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The Debate Over Cryptography and Scientific Freedom

By Alexander Fowler

"This is wonderful news. I hope I can get some of my ideas published before they change the law again," stated Daniel Bernstein in August after a District Court in California ruled that he could distribute his research findings on cryptography electronically and discuss it openly with other researchers. While a Ph.D. candidate at the University of California at Berkeley, Bernstein developed a cryptographic technique called "Snuffle." The now research assistant professor at the University of Illinois at Chicago sought in 1992 clarification from the State Department whether disseminating the source code and related information through traditional modes of scientific communication, including the Internet and at conferences, would violate current export controls. His objective was to disseminate his findings to his colleagues for evaluation, testing, and critique; peer review is one of the basic requirements of scientific research. During the next year, the government notified Bernstein that not only was Snuffle controlled by export regulations, but the underlying source code, his scientific paper, and all other technical information related to the technique were also restricted. In 1995, he filed suit in the District Court arguing that the government's restrictions on his research were an unconstitutional limit on his freedom of speech. At the end of this summer, District Judge Marilyn Patel ruled that Snuffle's source code did qualify as protected speech under the Constitution and that the government could not bar Bernstein or anyone else who makes an effort to "use, discuss, or publish" his cryptographic technique and related materials. Immediately following her decision, Judge Patel issued a stay of her ruling to delay its implementation long enough for the government to file its appeal.

Scientific Community Concerned Over Crypto Controls

Cryptography is the science of code writing and cryptographic research explores and develops theories and methodologies for rendering messages or information unintelligible to others. Up until the early 1980s, cryptography was the almost exclusive concern of governments. During the past 15 years, however, there has been an explosion of academic and private sector interest in the field. The widespread use of computers and electronic data storage and transmission, marked most recently by the privatization and rapid growth of the Internet, has generated strong demand for scientific and technical solutions to insure the security of information and computer-mediated communications.

Over the past 15 years, many scientific groups both inside and outside the government have conducted studies on the implications of export controls on cryptography. Although all but one of these studies have recommended loosening these restrictions, little has changed since the Cold War era. In 1981, the Public Cryptography Study Group, formed by the American Council on Education (ACE) under a grant from the National Science Foundation (NSF), issued a report recommending that the National Security Agency conduct, on a trial basis, voluntary, prepublication review of manuscripts on cryptography. The report met with fierce opposition by the scientific community because members of the group accepted the government's national security claims as valid in lieu of receiving the necessary security clearances to validate such claims independently.

The Office of Technology Assessment conducted a study in 1994 to flesh out the spectrum of policy issues and legislative options for Congress. OTA reported that "an important outcome...would be the development of more open

processes to determine how cryptography will be deployed throughout society."1 The Association for Computing also published a report in 1994 that concluded "all who have thought seriously about the issues of communications security—from civil libertarians to law enforcement officials to the computer industry and national security experts—agree that strong cryptography is necessary for protecting confidentiality, integrity, and authenticity of the information infrastructure."(p. vi)

Last year, the National Research Council (NRC) conducted a study, which determined that "the overall interests of the government and the nation would best be served by a policy that fosters a judicious transition toward the broad use of cryptography." (P.13) Unlike the earlier ACE study, members of NRC study group received security clearances to review the government's claims and still opted for a change in government's approach to crypto policy. Most recently, an ad hoc group of cryptographers and computer scientists reviewed the technical feasibility of government proposals for cryptographic systems that would allow government officials access to messages linked with ongoing criminal investigations. They concluded that the deployment of encryption technologies with backdoors for covert surveillance "will result in substantial sacrifices in security and greatly increased costs to the end user."

Last February, the American Association for the Advancement of Science (AAAS) wrote the Bureau of Export Administration in the Department of Commerce expressing its concerns with maintaining current export controls on cryptography and the subsequent impact these controls have on the scientific community. AAAS argued that maintaining current export controls "threatens to undermine essential features of scientific freedom and the open exchange of information that are generally acknowledged as critical to innovation in science and technology...AAAS opposes attempts by the government to restrict the communication or publication of unclassified research and technical information, efforts which we believe are inconsistent with scientific advancement." Specifically, the AAAS letter points out three ways that export controls on cryptography violate well-established norms of scientific freedom.

