better than others. Therefore, ethical problems can be similar to open-ended engineering design problems, where multiple solutions exist.

The purpose of this handbook is to provide students with an introduction to engineering ethics. The goals of this handbook include 1) fostering an increased awareness of ethical behavior, 2) presenting the accepted codes of ethics for professional engineering societies, and 3) presenting engineering case studies that illustrate ethical (or unethical) decisions. It is our hope that this handbook will invigorate and supplement the discussion of ethics in our MAE courses.

## 2.0 The Engineering Profession

Engineering practice can be defined as a "profession," as opposed to an "occupation" or "job." A *profession* has the following attributes:

- Work requires sophisticated skills, judgment, and exercise of discretion (work is not routine)
- Membership in the profession requires formal education

- Special societies (controlled by members of the profession) establish standards for admission into the profession and conduct of its members
- Significant positive public service results from the practice of the profession

Obviously, law and medicine are professions, and their practices are regulated by strong societies such as the American Medical Association (AMA) and the American Bar Association (ABA). Engineering is a profession, but differs from law and medicine in the following ways:

- Most engineers are not self-employed, but work for large companies (the exceptions include civil engineers and consulting engineers)
- Education is different: only a BS degree is required to practice engineering
- Engineering societies are not as powerful as the AMA or ABA, since BS degree holders can practice engineering *without* a Professional License

### 3.0 Codes of Ethics

Codes of ethics have been established by various professional engineering societies, such as the National Society of Professional Engineers (NSPE), the American Society of Mechanical Engineers (ASME), the Institute of Electrical and Electronics Engineers (IEEE), etc. These codes serve as a *framework* for ethical judgment for a professional engineer. The codes also express the rights, duties, and obligations of the members of the profession. Obviously, the codes of ethics are not comprehensive enough to cover all possible ethical dilemmas that an engineer might encounter in his or her career. The codes serve as starting points for making ethical decisions. It is important to note what a code of ethics does *not* represent:

- A code of ethics is not a legal document, so a professional cannot be arrested for violating its provisions
- Although violating the code of ethics may result in expulsion from a professional society (such as NSPE or ASME), expulsion from a society generally will not result in an inability to practice engineering
- A code of ethics does not create new moral and ethical principles; these principles are rooted in centuries of societal and human interactions

Codes of ethics for engineers were developed along with their respective professional societies, which began formal organization in the late 19<sup>th</sup> century. Initially, codes of ethics involved standard business practices. As the professional societies matured over the years, their codes of ethics were updated and modified. For example, clauses for public safety, public service, and environmental protection are more recent amendments to the various codes of ethics.

While each society's code of ethics exhibit similar themes, they have different formats. The NSPE Code of Ethics is very specific and detailed, while the IEEE Code of

Ethics is general and fairly concise. The NSPE code is reproduced in Appendix A, and the ASME code is reproduced in Appendix B. Note that the ASME code is also very detailed and specific, and is similar to the NSPE code.

First, let us look at the Fundamental Canons of the NSPE Code of Ethics:

- Engineers shall hold paramount the safety, health and welfare of the public
- Engineers shall perform services only in areas of their competence
- Engineers shall issue public statements only in an objective and truthful manner
- Engineers shall act for each employer or client as faithful agents or trustees
- Engineers shall avoid deceptive acts
- Engineers shall conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession

The Fundamental Principles of the ASME Code of Ethics are:

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

- Using their knowledge and skill for the enhancement of human welfare;
- Being honest and impartial, and serving with fidelity the public, their employers and clients; and
- Striving to increase the competence and prestige of the engineering profession

Note that the ASME code includes seven provisions under the Fundamental Principles that are nearly identical to the NSPE Fundamental Canons (compare Appendices A and B). Codes of ethics can be used to support engineers who are being sanctioned by an employer for uncovering unethical behavior.

