and taking the steps necessary to ensure worker safety, but to
no avail. A nonviolent strike is called and the metallurgical engi-
neers support it for reasons of worker safety and public health.

> We need engineers with the courage to speak out when
> things are not right, and colleagues to support them when
> the need arises.
>
> —The authors

Whistleblowing and Loyalty

No topic in engineering ethics is more controversial than whistle-
blowing. A host of issues are involved. When is whistleblowing
morally permissible? Is it ever morally obligatory, or is it beyond
the call of duty? To what extent, if any, do engineers have a right
to whistleblow, and when is doing so immoral and imprudent?
When is whistleblowing an act of disobedience and disloyalty to
an organization? What procedures ought to be followed in blow-
ing the whistle? Before considering these questions, we briefly
define *whistleblowing.* Then, after presenting two cases, we rec-
ommend procedures for responsible whistleblowing.

Definition

Whistleblowing occurs when an employee or former employee
conveys information about a significant moral problem to some-
one in a position to take action on the problem, and does so out-
side regular in-house channels for addressing disputes or griev-
ances. The definition has four main parts.

1. *Disclosure.* Information is intentionally conveyed outside
   approved organizational (workplace) channels or in situations
   where the person conveying it is under pressure from supervi-
   sors or others not to do so.
2. *Topic.* The information concerns what the person believes is a
   significant moral problem for the organization (or an organiza-
   tion with which the company does business). Examples of sig-
   nificant problems are serious threats to public or employee
   safety and well-being, criminal behavior, unethical policies or
   practices, and injustices to workers within the organization.
3. *Agent.* The person disclosing the information is an employee or
   former employee (or someone else closely associated with the
   organization).
4. *Recipient.* The information is conveyed to a person or organiza-
   tion in a position to act on the problem (as opposed, for example,

to telling it to a relative or friend who is in no position to do anything).[20] The desired response or "action" may consist in remedying the problem or merely alerting affected parties. Typically, though not always, the information being revealed is new or not fully known to the person or group receiving it.

Using this definition, we will speak of *external whistleblowing*, when the information is passed outside the organization. *Internal whistleblowing* occurs when the information is conveyed to someone within the organization (but outside approved channels or against pressures by immediate superiors to remain silent).

The definition also allows us to distinguish between open and anonymous whistleblowing. In *open whistleblowing*, individuals openly reveal their identity as they convey the information. *Anonymous whistleblowing*, by contrast, involves concealing one's identity. There are also overlapping cases that are partly open and partly anonymous, such as when individuals acknowledge their identities to a journalist but insist their names be withheld from anyone else.

Notice that the above definition does not mention the motives involved in the whistleblowing, and hence avoids assumptions about whether those motives are good or bad. Nor does it assume that the whistleblower is correct in believing there is a serious moral problem. In general, it leaves open the question of whether whistleblowing is justified. In turning to issues about justification, let us begin with two case studies, one in which the whistle was blown and one in which it was not.

Two Cases

Ernest Fitzgerald and the C-5A

One of the most publicized instances of open, external whistleblowing occurred on November 13, 1968. On that day, Ernest Fitzgerald was one of several witnesses called to testify before Senator William Proxmire's Subcommittee on Economy in Government concerning the C-5A, a giant cargo plane being built by Lockheed Aircraft Corporation for the Air Force. Fitzgerald, who had previously been an industrial engineer and management consultant, was then a deputy for management systems under the assistant secretary of the Air Force. During the preceding two years, he had reported huge cost overruns in the C-5A project to his superiors, overruns that by 1968 had hit $2 billion. He had argued forcefully against similar overruns in other projects, so forcefully that he had become unpopular with his superiors.

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[20] We adopt the fourth condition from Marcia P. Miceli and Janet P. Near, *Blowing the Whistle: The Organizational and Legal Implications for Companies and Employees* (New York: Lexington Books, 1992), p. 15.

They pressured him not to discuss the extent of the C-5A over-runs before Senator Proxmire's committee. Yet when Fitzgerald was directly asked to confirm Proxmire's own estimates of the overruns on that November 13, he told the truth.