I. Cryptography in the Classroom

Teaching courses on cryptography violates export controls if foreign students are enrolled in such courses. AAAS suggested that perhaps such a control was inadvertent, since one part of the Export Administration Regulations (EAR) states that "mere teaching or discussion of information about cryptography...by itself would not establish the intent described in this section, even where foreign persons are present." However, elsewhere in the EAR, controls are placed on all "educational information" applying to encryption software, and "Educational information" is defined as "release by instruction in...academic institutions." This is consistent with the thrust of post-WWII policies aimed at preventing the transfer of sensitive scientific know-how out of U.S. academic institutions and into the hands of foreign countries. For instance, atomic energy research was placed under a statutory blanket of secrecy and a number of scientific and technological exchanges between the U.S. and the former-Soviet Union were curtailed. On at least two occasions in 1980, Federal officials intervened to prevent nationals from Communist bloc countries from attending scientific professional conferences being held in the U.S.[1] In 1980, the NSF, at the behest of the NSA, withheld grant funds from a computer scientist because his research in cryptography impinged on national security.[2, Science, p. 995]

II. Cryptography in Scientific Journals

Another section of the EAR posits a difference between the paper and electronic publication of the same cryptographic materials. While it is acceptable under this provision to publish such material in a book and distribute it internationally without an export license, putting the same information on a disk and sending it abroad is subject to governmental approval. This distinction has serious ramifications for scholarly communication as many professional journals are now moving onto the Internet as electronic publications. "Will cutting-edge innovations in cryptography be publishable in this new medium?" AAAS asked. Scientific publications are a primary source of communication among researchers worldwide. AAAS concluded that "restrictions that limit potential collaborations and channels of communication into new and innovative cryptographic products will not only impede scientific progress, but will also retard the evolution of a secure Global Information Infrastructure."

III. Cryptography and Professional Ethics

The development of ethical standards by scientists to encourage responsible conduct and to establish accountability to a

supportive public is a central activity of scientific and engineering societies. In its letter to the Department of Commerce, AAAS stated that the codes of professional conduct promulgated by U.S. professional engineering and computing societies "all stress the importance of protecting established cultural and ethical norms of information privacy and data integrity." Current export controls on cryptography could compel scientists employed by major software and hardware computing companies to produce information security systems that are intentionally weak for international markets. "This would create an ethical dilemma for the professional," AAAS wrote. "He is bound by his responsibility to honor the ethical norms agreed upon by his profession, but as a citizen of the U.S., he is also bound by his responsibility to act according to...federal regulations. The government should avoid whenever possible creating circumstances where professionals must make such choices."

Government Appeals Bernstein Decision

At the time of publication, oral arguments in the government's appeal in the Bernstein case are just about to begin. The government will argue before the 9th Circuit Court of Appeals the Judge Patel's decision was based on an inaccurate depiction of what the EAR actually covers and that the relief it offers is too broad. In its reply brief for the appellants, the government states:

Bernstein does not need a license under EAR to engage in public discussions and instruction about cryptography in the classroom or in academic conferences, either here or abroad. Nor does he need a license to distribute copies of his encryption program to his student - or to anyone else in this country...other than an agent of a foreign government. And despite his insistence that the EAR excludes him from 'publishing' his encryption program electronically, he does not even need a license to distribute his program via the Internet, as long as he takes adequate precautions to prevent the unauthorized transfer of the program outside the United States.

However, the government's argument ignores that the scientific community is defined globally. At the very least, it is disingenuous to claim there are no limits to Bernstein's academic freedom so as long as he only distributes Snuffle to other American scientists. Regarding the Internet, he can publish it on a globally distributed network as long as he prevents its release to a colleague outside the U.S.