Finally, it should be noted that many corporations have developed their own codes of ethics for their employees. In many cases, these codes of conduct can be found on the websites of various large corporations. Companies often provide periodic ethical training sessions for their employees in order to explicitly express their accepted policies on business practices, relationships with vendors and government agencies, compliances with government regulations, health and safety issues, environmental issues, equal employment opportunities, sexual harassment, and diversity in the work place. Corporate codes are often very detailed and explicit, and they hold much more weight than professional society codes, since employment can be terminated if compliance is not met. By comparison, the professional codes have diminished power since the majority of professional engineers are not members of professional societies.

#### **4.0 Catastrophic Engineering Failures: Case Studies**

Several high-profile engineering failures can serve as case studies for discussions on ethics, whistle-blowing, and questions that arise in the course of engineering practice. A partial list of catastrophic engineering failures is shown below:

1. Space Shuttle Challenger accident
2. Ford Pinto exploding gas tanks
3. Kansas City Hyatt Regency walkway collapse
4. Teton Dam failure
5. DC-10 multiple failures

Detailed discussions of some of these case studies can be found on the excellent website for engineering ethics, <http://ethics.tamu.edu/ethicscasesstudies.htm> [2].

#### **5.0 Case Studies**

We choose to present smaller-scale case studies to illustrate engineering ethics. Practicing engineers are more likely to confront these fictional scenarios in their careers than a catastrophic failure such as the Challenger accident. The case studies presented here can also be found on the engineering ethics website [2].

##### **5.1 Case Study 1: “Suppressed Data”**

The first fictional case study was developed by Dr. Michael S. Pritchard at Western Michigan University for class discussion of ethical decision making [2]:

A recent graduate of Engineering Tech, you have been employed in the R & D Chemical Engineering Division of Larom, Inc. for the past several months. You were hired because of the promising research you did with catalysts as a student at Engineering Tech.

A meeting of your division is called by your supervisor, Alex Smith. He announces that your unit must make a recommendation within the next two days on what catalyst should be used by Larom in processing a major product. The overwhelming consensus of the engineers in your unit, based on many years of experience, is that catalyst A is best for the job. But the research you have been conducting at Larom provides preliminary evidence that catalyst B might be more reliable, more efficient, and considerably less costly. So, you ask if the recommendation can be delayed another month to see if firmer evidence can be found.

Alex replies, "We don't have a month. We have two days." He then asks you to write up the report, leaving out the preliminary data you have gathered about catalyst B. He says, "It might be nice to do some more research on B, but we've already taken too much time on this project. This is one of those times we have to be decisive--and we have to look

decisive and quit beating around the bush. Management is really getting impatient with us on this one. Besides, we've had a lot of experience in this area."

You like working for Larom, and you feel fortunate to have landed such a good job right out of Engineering Tech. You have no desire to challenge your colleagues. Besides you don't necessarily disagree with them about which catalyst is best. Still, you wish you had been given more time to work on catalyst B, and you feel uncomfortable about leaving the preliminary data out of the report. What should you do?

1. Write up and sign the report as instructed.
2. Write up the report as instructed, but refuse to sign it.
3. Refuse to write up the report, threatening to go around Alex to the next level of management if a fully accurate report is not made.
4. Other.

*Commentary from the Author:*

Engineering students may respond to cases like this in a variety of ways. A rather large percentage of students select the first option, indicating that they really have no choice if they are to keep their jobs. Some insist that, since they would only be following orders, they would not really be responsible if something goes wrong. A few immediately select the third option, adding that they might make sure they have another job offer first. What is surprising is how few select "Other." Yet, a sensible alternative seems to be to suggest that catalyst A be recommended, but that the data about B be included. After all, it might be argued, if the data about B has not engendered serious doubts among the experienced engineers in the unit, why should they fear that management would counter their recommendation of A?

For those students who favor suppressing the data, there is a second scenario, "The Suppressed Data Strike Back."