Doing so turned his career into a costly nightmare for himself, his wife, and his three children.[21] He was immediately stripped of his duties and assigned trivial projects, such as examining cost overruns on a bowling alley in Thailand. He was shunned by his colleagues. Within 12 days, he was notified that his promised civil service tenure was a computer error. And within four months, the bureaucracy was restructured so as to abolish his job. It took four years of extensive court battles before federal courts ruled that he had been wrongfully fired and ordered the Air Force to rehire him. After years of further litigation, involving fees of around $900,000, he was finally reinstated in his former position in 1981.

Dan Applegate and the DC-10

In 1974, the first crash of a fully loaded DC-10 jumbo jet occurred over the suburbs of Paris; 346 people were killed, a record for a single-plane crash. It was known in advance that such a crash was bound to occur because of the jet's defective design.[22]

The fuselage of the plane was developed by Convair, a subcontractor for McDonnell Douglas. Two years earlier, Convair's senior engineer directing the project, Dan Applegate, had written a memo to the vice president of the company itemizing the dangers that could result from the design. He accurately detailed several ways the cargo doors could burst open during flight, depressurize the cargo space, and thereby collapse the floor of the passenger cabin above. Since control lines ran along the cabin floor, this would mean a loss of full control over the plane. Applegate recommended redesigning the doors and strengthening the cabin floor. Without such changes, he stated, it was inevitable that some DC-10 cargo doors would open in midair, resulting in crashes (Golich[22]).

In responding to this memo, top management at Convair disputed neither the technical facts cited by Applegate nor his predictions. Company officials maintained, however, that the possible

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[21] Ernest Fitzgerald, *The High Priests of Waste* (New York: W. W. Norton, 1972); Berkeley Rice, *The C5-A Scandal* (Boston: Houghton-Mifflin, 1971).

[22] See John H. Fielder and Douglas Birsch, eds., *The DC-10 Case* (Albany, NY: State University of New York Press, 1992); Paul Eddy, Elaine Potter, and Bruce Page, *Destination Disaster* (New York: Quadrangle, 1976); John Godson, *The Rise and Fall of the DC-10* (New York: David McKay, 1975); John Newhouse, *The Sporty Game* (New York: Alfred A. Knopf, 1982). Vicki Golich: *The Political Economy of International Air Safety* (New York: St. Martin's Press, 1989), p. 75, 115.

financial liabilities Convair might incur prohibited them from passing on this information to McDonnell Douglas. These liabilities could be severe since the cost of redesign and the delay to make the necessary safety improvements would be very high and would occur at a time when McDonnell Douglas would be placed at a competitive disadvantage.

Moral Guidelines

Under what conditions can or should engineers blow the whistle? Certainly it should be done when substantial harm can result from an organization's acts of omission or commission. The harm may have occurred already but is not noticeable yet. It could also occur in the future. The harm may be done to a customer, to the general public, to workers, or to the shareholders. It may be in the form of faulty products, unsafe working conditions, unfair policies, or fraud. Nevertheless, because going outside one's organization with sensitive information is a serious undertaking, it stands to reason that certain conditions should be met before anyone blows the whistle:[23]

1. The actual or potential harm reported is serious and has been adequately documented;
2. The concerns have been reported to immediate superiors;
3. After not getting satisfaction from immediate superiors, regular channels within the organization have been used to reach up to the highest levels of management.

The information may then be released confidentially to a relevant government authority, and only when that fails to bring an adequate response should public disclosure be considered.

One needs to consider exceptions.[24] Condition (1) might not be met if it is difficult to obtain documentation because cloaks of secrecy are imposed on evidence that, if revealed, could supposedly aid commercial competitors or a nation's adversaries. In such cases it may be very difficult to establish adequate documentation and the whistleblowing would consist essentially of a request to the proper authorities to carry out an external investigation, or to request a court to issue an order for the release of information.

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[23] Adapted from Richard T. De George, "Ethical Responsibilities of Engineers in Large Organizations: The Pinto Case," *Business and Professional Ethics Journal* 1 (Fall 1981), p. 6. De George also distinguishes between obligatory and mandatory whistleblowing.