On November 11, several organizations filed *amicus curiae* or "friends of the court" briefs in support of Bernstein. In addition to addressing the First Amendment issues fundamental to Bernstein's role as an academic, the underlying argument in all of the briefs is that source code is protected expression under the First Amendment. As one of the briefs noted, "source code written in C programming language containing encryption algorithms...is an important vehicle for communication among scientists and mathematicians of their theories and ideas."

Where Do We Go From Here?

Back in the 1950's, the President's Scientific Research Board concluded that government security regulations "should be applied only when strictly necessary [and] they should not attempt to cover basic principles or fundamental knowledge." [2] Three years later, a report prepared for the Department of State similarly concluded that "there is ample evidence that unnecessary restrictions exist on the flow of unclassified scientific and technological information [that] are dangerous to the progress of United States science, affect adversely the conduct of foreign relations in science, and are therefore damaging to our national security." The report added "with respect to unclassified technical information, no definite and positive controls are possible under our system of government...the principle danger of unnecessary restrictions lies in the creation of a furtive atmosphere in which the flow of information necessary to progressive science is brought to a halt." [3] Both reports were conducted at the highest levels of government during an era filled with fears and apprehensions about communism. Yet, in both cases, the importance of the full and open exchange of scientific information was reaffirmed. If we decide to disregard these important conclusions and continue restricting the climate around cryptography, then we will need to consider implementing mechanisms that minimize the ethical concerns for these scientists. For instance, we may need to alert users to government imposed limits on their information privacy and security: "Warning: the e-mail message you are about to send is secure from everyone *except* the government." Wouldn't it be far more productive to grant Bernstein and other cryptographers the freedom to conduct their research in a climate consistent with all other areas of science and engineering?

Endnotes

- 1 OTA, *Information Security and Privacy in Network Environments* (OTA: Washington, DC, 1994, p.16).
- 2 ACM U.S. Public Policy Committee, *Codes, Keys, and Conflicts: Issues in US Crypto Policy* (ACM: New York, NY, 1994, p. VI).
- 3 K.W. Dam and H.S. Lin eds., *Report of the Committee to Study National Cryptography Policy* (NAS Press: Washington, DC, 1996, p. 13).
- 4 Ad Hoc Group of Cryptographers and Computer Scientists, *The Risks of Key Recovery, Key Escrow, and Trusted Third Party Encryption* (1997, p. 3).
- 5 See <http://www.aaas.org/spp/sfirl/crowe.htm>.
- 6 H.C. Relyea, *Striking a Balance: National Security and Scientific Freedom* (AAAS: Washington, DC, 1985, p. 3).
- 7 G.B. Kolata, "Cryptography: A New Clash Between Academic Freedom and National Security," *Science*, August 29, 1980, p. 995.
- 8 Department of Commerce, *Reply Brief to the Appellants in Bernstein v. Commerce*, November 20, 1997, pp. 3-4.
- 9 See www.eff.org/pub/Privacy/ITAR_export/Bernstein_case/Legal/.
- 10 Electronic Privacy Information Society, *Brief for Amici Curiae in Bernstein v. Commerce*, November 7, 1997, p. 24.
- 11 Quoted in Relyea, p. 86.
- 12 Ibid., p. 87.

IN THE NEWS

NRC Report Finds Study of Human Genetic Diversity Worthwhile

A project proposed by an international group of scientists to collect, preserve, and analyze the genetic information of the world's indigenous populations has been deemed worthwhile by a National Research Council (NRC) report released on October 21. The Human Genome Diversity Project (HGDP) addresses concerns among scientists that human genetic diversity is diminishing as the number of distinct populations around the world declines. The HGDP is interested in preserving this information before it disappears, and to use it to provide insight into the evolutionary history of the human race and certain populations' susceptibility to diseases. Unexpected by project planners, the HGDP raised much criticism from indigenous groups around the world. Some of the concerns raised included: the procedures for the collection and storage of DNA samples, the intellectual property rights and possible commercial exploitation of the products developed, and the fear of potential abuses such as discrimination against individuals or groups. The controversy surrounding the project prompted the National Science Foundation (NSF) and the National Institutes of Health (NIH) to request an evaluation by the NRC. In its report, *Evaluating Human Genetic Diversity*, the NRC was persuaded that, "a global assessment of the extent of human genetic variability has substantial scientific merit and warrants support, largely because of the insight that the data collected could provide into the origin of the human species." Nevertheless, "the committee also foresees numerous ethical, legal, and human-rights challenges in