You write the report as instructed, and Larom proceeds with catalyst A. Two months later Charles Trent, Vice-President for Research at Larom, learns that a major competitor has just begun using catalyst B in a similar process. Its engineers discovered that B is ideal for this process. It is more reliable, more efficient, and much less expensive. Vice-President Trent is very upset that Alex Smith's unit "missed the boat," and he personally meets with the entire unit to make his irritation known. He complains, "Larom has invested a lot of money in this process--only to find out that it's now falling behind a major competitor. It's going to cost us time and money to convert the process--and it's probably going to cost us a few customers as well."

At this point many students say, "Let's go back to the first situation." The point is not that giving further thought to the initial situation will yield an obvious and non-problematic solution. (Any option here might have some undesirable consequences.) It is that, through the use of moral imagination, more satisfactory alternatives may be discovered.

## 5.2 Case Study 2: “Machine Failure”

This fictional case was developed by Dr. Michael S. Pritchard and Dr. Kenneth L. Carper from Washington State University [2].

### Part 1

R&M Machinery had for years provided XYZ Inc. with sophisticated equipment and reliable repair service. XYZ Inc. returned a failed piece of equipment. A meeting was held which included Archie Hunter, a representative from XYZ Inc.; Norm Nash, R&M's returned goods area representative, and Walt Winters, an R&M engineer intimately acquainted with the kind of equipment XYZ Inc. had returned.

Norm Nash represented R&M's "official position": the piece of equipment is all right. However, during the course of the meeting it becomes apparent to Walt Winters that the problem has to be R&M's. He suspects that the equipment was not properly tested out by R&M, and that it failed because of an internal problem.

### Discussion Question #1:

Should Walt say anything about this in the presence of the customer, or should he wait until after the meeting to discuss this with Norm Nash?

### Part 2

Walt keeps silent during the meeting. After the meeting he talks with Norm about his diagnosis. He suggests they tell XYZ Inc. that the problem is R&M's fault, and that R&M will replace the defective equipment. Norm replies, "I don't think it's wise to acknowledge that it's our fault. There's no need to hang out our wash and lessen XYZ Inc.'s confidence in the quality of our work. A 'good will' gesture to replace the equipment should suffice."

R&M management decides to tell XYZ Inc. that they will adjust to the customer's needs "because you have been such a good customer all these years." Although R&M replaces the equipment at its own expense, it does not tell XYZ Inc. the real nature of the problem.

### Discussion Question #2:

Discuss R&M's resolution of the problem. Should R&M's way of handling the problem be of any concern to Walt Winters at this point, or is it basically a "management problem"?

### Part 3

Many engineers eventually move into management positions. If Walt Winters moves into management, what lessons, if any, might he take with him from the above situation?

### *Commentary from the Authors:*

The fundamental moral concept of honesty is at stake in this case study. Norm Nash, representing the position of management, has made the decision to deny the possibility of a defective product. This decision has been made on the basis of public image and ignores the technical opinion given by Walt Winters, one of the firm's engineers.

Winter's silence is probably appropriate in the first meeting with the client. His position is one of technical support, not public relations. Also, his suspicions are not yet confirmed, and a preliminary contradiction of Nash's statement is unwarranted. Winters is correct in raising his objections directly with Nash following the meeting with the client.

Norm Nash's reaction is unfortunate. Walt Winters should be distressed by this reaction. His first move should be to disassemble the equipment to confirm his diagnosis, if possible. If the evidence supports his hypothesis, he should then press Nash vigorously to deal honestly with the client.

While this one experience with one executive may not be indicative of the attitudes of all management executives in the corporation, Winter should observe corporate management decisions carefully for other moral deficiencies. The expression that this is merely a "management problem" of little concern to technical staff can lead to serious consequences. If management decisions routinely overrule factual technical information, placing public relations over honesty, the stage has been set for potential moral disaster. There are many examples from all engineering disciplines. One well-documented case is the Morton-Thiokol treatment of the events leading up to the Challenger Space Shuttle accident.