[24] Gene G. James, "Whistle Blowing: Its Moral Justification," in *Business Ethics,* ed. W. Michael Hoffman and Jennifer Mills Moore (New York: McGraw-Hill, 1990), pp. 332–44.

Second, conditions (2) and (3) may be inappropriate in some situations, such as when one's supervisors are the main source of the problem or when extreme urgency leaves insufficient time to work through all regular organizational channels.

Finally, since whistleblowing is a very personal matter and often demands great sacrifices, one cannot overlook that there are often personal obligations to family and others that militate against whistleblowing. Where blowing the whistle openly could result not only in the loss of one's job but also in being blacklisted within the profession, the sacrifice may become supererogatory— more than one's basic moral obligations require. Engineers share responsibilities with many others for the products they help create. It seems unfair to demand that one individual bear the harsh penalties for picking up the "moral slack" for other irresponsible persons involved. Most important, the public also shares some responsibilities for technological ventures and hence for passing reasonable laws protecting responsible whistleblowers. When those laws do not exist or are not enforced, the public has little basis for demanding that engineers risk their means of livelihood.[25] Still we find that engineers who could have remained silent have stepped forward, mostly because of a strong sense of individual responsibility: determined to be responsible not only as engineers, but also as citizens.

Certainly, Fitzgerald's action was morally permissible and admirable when he engaged in whistleblowing. His case seems to us clear-cut for several reasons: He had made every effort to first seek a remedy to the abuses he uncovered by working within accepted organizational channels; his views were well-founded on hard evidence; the harm done to the Air Force by his disclosures was far outweighed by the benefits that accrued to the public; he was a public servant with especially strong obligations to the public that his organization, the Air Force, is committed to serve; and to have withheld the information from Senator Proxmire would have involved lying and participating in a cover-up.

Was Fitzgerald obligated to do what he did? In his situation, as is often true, failure to blow the whistle would have amounted to complicity in wrongdoing. The Code of Ethics for the United States Government Service says that employees should "put loyalty to the highest moral principles and to country above loyalty to persons, party, or government department" and that they should expose "corruption wherever discovered." A cover-up of a $2 billion expenditure of taxpayers' money in contract overruns would seem to qualify as corruption. If we feel any hesitation in

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[25] Mike W. Martin, "Whistleblowing," ch. 9 of *Meaningful Work: Rethinking Professional Ethics* (New York: Oxford University Press, 2000).

saying Fitzgerald was obligated to whistleblow, all things considered, it is because we might be asking too much of someone in his position to do what he did. Is it not beyond the call of duty to require such an incredible degree of personal sacrifice in performing one's job?

How about Applegate? As a loyal employee, Applegate had a responsibility to follow company directives, at least reasonable ones. Perhaps he also had family responsibilities that made it important for him not to jeopardize his job. Yet as an engineer, he was obligated to protect the safety of those who would use or be affected by the products he designed. Given the great public hazard involved, few would question whether it would be morally *permissible* for him to blow the whistle, either to the FAA or to the newspapers. Was he also morally *obligated* to blow the whistle? We leave this as a study question.

Not all whistleblowing, of course, is admirable, obligatory, or even permissible. Certainly, inaccurate whistleblowing can cause unjustified harm to companies that unfairly receive bad publicity that hurts employees, stockholders, and sometimes the economy.[26] But is there a general presumption against whistleblowing that at most is overridden in extreme situations? The most common argument *against* whistleblowing portrays it as an act of disobedience that therefore is supposed to constitute disloyalty to the employer by a disgruntled employee. This presumption will lead us now into a discussion of loyalty and related concepts.

Loyalty to an employer can mean two things.[27] *Agency-loyalty* is acting to fulfill one's contractual duties to an employer. These duties are specified in terms of the particular tasks for which one is paid, as well as the more general activities of cooperating with colleagues and following legitimate authority within the corporation. As its name implies, agency-loyalty is entirely a matter of actions, such as doing one's job and not stealing from one's employer, regardless of the motives for it.

Above we have adorned the term *contractual* with quotation marks to draw attention to the fact that most engineers in the United States do not sign contracts as such. Instead, less formal employment agreements are the vogue. In many other countries,

[26] Michael Davis, "Avoiding the Tragedy of Whistle-blowing," *Business and Professional Ethics Journal* 8 (1989), pp. 3–19.