the prosecution of a global effort...." To address these issues the NRC recommended that the study, "should be designed and conducted in such a way that protects the identities of DNA donors." It suggested that the set of data that would be most economical with a minimum of ethical and legal complications would be that obtained from unrelated individuals within a given population with the identity of the donors not linked to the samples. This would protect the privacy of the donors as well as freeing researchers from having to obtain consent each time a new study is conducted. Although this approach would limit the discovery of new disease genes, it would eliminate the concerns of commercial exploitation. Finally, it was recommended that until a clear methodology and ethical protocol have been firmly established, work should be limited to studies originating in the United States. A copy of the NRC report can be obtained by calling (800) 624-6242. [See *announcement of AAAS Annual Meeting symposium on the HGDP*, page 6—*Ed.*]

Policies for Open Internet Use

A conference in Brussels, Belgium, organized by the Parliamentary Human Right Foundation (PHRF), PHRF/Europe, and the Internet Program of the Open Society Institute, was held on November 23, 1996 to discuss policies pertaining to principles and guidelines for Internet use. The document that was developed and adopted at the meeting, entitled Open Internet Policy Principles (OIPP), includes a set of recommendations intended to serve as a framework for government officials, parliamentarians, and non-governmental organizations when assessing the impact of Internet technologies around the world. The principles articulated in the document are intended to "ensure that the Internet remains open and continues to support basic democratic values." The principles advocate access to the Internet for all citizens of the world, with governments and industry sharing the responsibility for building a "Global Information Infrastructure." The document discusses a legal framework to address the rights and responsibilities of Internet users, and acknowledges that any legal regulations need to recognize international human rights law and legitimate national law enforcement interests. The question of objectionable content is raised with priority given to "downstream filtering" by the user, and "There should be no government censorship of Internet content." Finally, the issue of anonymity in communication, with the principles declaring that "Users should have the right to communicate without disclosing their identity....Choice among various levels of identification should be made by the users involved, not dictated by law." Users should also have the right to use any form of cryptographic technology without obligation to guarantee law enforcement access to communications. The creation of the OIPP was the first phase of the project. A second phase will evaluate how certain countries conform to the OIPP, with the results used as a template for developing Internet legislative and regulatory frameworks in other countries. The text of the OIPP may be found on the WWW at <http://www/soros.org/principles.html>.

FDA to Enforce Inclusion of Women in Drug Studies

The Food and Drug Administration (FDA) proposed a rule on September 23, 1997 (*Federal Register* 62: 49946-49954, September 24, 1997) to help ensure that women with reproductive potential, who have a life-threatening disease, are not automatically excluded from early clinical drug trails because of the risk of reproductive or developmental toxicity. This proposal is meant to implement recommendations from both the National Task Force on AIDS Drug Development and the Presidential Advisory Council on HIV/AIDS. The rule will allow the FDA to halt or prevent clinical investigations where women are being excluded from the study for fear of their becoming pregnant. A guideline issued by the FDA (58 FR 39406) in 1993 had already recommended that such an exclusion be dropped from all drug trails for life-threatening diseases. But in a recent limited agency review of clinical trail protocols, it was revealed that women with reproductive potential are still being excluded from some HIV related drug trials. According to the proposed rule, "The agency believes that this violates ethical principles and in some cases could lead to inadequate data on use in women prior to wide availability of the drug." The proposal is meant to enforce the compliance of the drug companies to include woman in all phases of drug testing. The FDA concludes that, as long as the patient volunteers are fully informed of the risks associated with a drug trial, women with serious or life-threatening diseases "should be able to make their own risk-benefit determination." The rule does not apply to studies conducted exclusively on healthy volunteers, on single gender populations, or on men, as long as a similar study that does not exclude subjects due to reproductive potential is being conducted on women. Nor does it apply to pregnant women. The public can comment on the proposal up until December 23, 1997.