One puzzling question comes to mind: What is the cost of honesty here? The relationship between R&M and XYZ Inc. is firmly established, based on years of reliable service. An honest admission of equipment failure will not damage such a relationship. Confidence is built, not destroyed, by honesty and integrity. This client is left with unanswered questions: Is this an equipment deficiency? Is it an installation problem? Has the breakdown occurred due to operator error or improper maintenance? These unanswered questions may lead to suspicions. Unanswered questions are far more likely to undermine client confidence than an honest admission of potential manufacturing defects. And Nash has already agreed to replace the equipment at no cost to the customer. What possible economic cost could honesty demand beyond this?

It is precisely the lack of economic cost that makes this case so disturbing. The lessons for Winters, potentially a future manager, are clear: If honesty can be compromised in such a trivial instance, why should one insist on integrity when the costs are high? Honesty is not always this inexpensive. Sometimes it costs a great deal. When the stakes are high, surely it will be easier to dismiss moral commitments.

The image of infallibility cultivated by managers like Nash, and their unwillingness to admit fault leads to unrealistic expectations by clients. When failures do occur, society is unprepared for the consequences.

The concept of risk is not at all well understood by the public. Instead of providing assistance in understanding this concept, many engineers and managers like Nash have encouraged unrealistic expectations by their attitudes. The public has become more intolerant of failure and more suspicious of the technical experts who are unable to deliver the promised risk-free society.

In fact, the very foundation of engineering design is based in trial-and-error experience. The state-of-the-art cannot be advanced without failure. The implication of a condition where failure does not occur is that technology is not advancing. When products do not fail once in awhile, one must conclude that they are inefficient and over-designed.

Technical professionals and product manufacturers have a clear ethical responsibility to communicate honestly about failures, thus contributing to the safety and reliability of products and the advancement of engineering design practice. Admittedly, this communication has been greatly hindered by the expanding litigiousness of contemporary American society.

Finally, some additional questions ought to be considered. It has been noted that the cost of honesty is very small in this case. What if the anticipated cost were higher? What if XYZ Inc. were a new prestigious client, with no established business relationship? An honest admission of fallibility might destroy the relationship in its infancy, with implications for many employees of R&M. What if the equipment failure had resulted in great economic losses to XYZ Inc., as products and other equipment may have been damaged by the failure? What if serious injuries, or even deaths, were caused by failure of this equipment? Should the actions of Nash and Winters be any different?

Do these more serious consequences and potential costs create an intrinsically different moral situation, or is the situation merely made more complex by the legal implications? Does the fear of litigation dictate the appropriate moral response?

Unfortunately, the example provided by Norm Nash gives Walt Winters very little to encourage principled moral reasoning.

### **5.3 Case Study 3: “Fabricated Data”**

This fictional case was developed by Dr. Gale Cutler, a management consultant in Michigan [2].

#### Part 1:

Project leader Bruce Barton was being sorely pressed to complete the development of several engineering prototypes for a field test of a new appliance model for the XYZ



company. One particular plastic component of the new model had given difficulty in laboratory tests as it failed repeatedly before reaching the stress level necessary for successful operation. Bruce had directed a redesign of the component using a tough new engineering plastic recommended by the Research Laboratory's Material Science Department. Stress tests needed to be run on the redesigned component, but Bruce was running short of time and needed to get on with building the prototype.

Bruce sought out the manager of the Material Science Department for help in running stress tests on samples of the new component. With this assistance he could go ahead with prototype building and conduct the tests concurrently. The prototypes, of course, would not be released to field test until the stress tests on the redesigned component proved its design to be satisfactory.

Tom Mason, manager of the Material Science Department, was willing to assist because he knew how critical completion of the development was to XYZ's future appliance plans. However, this was also a busy time for Tom's department. So, Tom suggested to Bruce that he could assign the test work to one of the engineering co-op students. Tom was also coordinator of engineering co-op students, and he liked to use the co-op students in demanding situations to give them practical experience.

Tom assigned the test work to Jack Jacobs, an engineering co-op student from the State University who was completing his second work session at XYZ. Jack was familiar with the test equipment and previously had done similar test work. Jack was a good student and his co-op work had been usually well done. Tom commented to Jack that he would need to work diligently to complete the tests before he had to return to State University.