[27] John Ladd, "Loyalty," in *The Encyclopedia of Philosophy,* vol. 5, ed. Paul Edwards (New York: Macmillan, 1967), pp. 97–98. Also see Andrew Oldenquist, "Loyalties," *Journal of Philosophy* 79 (1982), pp. 173–93; and George P. Fletcher, *Loyalty* (New York: Oxford University Press, 1993). For additional views, see Marcia Baron, *The Moral Status of Loyalty* (Dubuque, IA: Kendall/Hunt, 1984); and John H. Fielder, "Organizational Loyalty," *Business and Professional Ethics Journal* 11 (Spring 1992), p. 83.

notably in Europe and being standardized now, very specific and government sanctioned contracts are used, giving the engineers there much more protection from unfounded firings.

Attitude-loyalty, by contrast, has as much to do with attitudes, emotions, and a sense of personal identity as it does with actions. It can be understood as agency-loyalty that is motivated by a positive identification with the group to which one is loyal. It implies seeking to meet one's moral duties to a group or organization willingly, with personal attachment and affirmation, and with a reasonable degree of trust. People who do their work grudgingly or spitefully are not loyal in this sense, even though they may adequately perform all their work responsibilities and hence manifest agency-loyalty.

When codes of ethics assert that engineers ought to be loyal (or faithful) to employers, is agency-loyalty or attitude-loyalty meant? Within proper limits, agency-loyalty to employers is an obligation, or, rather, it comprises the sum total of obligations to employers to serve the corporation in return for the contractual benefits from the corporation. But it is not the sole or paramount obligation of engineers; this overriding obligation of engineers remains "to hold paramount the safety, health and welfare of the **public** in the performance of their professional duties." (Opening statement of the *Fundamental Canons of the NSPE Code of Ethics.* Bold-face emphasis added.)

What about attitude-loyalty: Is it obligatory? In our view, attitude-loyalty is often a virtue but not strictly an obligation. It is good when it contributes to a sense of corporate community and, thereby, increases the prospects for corporations to meet their desirable goals of productivity. We might say that loyalty is a "dependent virtue": its desirability depends on the value of the projects and communities to which it contributes.[28] Collusion in covering up wrongdoing or serious harm to the public does not qualify as a valuable project.

Any discussion of employee loyalty must address the effects of today's rapidly changing scene of corporate ownerships through mergers and incessant trading of shares. Prospective investors are identified with the aid of firms finding supposedly private information by searching through computer-based data banks. These names and associated profiles are made available for sale and eventually reach brokers who will use them to offer shares for sale by phone. The sales pitch will feature price and claimed profitability, but usually the salesperson will be ignorant of the company's history of employee relations, complaints or recalls on its

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[28] The concept of dependent virtues is developed by Michael Slote in *Goods and Virtues* (Oxford: Clarendon Press, 1983).

products, and violations of safety regulations. The reason a salesperson usually does not have such information to share is that probably no one ever asks these questions, or the information is not divulged when it would reveal a hostile take-over followed by massive layoffs and raiding of the employees' pension fund.

In such ways ownerships make their merry rounds, and while shareholders may abandon a company by selling their shares in an instant on a mere whim, the company's employees are expected to display long-lasting loyalty. Even the employees' pride in the company's product may be lessened by the knowledge that its quality is less important than optimal gain and the shareholders' satisfaction. Automobile executive Lee Iacocca expressed industry's and the financial market's view when he reportedly stated that "our most important customers are not the people who buy our cars—our most important customers are the people who buy our shares."

Collegiality

When engineering codes of ethics mention collegiality, they generally do so in terms of acts that constitute *dis*loyalty. The National Society of Professional Engineers (NSPE) code, for example, states that "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" (Sec. III-8).