Global Science System in Transition

An international workshop, sponsored by the International Institute for Applied Systems Analysis, was held in Laxenburg, Austria on May 23-25, 1997. The meeting was convened to assess the current status of international scientific cooperation. Following the workshop the participants issued "The Laxenburg Statement on the Global Science System" to bring attention to the "importance of sustaining and expanding the scope for international cooperation and the free exchange of scientific information upon which depends the long-term vitality of the world's basic research activities." Through the rapid advances in information and telecommunication technologies the opportunities for collaborative research have been greatly expanded, yet "unfortunately, a political and economic climate has developed that is proving less and less hospitable to the international organization of new initiatives that involve long-term programmes of scientific inquiry." In this new era of international competitiveness governments have become less willing to fund basic research when there is no immediately foreseeable economic advantage. Cooperative international initiatives being imperiled are "global climate change, the multiplication and spread of antibiotic-resistant pathogens, environmental degradation...." The challenge is to convince nations that there are sound reasons to participate in collaborative research for the common good. In particular, vigilance is required to preserve the free exchange of scientific research from private business interests and public agencies for commercial exploitation and international competitive advantage. An elaboration of legal protections has arisen to establish intellectual property rights in science and technology, with the "Widespread patenting of research materials and computational algorithms, and copyrighting of the scientific databases without due provisions for 'fair use'..." having the potential to impede scientific advance. This statement calls for the establishment of an independent organization of experts to assess the state of the global science system, by evaluating the impact of electronic communications on the research process, identifying emerging phenomena and policy issues to be addressed, and proposing procedures to improve international scientific cooperation, by protecting researchers' access to tools, methods and data. To obtain a copy or make comments regarding this statement send E-mail to globsci@aps.org .

UNESCO's Human Genome Declaration

UNESCO has adopted a "Universal Declaration on the Human Genome and Human Rights," the first international text on the ethics of genetic research. It sets universal ethical standards on human genome research and practices that balance the freedom of researchers with the need to protect humanity from potential abuses. The text was finalized in July 1997, after four years of elaboration by the International Bioethics Committee (IBC) of UNESCO, and was adopted unanimously by the General Conference on November 11, 1997. The Declaration, which is non-binding, is designed to establish lasting ethical principles to be used as a framework for countries establishing bioethical policies. In its principal articles, the Declaration establishes limits on intervention in the genetic heritage of humanity and its individuals. Three basic principles emerge: the concept of the human genome as the "the heritage of humanity" in a symbolic sense; respect for the dignity and human rights of every individual, regardless of their genetic characteristics; and the rejection of genetic determinism. The Declaration details the rights of individuals: prior consent to all research, treatment or diagnosis; protection against any discrimination based on genetic characteristics; confidentiality of genetic information; and the right to "just reparation" from harm arising from genomic interference. After reaffirming that the rights and freedoms of the individual must be of primary concern it is recognized that freedom of scientific thought and creativity is also essential and must be protected. Nonetheless, no research concerning the human genome nor its applications "should prevail over the respect for human rights, fundamental freedoms and human dignity of individuals or, where applicable, of groups of people." There is no intent to limit the progress of knowledge or commercial application relating to the genome, but the dissemination and free exchange of such knowledge and the strengthening of research capacities in developing countries should be ensured. By drafting legislation, setting up ethics committees, and establishing programs of education in bioethics, with continuing guidance from the IBC, countries can reach the goals set forth in this document. The Draft of the Declaration can be found on the WWW at <http://www.unesco.org/ibc/uk/genome/projet/index.html>.