Jack completed the tests on schedule and turned in a report to Tom indicating the component had successfully passed the stress tests. Upon completion of the test report Jack returned to the university for his next school session. Tom gave Bruce the good news. The prototypes were completed and the field test of these prototypes got underway on schedule.

A few weeks later, Bruce rushed into Tom's office to tell him that most of the prototypes were out of operation because of a catastrophic failure of the component that had been tested in Tom's lab. Bruce wanted to discuss the test immediately with Jack; but since Jack had already returned to the university, he and Tom settled for studying Jack's lab notebook in detail.

After review Tom said, "Bruce, I hate to say it but these data look **too good**. I know the equipment and there should be more scatter in the measurements Jack took. I think some, if not all, these measurements are in error or they have been faked! At best, Jack probably took a few points and 'extrapolated' the rest!"

#### Discussion Question #1:

What ethical issues, if any, does this scenario raise?

## Part 2:

Bruce and Tom made plans to run all the tests again. Meanwhile, Tom phoned Dr. Frank Thompson, Co-op Coordinator at State University, to discuss his fear that Jack had falsified data. In the course of the conversation he asked Dr. Thompson if any effort was made to discuss professional ethics with co-op students before their first work session and if the importance and value of engineering test results were stressed to these students. Dr. Thompson explained that no specific instruction on professional ethics was given to co-op students, but all lab courses emphasized the need for accuracy in data taking. Dr. Thompson added that he found it hard to believe that a co-op student would "fake" data!

## Discussion Questions #2:

Was it appropriate for Tom to discuss his concerns about Jack with the university's Co-op Coordinator **prior** to discussing the matter with Jack?

Should Tom have a conversation with Jack about his concerns? If so, what type of conversation should Tom have with Jack when he talks with him? Should he refuse to have Jack return to XYZ as a co-op student?

## *Commentary from the Author: Question #1*

If Jack Jacobs, the co-op student, either faked the test results or took a few points and extrapolated the rest, he was taking credit for work without doing it, which is like cheating on a test or plagiarizing a paper. He was also making the company count on work which hadn't been done properly, trusting in something which turned out to be unreliable.

There are other possibilities, however, that shouldn't be discounted. The test may have been carried out properly but be an inadequate test for whether the part can operate under the strain of regular use. The test results may be in error in some other way. Jack may have not run the test properly. Although Jack was familiar with the test equipment and had previously done similar work, he may still have misused it and made honest mistakes. There is only presumptive, not conclusive, evidence that Jack did not run the tests to the best of his ability.

Another issue is whether Jack was getting proper supervision in his work session at XYZ. It is good for co-op students to get demanding work to give them practical experience, but shouldn't their work be checked, both while doing it and after done, so that they and the company know if they are doing it properly?

## *Commentary from the Author: Question #2*

If Tom had talked with Jack first, what could that have achieved? If Jack falsified the data, he might have lied about it and simply gotten himself into deeper unethical water. And if he did lie, what more would Tom know than he already knew? There would

still be presumptive evidence that the results were falsified, but no more proof than before the conversation. On the other hand, if Jack had misused the equipment or had extrapolated from a few tests, that might be found out, and Jack would be known to be guilty of the lesser of the suspected errors. And Jack might not realize that extrapolation from a few tests could have the dire consequences that did in fact occur from passing on materials which would not stand up under complete tests. There would be two reasons, then, for having a conversation with Jack. One would be to find out more about what really happened. The other would be to impress upon Jack the consequences of his poor performance.

But is it Tom's responsibility to get in touch with Jack? Students are hard to reach at the University. Jack may not have a private telephone, and to write a letter hoping for an answer is a slow way of doing something. Furthermore, the case is not just about Jack. It is about preparation of students for co-op work and, ultimately, for their professional work. Tom wants the Co-op Coordinator to be informed that a student probably falsified data or at least extrapolated from a few tests, which is not adequate job performance. The Coordinator should be told, for Jack's performance reflects on the University and its training of its students. Jack's identity would be hard to keep secret, in case Tom wanted to do so; but there isn't any reason to keep it secret. There is evidence that Jack failed to do honest work.