These injunctions not to unjustly defame colleagues and not to condone unethical practice are important, but in this context collegiality also has a more positive dimension. Craig Ihara suggests that "Collegiality is a kind of connectedness grounded in respect for professional expertise and in a commitment to the goals and values of the profession, and . . . as such, collegiality includes a disposition to support and cooperate with one's colleagues."[29] In other words, the central elements of collegiality are (1) respect for colleagues, valuing their professional expertise and their devotion to the social goods promoted by the profession; (2) commitment, in the sense of sharing a devotion to the moral ideals inherent in one's profession; and (3) connectedness, or awareness of participating in cooperative projects based on shared commitments and mutual support. As such, collegiality is a virtue defining the teamwork essential for pursuing shared goods.

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[29] Craig K. Ihara, "Collegiality as a Professional Virtue," in *Professional Ideals,* ed. Albert Flores (Belmont, CA: Wadsworth, 1988), p. 60.

Respect for Authority

Respect for authority is important in meeting organizational goals. Decisions must be made in situations where allowing everyone to exercise unrestrained individual discretion would create chaos. Moreover, clear lines of authority provide a means for identifying areas of personal responsibility and accountability.

The relevant kind of authority has been called *executive authority*: the corporate or institutional right given to a person to exercise power based on the resources of an organization.[30] It is distinguishable from *power* (or influence) in getting the job done. It is distinguishable, too, from *expert authority*: the possession of special knowledge, skill, or competence to perform some task or to give sound advice. Employees *respect authority* when they accept the guidance and obey the directives issued by the employer having to do with the areas of activity covered by the employer's institutional authority, assuming the directives are legal and do not violate norms of moral decency.

Taken together, loyalty, collegiality, and respect for authority create a presumption against whistleblowing, but it is a presumption that can be overridden. Loyalty, collegiality, and respect for authority are not excuses or justification for shielding irresponsible conduct. To think otherwise would be to lapse into a form of *corporate egoism*: the view that the corporation is more important than the wider good of the public. In addition to corporate virtues, there are public-oriented virtues, especially respect for the public's safety.
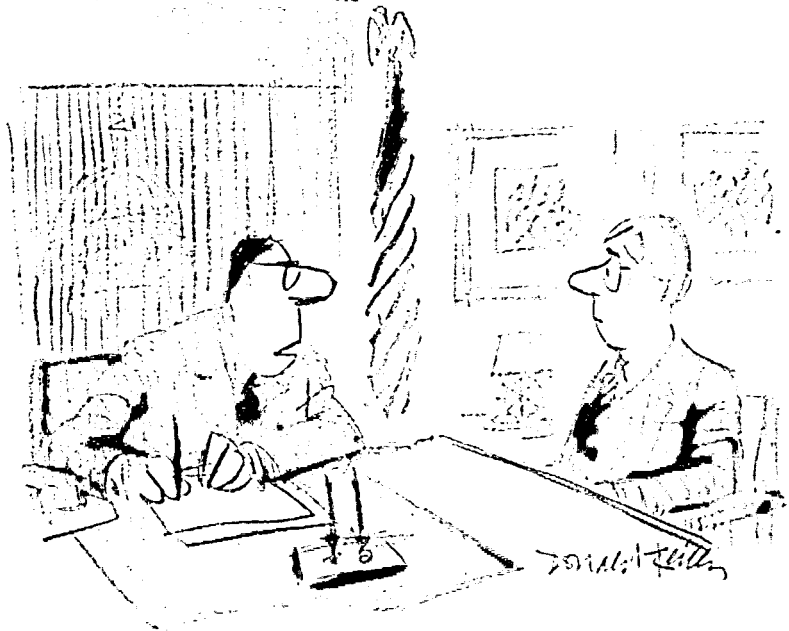
Protecting Whistleblowers

Most whistleblowers have suffered unhappy and often tragic fates. In the words of one lawyer who defended a number of them:

> Whistleblowing is lonely, unrewarded, and fraught with peril. It entails a substantial risk of retaliation which is difficult and expensive to challenge. Furthermore, "success" may mean no more than retirement to a job where the bridges are already burned, or monetary compensation that cannot undo damage to a reputation, career and personal relationships.[31]

Yet the vital service to the public provided by many whistleblowers has led increasingly to public awareness of a need to

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[30] Joseph A. Pichler, "Power, Influence and Authority," in *Contemporary Management*, ed. Joseph W. McGuire (Englewood Cliffs, NJ: Prentice Hall, 1974), p. 428; Richard T. De George, *The Nature and Limits of Authority* (Lawrence: University Press of Kansas, 1985).