Malaysian Scientists Silenced on Fires

The haze from Indonesian forest fires, covering many parts of Malaysia in the last several months, has had a large negative impact on the country's approximately \$4.5 billion tourist industry. For this reason, on November 5, 1997 the Malaysian government ordered scientists, teachers, and environmentalists, at state funded universities, to stop making public comments on the country's haze problem. This "gag" order drew much criticism and concern from the academic community, lawyers, and opposition leaders in Malaysia and elsewhere. Responding to the negative press surrounding

the order the Education Ministry sent out a new circular to all universities on November 13. It declared that "Academics of local universities can release their findings on the haze to the media if their research has been properly verified." This was then revised further emphasizing that there was no attempt to bar academics from communicating with the press and the public. It said "that statements and academic analyses made should be done with a full sense of responsibility, accountability, and profound awareness about the positive and negative implications for the university and the nation." Researchers must remember to only release and publish quality findings to the media, to ensure that they were backed by scientific fact and concrete analyses, verified by peers, and cleared by research sponsors before being made public.

IN THE SOCIETIES

AAA Recommends "Race" be Eliminated in OMB Directive

The American Anthropological Association (AAA) has released a response to the Office of Management and Budget (OMB) concerning the revision of Directive 15: Race and Ethnic Standards for Federal Statistics and Administrative Reporting. Directive 15 standardizes the collection of racial and ethnic information among federal agencies and non-governmental groups. The original 1977 Directive distinguished among four races: American Indian or Alaskan Native, Asian or Pacific Islander, Black, and White; and two ethnic backgrounds: of Hispanic origin and not of Hispanic origin. Criticism that the federal race and ethnic categories did not adequately reflect the Nation's diversity led to a formal review commencing in 1993. Recommendations for revisions, from an interagency committee, were published by OMB in the Federal Register (62: 36847-36946, July 9, 1997). These included maintaining the original racial and ethnic categories and collecting the information from two separate questions with the ethnicity question first, changing to "Black or African-American," and allowing respondents to report more than one race. The AAA considered these proposed changes and noting that "there are many misunderstandings associated with notions of race and ethnicity," made the following recommendations. It supports the change allowing participants to choose more than one category of race. On the other hand, it advises that the race and ethnicity categories be combined into one question and "that further research be conducted to determine the term that best delimits human variability...." It proposes "that the term 'ethnic group' is better understood by individuals as a concept related to ancestry or origin." Finally, it advocates the removal of the term "race" during the planning for the 2010 Census, since the concept has no biological justification. The vagueness of definitions for race, origin, and ethnicity, which persists and has no scientific or anthropological foundations for their formulations, continues to be a major concern. The AAA response statement and fact sheet are available on the WWW at <http://www.amerantassn.org/ombprinf.htm> .

Standards for Bioethics Consultation

Experts from the fields of health care ethics, health care, and health policy comprise the SHHV-SBC (Society for Health and Human Values-Society for Bioethics Consultation) Task Force on Standards for Bioethics Consultation, the mission of which is to explore standards for health care ethics consultation. It has prepared a Discussion Draft that focuses on the nature and goals of ethics consultation and the types of skills, knowledge, and character traits important for conducting ethics consultations. In addition, the emerging area of organizational ethics consultation, the evaluation of ethics consultants, and the special obligations of consultants and institutions are also addressed. The Task Force recommends using the report as a voluntary model and not for certification or accreditation of individuals or groups. It offers guidance on the "core competencies" required and how to acquire them. A "qualified facilitation" model is presented that is intended to "improve the provision of health care and its outcome through the identification, analysis, and resolution of ethical issues as they emerge in consultation regarding particular clinical cases in health care institutions." Two categories of skills are recommended: (1) skills of ethical assessment to identify and analyze the nature of the value uncertainty or conflict; and (2) process and interpersonal skills to resolve the value uncertainty or conflict as it emerges in health care settings. Additionally, a listing of nine knowledge areas required for effectively conducting ethics consultations is given. This report is intended for ethical consultants, educational programs, and health care institutions. A copy of the Discussion Draft is available on the WWW at <http://www.mcw.edu/bioethics/DISDRFT4.html>.