Another question is whose job it is to discipline Jack if he has done dishonest work for XYZ. XYZ could refuse to have him return as a co-op student. It could also write a letter to the coordinator to put into writing the charge. It could inform all the people at XYZ with whom Jack had worked that if he asked for letters of reference, they should be aware of this failing. But ultimately, the University has to be responsible for dealing with Jack's dishonesty. How should it be dealt with by the University? If Jack is getting academic credit for the co-op work, should it be denied? If he deliberately falsified the data, should he be dismissed from the University? What procedure should be used for ascertaining the facts and assigning a penalty? Should this be treated in the same way as a case of cheating on a test or plagiarizing a paper, and by the same procedures? Or is honesty something that the University should leave to society in general and the conscience of the individual?

## **Bibliography**

[1] Fleddermann, C.B., "Engineering Ethics," Pearson Prentice Hall, Upper Saddle River, NJ, 2004.

[2] Rabins, M.J., Harris, E., Pritchard, M.S., and Lowery, L.L., "Engineering Ethics," <http://ethics.tamu.edu>

## **Appendix A: NSPE Code of Ethics**

### **Preamble**

Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering 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. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

### **I. Fundamental Canons**

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

1. Hold paramount the safety, health and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

### **II. Rules of Practice**

1. Engineers shall hold paramount the safety, health, and welfare of the public.
  - a. If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.
  - b. Engineers shall approve only those engineering documents that are in conformity with applicable standards.
  - c. Engineers shall not reveal facts, data, or information without the prior consent of the client or employer except as authorized or required by law or this Code.
  - d. Engineers shall not permit the use of their name or associate in business ventures with any person or firm that they believe are engaged in fraudulent or dishonest enterprise.
  - e. Engineers shall not aid or abet the unlawful practice of engineering by a person or firm.
  - f. Engineers having knowledge of any alleged violation of this Code shall report thereon to appropriate professional bodies and, when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required.

2. Engineers 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.
  - c. 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, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony, which should bear the date indicating when it was current.
  - b. Engineers may express publicly technical opinions that are founded upon knowledge of the facts and competence in the subject matter.
  - c. Engineers shall issue no statements, criticisms, or arguments on technical matters that 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 engineers may have in the matters.
4. Engineers shall act for each employer or client as faithful agents or trustees.
  - a. Engineers shall disclose all known or potential conflicts of interest that 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 and agreed to by all interested parties.
  - c. Engineers shall not solicit or accept financial or other valuable consideration, directly or indirectly, from outside agents in connection with the work for which they are responsible.
  - d. Engineers in public service as members, advisors, or employees of a governmental or quasi-governmental body or department shall not participate in decisions with respect to services solicited or provided by them or their organizations in private or public engineering practice.
  - e. Engineers shall not solicit or accept a contract from a governmental body on which a principal or officer of their organization serves as a member.
5. Engineers shall avoid deceptive acts.

a. Engineers shall not falsify their qualifications or permit misrepresentation of their or their associates' qualifications. They shall not misrepresent or exaggerate their 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 venturers, or past accomplishments.

b. Engineers shall not offer, give, solicit or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority, or which may be reasonably construed by the public as having the effect of intent to influencing the awarding 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 relations by the highest standards of honesty and integrity.

a. Engineers shall acknowledge their errors and shall not distort or alter the facts.

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 engineering 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 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 participate in civic affairs; career guidance for youths; 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 in conformity with applicable 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.

3. Engineers shall avoid all conduct or practice that deceives the public.

a. Engineers shall avoid the use of statements containing a material misrepresentation of fact or omitting a material fact.

b. Consistent with the foregoing, engineers may advertise for recruitment of personnel.

c. Consistent with the foregoing, engineers 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, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve.

a. Engineers shall not, without the consent of all interested parties, promote or arrange for new employment or 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 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. Engineers 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 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 commission on a contingent basis under circumstances in which their 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 considerations.

c. Engineers shall not, without consent, use equipment, supplies, laboratory, or office facilities of an employer to carry on outside private practice.

7. Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers. 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.
8. Engineers shall accept personal responsibility for their professional activities, provided, however, that engineers may seek indemnification for 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.
9. 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 that may justify copyrights or patents, should enter into a positive agreement regarding ownership.
  - d. Engineers' designs, data, records, and notes referring exclusively to an employer's work are the employer's property. The employer should indemnify the engineer for use of the information for any purpose other than the original purpose.
  - e. Engineers shall continue their professional development throughout their careers and should keep current in their specialty fields by engaging in professional practice, participating in continuing education courses, reading in the technical literature, and attending professional meetings and seminars.



## **Appendix B: ASME Code of Ethics**

### **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, and
- III. striving to increase the competence and prestige of the engineering profession.

### **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 continue their professional development throughout their careers and shall provide opportunities for the professional development of those engineers under their supervision.
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 reputations on the merit of their services and shall not compete unfairly with others.
6. Engineers shall associate only with reputable persons or organizations.
7. Engineers shall issue public statements only in an objective and truthful manner.

### **THE ASME CRITERIA FOR INTERPRETATION OF THE CANONS**

The ASME criteria for interpretation of the Canons are guidelines and represent the objectives toward which members of the engineering profession should strive. They are principles which an engineer can reference in specific situations. In addition, they provide interpretive guidance to the ASME Committee on Ethical Standards and Review on the Code of Ethics of Engineers.

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 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.
  - c. Whenever the Engineers' professional judgments are over-ruled under circumstances where the safety, health, and welfare of the public are endangered, the Engineers shall inform their clients and/or employers of the possible consequences.

- (1) Engineers shall endeavor to provide data such as published standards, test codes, and quality control procedures that will enable the users to understand safe use during life expectancy associated with the designs, products, or systems for which they are responsible.
  - (2) Engineers shall conduct reviews of the safety and reliability of the designs, products, or systems for which they are responsible before giving their approval to the plans for the design.
  - (3) Whenever Engineers observe conditions, directly related to their employment, which they believe will endanger public safety or health, they shall inform the proper authority of the situation.
- d. If engineers have knowledge of or reason to believe that another person or firm may be in violation of any of the provisions of these Canons, 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.
2. Engineers shall perform services only in areas of their competence.
    - a. Engineers shall undertake to perform engineering assignments only when qualified by education and/or experience in the specific technical field of engineering involved.
    - b. Engineers may accept an assignment requiring education and/or experience outside of their own fields of competence, but their services shall be restricted to other phases of the project in which they are qualified. All other phases of such project shall be performed by qualified associates, consultants, or employees.
  3. Engineers shall continue their professional development throughout their careers, and should provide opportunities for the professional and ethical development of those engineers under their supervision.
  4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest or the appearance of 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 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, or 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 or accept financial or other valuable considerations, for specifying products or material or equipment suppliers, without disclosure to their clients or employers.
- e. Engineers shall not solicit or 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. Where official public policy or employers' policies tolerate acceptance of modest gratuities or gifts, engineers shall avoid a conflict of interest by complying with appropriate policies and shall avoid the appearance of a conflict of interest.
- 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(s) in private or product engineering practice.
- g. Engineers shall not solicit an engineering contract from a governmental body or other entity on which a principal, officer, or employee of their organization serves as a member without disclosing their relationship and removing themselves from any activity of the body which concerns their organization.
- h. Engineers working on codes, standards or governmental sanctioned rules and specifications shall exercise careful judgment in their determinations to ensure a balanced viewpoint, and avoid a conflict of interest.
- i. When, as a result of their studies, Engineers believe a project(s) will not be successful, they shall so advise their employer or client.
- j. 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.
  - (1) They will not disclose confidential information concerning the business affairs or technical processes of any present or former employer or client or bidder under evaluation, without his/her consent, unless required by law or court order.
  - (2) They shall not reveal confidential information or finding of any commission or board of which they are members unless required by law or court order
  - (3) Designs supplied to Engineers by clients shall not be duplicated by the Engineers for others without the express permission of the client(s).
- k. Engineers shall act with fairness and justice to all parties when administering a construction (or other) contract.
- l. Before undertaking work for others in which Engineers may make improvements, plans, designs, inventions, or other records which may justify seeking copyrights,

patents, or proprietary rights, Engineers shall enter into positive agreements regarding the rights of respective parties.