[31] Peter Raven-Hansen, "Dos and Don'ts for Whistle-Blowers: Planning for Trouble," *Technology Review* 82 (May 1980), p. 44.

*"One final question. As far as you know, have you any family
history of loose-cannonism or whistle-blowing?"*

protect them against retaliation by employers. Government
employees have won important protections. Various federal laws
related to environmental protection and safety and the Civil Ser-
vice Reform Act of 1978 protect them against reprisals for lawful
disclosures of information believed to show "a violation of any
law, rule, or regulation, mismanagement, a gross waste of funds,
an abuse of authority, or a substantial and specific danger to
public health and safety."[32] The fact that few disclosures are
made appears to be due mostly to a sense of futility—the feeling
that no corrective action will be undertaken or that many years
may lapse before a case is closed satisfactorily. In the private sec-
tor, employees are covered by statutes forbidding firing or
harassing of whistle-blowers who report to government regula-
tory agencies the violations of some 20 federal laws, including
those covering coal mine safety, control of water and air pollu-
tion, disposal of toxic substances, and occupational safety and

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[32] Ibid., p. 42; Stephen H. Unger, *Controlling Technology: Ethics and the
Responsible Engineer,* 2nd ed. (New York: Holt, Rinehart and Winston, 1992),
pp. 179–81.

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[32] Ibid., p. 42; Stephen H. Unger, *Controlling Technology: Ethics and the
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health. In a few instances, unions provide further protection. Overall, the laws concerning whistleblowing are in transition, and a number of observers believe they are moving in directions favorable to responsible whistleblowing.[33]

Nevertheless, there is still one group of employees who are caught in particularly difficult positions because they are paid by private companies to work on government projects at government sites. Nowhere has remedial action been resisted and delayed as much as on clean-up jobs at nuclear sites across the U.S. It is not unusual that the management of the contractor or of the on-site supervising government agency, or both, will shroud complaints in an official cloak of secrecy "for national security reasons" while doing little to resolve the underlying problems. The Government Accountability Project (GAP, website www.whistleblower.org) is an independent organization that offers its assistance to contractor employees and government employees caught in such situations.

In addition to laws that protect government employees, there is legislation to reward whistleblowers who report overcharging on federal contracts (see Discussion Topic 3).

Such laws, when they are carefully formulated and enforced, provide two types of benefits for the public, in addition to protecting the responsible whistleblower: episodic and systemic. The *episodic* benefits are in helping to prevent harm to the public in particular situations. The *systemic* benefits are in sending a strong message to industry to act responsibly or be subject to public scrutiny once the whistle is blown. While the law provides a measure of protection to the responsible whistleblower, there is also an important potential role for professional societies. Until recently, few societies openly supported engineers who had followed their codes of ethics in notifying "proper authorities" after their superiors had overruled them and their professional judgments about dangers to the public. But this is changing. For example, the Institute of Electrical and Electronics Engineers (IEEE) has supported responsible whistleblowers by backing them in court and by establishing forms of honorary recognition for whistleblowers who act according to its ethical code, and by helping to locate new jobs for discharged engineers.[34] Another

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[33] Kenneth Walters, "Your Employees' Right to Blow the Whistle," *Harvard Business Review* 53 (July 1975), p. 34; David W. Ewing, *Freedom Inside the Organization* (New York: McGraw-Hill, 1977), p. 113; Alan F. Westin, ed., *Whistle-Blowing! Loyalty and Dissent in the Corporation* (New York: McGraw-Hill, 1981), pp. 163–64; James C. Petersen and Dan Farrell, *Whistle-Blowing* (Dubuque, IA: Kendall/Hunt, 1986), p. 20.

[34] Robert M. Anderson, Robert Perrucci, Dan E. Schendel, and Leon E. Trachtman, *Divided Loyalties* (West Lafayette, IN: Purdue University Press, 1980).

avenue of protection for engineers being explored by professional societies is the publication in their journals of the names of companies who take unjust reprisals against whistleblowers. Some societies have experimented with hot-lines for engineers contemplating blowing the whistle, but caution advised by lawyers who thought threats of lawsuits might require prohibitively expensive insurance coverage caused at least one society, the IEEE, to abandon its promising hot-line prematurely.