Ethical Aspects of Dental Practice

The American Dental Association (ADA) Council on Ethics revised a 1995 provision in its Bylaws and Judicial Affairs concerning the ethical aspects of dental practice. Addressing the issue of managed care, the profession advocates the placing of the patient's welfare above all other considerations. Regardless of the patient's method of healthcare, the dentist is required to provide quality care and must not allow the demands of "third parties" to influence the type of treatment administered. Business obligations do not excuse dentists "from their professional duty to put the patient's welfare first."

Call for the Establishment of Ethics Section in ASPA

The classical definition of a professional is one who nurtures excellence in not only technical competence but also moral character. This Section, accordingly, is consistent with—and will contribute to—the Society's mission "to advance the science, processes, and art of public administration... (by) affirming the spirit of professionalism within its membership..." (Public Administration Review, any recent issue, back cover). It is also consistent with the ASPA's Professional Ethics Committee's vision to "empower ASPA members to choose the ethical way and generate a public service culture committed to ethical excellence." Complementing existing sections, the Ethics Section will affirm this spirit by involving the membership at large in a sustained, self-supporting effort to cultivate ethical issues pertinent to the field, nationally and internationally. Specifically the Section seeks to further the understanding of ethics in government and the non-profit sector by offering activities characteristic of ASPA sections. It will offer a journal (*Public Integrity Annual* sponsored by ASPA and the Council on State Governments) as well as a newsletter, panels, workshops, and symposia at regional and national conferences. The Section will also have a WWW site and an ethics listserv. Dues are estimated to be \$16-24. For more information, contact Donald C. Menzel, 1031 Sylvia Lane, Tampa, FL, 33613; Fax (813) 974-9832; E-mail menzel@luna.cas.usf.edu; or James S. Bowman, School of Public Administration, 620 Bellamy Building, Florida State University, Tallahassee, FL, 32306-2032; Fax (904) 644-7617; E-mail jbowman@garnet.acns.fsu.edu. Information about the Ethics Section is on the WWW at <http://www.cas.usf.edu/~menzel/aspa/WWWlink.htm>.

ETHICS, LAW & PUBLIC POLICY

The Corporate Practice of Engineering: A Trend?

By Arthur Schwartz

With increased global competition, engineering companies are finding it necessary to be more and more flexible in adapting to an ever-changing market. Design-build, construction management, build, own, operate and transfer ("boot") arrangements, equity arrangements, and other innovative project delivery systems all present new and challenging opportunities for engineers in the decades ahead. Engineers will need to be able to provide their services in a manner that provides a high degree of business flexibility yet recognizes their professional obligation to perform engineering services competently and ethically consistent with the law.

One of the increasingly popular organizational structures for engineering firms is the engineering business corporation. However, corporate practice within the practice of engineering is certainly not a new phenomenon. As noted by Robert F. Cushman in his book *Design Professional's Handbook of Business and Law*:

With the increase in complexity and magnitude of design projects in this century, it became more and more difficult to provide the necessary design services in the traditional sole practitioner and partnership organizations. As professional organizations became larger, reflecting a multidisciplinary approach to projects, and as practice spread across the country in various branch offices, the advantages of corporate organization form became apparent. Nevertheless, the issue of practicing design professional services through a corporation has been very contentious.

From the time of the enactment of the first state engineering licensure law permitting business corporations to practice engineering in 1921, the subject of corporate practice of engineering has been a topic of considerable discussion and

debate.

At the outset, and as a point of clarification, it should be noted that most engineers are in fact employed and practice in corporations – small, medium large, and mega-sized industrial corporations. Those employed engineers are generally involved in the design and manufacturing of products and processes for the benefit of their industry employers and their customers. Since these engineers are not technically offering engineering services directly to the public, this area of engineering activity is not the focus of this paper.

Also, this essay discusses the practice of engineering through a business corporation and not the practice of engineering through a professional corporation. Professional corporations are created pursuant to state law to enable incorporated professionals to take advantage of favorable federal tax and pension rules, but still restrict participation in the management of the business (stock ownership and transfer, serving as an corporate officer, member of the board of directors) solely to the particular licensed professionals involved.