- m. Engineers shall admit their own errors when proven wrong and refrain from distorting or altering the facts to justify their mistakes or decisions.
  - n. Engineers shall not accept professional employment or assignments outside of their regular work without the knowledge of their employers.
  - o. Engineers shall not attempt to attract an employee from other employers or from the market place by false or misleading representations.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
- a. Engineers shall negotiate contracts for professional services on the basis of demonstrated competence and qualifications for the type of professional service required.
  - b. Engineers shall not request, propose, or accept professional commissions on a contingent basis if, under the circumstances, their professional judgments may be compromised.
  - c. Engineers shall not falsify or permit misrepresentation of their, or their associates, academic or professional qualification. They shall not misrepresent or exaggerate their degrees of responsibility in or for the subject matter of prior assignments. Brochures or other presentations used to solicit personal employment shall not misrepresent pertinent facts concerning employers, employees, associates, joint venturers, or their accomplishments.
  - d. Engineers shall prepare articles for the lay or technical press which are only factual.
    - 1) Technical Communications for publication (theses, articles, papers, reports, etc.) which are based on research involving more than one individual (including students and supervising faculty, industrial supervisor/researcher or other co-workers) must recognize all significant contributors. Co-authors listed on proposed and accepted publications should have entered the joint authorship arrangement by mutual consent prior to submittal of the document for publication and should have received written permission to use any unpublished work of others which serves as the major basis or key component of the publication.
    - 2) Technical Communications should adhere to clearly defined and appropriately disseminated guidelines on authorship. These guidelines should be promulgated and publicized in corporate, university or other employer policies and should take cognizance of professional technical society recommendations on ethical practice.
    - 3) Plagiarism, the act of substantially using another's ideas or written materials without due credit, is unethical.

- e. 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.
  - f. Engineers shall not use equipment, supplies, laboratory or office facilities of their employers to carry on outside private practice without consent.
6. Engineers shall associate only with reputable persons or organizations.
- a. Engineers shall not knowingly associate with or permit the use of their names or 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, or partnerships to disguise unethical acts.
7. 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. They shall include all relevant and pertinent information in such 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 on their adequate knowledge of the facts in issue, their background of technical competence in the subject matter, and their belief in the accuracy and propriety of their testimony.
  - d. Engineers shall issue no statements, criticisms, or arguments on engineering matters which are inspired or paid for by an interested party, or parties, unless they preface their comments by identifying themselves, by disclosing the identities of the party or parties on whose behalf they are speaking, and by revealing the existence of any financial interest they may have in matters under discussion.
  - e. Engineers shall be truthful in explaining their work and merit, and shall avoid any act tending to promote their own interest at the expense of the integrity and honor of the profession or another individual.
8. Engineers shall consider environmental impact in the performance of their professional duties.
- a. Engineers shall concern themselves with the impact of their plans and designs on the environment. When the impact is a clear threat to health or safety of the public, then the guidelines for this Canon revert to those of Canon 1.
9. Engineers shall consider sustainable development in the performance of their professional duties.

- a. Engineers shall consider development that meets the needs of the present without compromising the ability of future generations to meet their own needs. When the impact of the trade-off between economic, ecological, and social issues forms a clear threat to health or safety of the public, then the guidelines for this Canon revert to those of Canon 1.
10. Engineers accepting membership in The American Society of Mechanical Engineers by this action agree to abide by this Society Policy on Ethics and procedures for its implementation.

July 25, 2005