Commonsense Procedures

It is clear that a decision to whistleblow, whether within or outside an organization, is a *serious matter that deserves careful reflection.* And there are several rules of practical advice and common sense that should be heeded before taking this action.[35]

1. Except for extremely rare emergencies, always try working first through normal organizational channels. Get to know both the formal and informal (unwritten) rules for making appeals within the organization.
2. Be prompt in expressing objections. Waiting too long may create the appearance of plotting for your advantage and seeking to embarrass a supervisor.
3. Proceed in a tactful, low-key manner. Be considerate of the feelings of others involved. Always keep focused on the issues themselves, avoiding any personal criticisms that might create antagonism and deflect attention from solving those issues.
4. As much as possible, keep supervisors informed of your actions, both through informal discussion and formal memorandums.
5. Be accurate in your observations and claims, and keep formal records documenting relevant events.
6. Consult trusted colleagues for advice—avoid isolation.
7. Before going outside the organization, consult the ethics committee of your professional society. For employees of the U.S. Government and its contractors, the Government Accountability Project may be a good source (www.whistleblower.org).
8. Consult a lawyer concerning potential legal liabilities.

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[35] Stephen H. Unger, "How to be Ethical and Survive," *IEEE Spectrum* 16 (December 1979), pp. 56–57; Frederick Elliston, John Keenan, Paula Lockhart, and Jane van Schaick, *Whistle-Blowing Research: Methodological and Moral Issues* (New York: Praeger, 1985); Frederick Elliston, John Keenan, Paula Lockhart, and Jane van Schaick, *Whistle-Blowing: Managing Dissent at the Workplace* (New York: Praeger, 1985).

Beyond Whistleblowing

Sometimes whistleblowing is a practical moral necessity. But generally it holds little promise as the best possible method for remedying problems and should be viewed as a last resort.

The obvious way to remove the need for internal whistleblowing is for management to allow greater freedom and openness of communication within the organization. By making those channels more flexible and convenient, the need to violate them would be removed. But this means more than merely announcing formal "open-door" policies and appeals procedures that give direct access to higher levels of management. Those would be good first steps, and a further step would be the creation of an ombudsperson or an ethics review committee with genuine freedom to investigate complaints and make independent recommendations to top management. The crucial factor that must be involved in any structural change, however, is the creation of an atmosphere of positive affirmation of engineers' efforts to assert and defend their professional judgments in matters involving ethical considerations.

What about external whistleblowing? Much of it can also be avoided by the same sorts of intra-organizational modifications. Yet there will always remain troublesome cases where top management and engineers differ in their assessments of a situation even though both sides may be equally concerned to meet their professional obligations to safety. To date, the assumption has been that management has the final say in any such dispute. But our view is that engineers have a right to some further recourse in seeking to have their views heard, including confidential discussions with the ethics committees of their professional societies.

When an engineer so strongly disagrees with the purposes of a product, the policies of management, the low level of safety in manufacturing/construction, or the lack of candor in advertising, he or she may simply decide to quit. Under such circumstances engineers may ask to be removed from the projects at hand, or they may decide to separate entirely from their employer. Freed of the usual employment obligations, the now unemployed engineer can more freely blow the whistle but should keep in mind that this may lessen chances of finding employment in the future, especially when claims of wrongdoing are greatly exaggerated, whether by the whistleblower or a news medium. One obligation carried over from the resigned position is the duty not to divulge trade or national security secrets. When that is unavoidable, the secrets should be revealed only in a manner the law may allow or the engineer's professional society recommends.

The following examples are but a few of the many that could be cited and do not include engineers or scientists who abstained

from certain lines of work because they could tell from the outset that their principles might be compromised. Norbert Wiener, the father of cybernetics, is one such person. He refused to work on projects which could not be freely discussed and which would threaten human well-being and liberties.

Roy Woodruff was associate director of defense systems at the Lawrence Livermore National Laboratory when he resigned his position over differences with Edward Teller, who was his boss and Director of the Laboratory. Woodruff declared that tests had proven an X-ray laser beam, the Excalibur system proposed for use in the Star Wars Project, to be ineffective as a tool for disabling incoming enemy missiles. Teller, on the other hand, extolled its virtues and had the ear of President Reagan and top level decision makers in Washington. Woodruff resigned his position as associate director but stayed on at the Laboratory to pursue other interests while trying to get more of a hearing for his assessment of space-based weaponry.[36]

David Parnas, a computer scientist, was also involved in a Star Wars project. He resigned from an advisory panel on computing when he lost his initial enthusiasm for the Strategic Defense Initiative (SDI) after only the first meeting of the panel. When agency officials would not seriously listen to his doubts about the feasibility of the project, he gradually succeeded through journal articles, open debates, and public lectures to convince the profession that Star Wars did not differ much from conventional anti-ballistic-missile defense without overcoming earlier shortcomings. Indeed, the system's complexity made it practically impossible to write software as reliable as it ought to be in tight-trigger situations. For his efforts on behalf of the public interest, he was honored with the Norbert Wiener Award by the society of Computer Professionals for Social Responsibility (CPSR).[37] Incidentally, Parnas also chafed at what he saw as opportunistic proposals by researchers in industry and academe for favorite projects often only remotely related to SDI, but with large budgets supported by a generous pool of available money, thus providing SDI with some base of support.

Greg Minor, Richard Hubbard, and Dale Bridenbaugh were nuclear reactor specialists with General Electric. Independently of each other they had found a variety of safety defects in GE reactors but received no responses from management that would have allayed their concerns. After the three engineers had individually decided to resign, they quit in unison so their step would

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[36] Robert Scheer, "The Man Who Blew the Whistle on 'Star Wars'," *Los Angeles Times Magazine,* July 17, 1988, p. 6–32.
[37] Carl Page, "Star Wars, Down but Not Out," Fall 1996 Newsletter of Computer Professionals for Social Responsibility, v.14, n.4, Fall 1996.

draw greater attention. Thereafter they proceeded to advise citizens' groups and the Union of Concerned Scientists (UCS) on nuclear plant safety. In 1978 they gave technical advice for the filming of *The China Syndrome* shortly before the Three Mile Island accident occurred (unrelated to GE reactors).[38]

Discussion Topics

1. According to Kenneth Kipnis, a professor of philosophy, Dan Applegate and his colleagues share the blame for the death of the passengers in the DC-10 crash. Kipnis contends that the engineers' overriding obligation was to obey the following principle: "Engineers shall not participate in projects that degrade ambient levels of public safety unless information concerning those degradations is made generally available."[39] Do you agree or disagree with Kipnis, and why? Was Applegate obligated to blow the whistle?

2. Present and defend your view as to whether in the case described below the actions of Ms. Edgerton and her supervisor were morally permissible, obligatory, or admirable. Did Ms. Edgerton have a professional moral right to act as she did? Was hers a case of legitimate whistle-blowing?

   In 1977, Virginia Edgerton was senior information scientist on a project for New York City's Criminal Justice Coordinating Council. The project was to develop a computer system for use by New York district attorneys in keeping track of data about court cases. It was to be added on to another computer system, already in operation, that dispatched police cars in response to emergency calls. Ms. Edgerton, who had 13 years of data-processing experience, judged that adding on the new system might result in overloading the existing system in such a way that the response time for dispatching emergency vehicles might be increased. Because it might risk lives to test the system in operation, she recommended that a study be conducted ahead of time to estimate the likelihood of such overload.

   She made this recommendation to her immediate supervisor, the project director, who refused to follow it. She then sought advice from the IEEE, of which she was a member. The Institute's Working Group on Ethics and Employment Practices referred her to the manager of systems programming at Columbia University's computer center, who verified that she was raising a legitimate issue.

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[38] Karen Fitzgerald, "Whistleblowing: Not Always a Losing Game," IEEE Spectrum, December 1990, p. 49–52.

[39] Kenneth Kipnis, "Engineers Who Kill: Professional Ethics and the Paramountcy of Public Safety," *Business and Professional Ethics Journal* 1 (1981), p. 82.