Historical Background

As noted, the issue of engineering corporate practice was not without some controversy, particularly when it was first raised many years ago. Since the practice of engineering involves a high degree of specialized education, practice experience, and technical competence residing in the individual practitioner, it was first argued that such characteristics cannot be acquired by a corporation, except to the degree that individuals of the corporation can provide this service. In addition, there was deep concern that, by permitting business corporations to practice engineering, professional engineers would lose their ability to exercise independent judgment. Additional concern was expressed that by permitting corporate practice, engineers would forfeit control of engineering practice to non-engineers who lack engineering competence that could endanger the public health and safety. There were also fears expressed that corporate practice would infringe on the ethical obligations of the engineer to accept personal responsibility for all professional actions as well as lead to conflicts of interest that would inevitably arise between the engineer's obligations to the public and to the corporation.

Early proponents of engineering corporate practice often included large construction companies involved in public works as well as design/build entities, which customarily take a project from conception and design through the construction phase. In the late 1940s and early 1950s, specific efforts were directed toward removing the prohibition on corporate practice from the New York engineering licensure statute. A group of companies formed the Committee on Engineering Laws (CEL) and introduced legislation in New York in 1953 and 1954 to remove the restrictions on corporate practice. The effort was unsuccessful in New York, but in 1983 a similar provision in the Ohio engineering licensure statute was removed, leaving New York to this day as one of only a small handful of states with such a restriction.

The National Council of Examiners for Engineering and Surveying (NCEES)—the umbrella organizations for the 55 state and territorial engineering licensure boards—adopted a pertinent provision in its model engineering licensure law in the late 1950s. It recognized the practice of engineering by individual engineers acting through a joint stock company or corporation, provided "they shall be individually liable for their professional acts" and "all personnel who act in its behalf as engineers are registered or are persons exempt under the provisions under the Act."

The current language in the NCEES Model Law permits the practice of engineering through a business corporation provided that the person in direct control or having personal supervision of such practice and all personnel who act on behalf of the firm in professional engineering matters are licensed and the firm has been issued a certificate of authorization by the licensing board. Importantly, the NCEES language also recognizes that no individual practicing engineering within a business corporation is relieved of responsibility for engineering services by reason of the individual's employment or other relationship with the business corporation.

The National Society of Professional Engineers Professional Policy 74-B—Professional Engineering Licensure—Corporate Practice, states:

The National Society of Professional Engineers believes that engineers should have the right to select any form of business organization permitted by state law, and adopts the position that engineering practice

through or by a corporation should be permitted only under the following minimum conditions and limitations:

All professional engineering work on behalf of the corporation be performed only by or under the direct supervision of licensed engineers;

No corporation be permitted to provide engineering services to others unless first having been issued a certificate of authority by the state licensure board, with the certificate subject to periodic renewal; and

The state licensure board have the authority to revoke an authorization for a corporation to provide engineering services upon a finding that the officers or directors have induced or permitted (a) the performance of engineering services by persons not legally qualified under the state engineering licensure laws; or (b) the violation of any rules, regulations, or code or practice adopted by the board.

Today the issue of personal responsibility has been addressed in all states that permit the practice of engineering through a business corporation. Each state engineering licensure law holds the individually licensed professional personally liable for the work the licensed professional performs or that is performed under the licensed professional's direct control and personal supervision, regardless of the business organization through which practice is provided.

Trends

There are several practical advantages of corporate practice by engineers. The business corporate form allows for better integration of engineers, other professionals, and non-professionals service providers in the management and operations of a business. There are important tax and employee benefit plan advantages to a business corporation that enable these entities to attract, compensate, and retain their staff and remain competitive. A business corporation also has the ability to remain private or go public and attract and accumulate capital, develop financial strength, and retain the necessary resources to execute large projects. The business corporation provides far greater flexibility in ensuring the continuity of the business and in permitting a wider range of ownership and management options.

RESOURCES

In Print

Developing a Code of Ethics in Research: A Guide for Scientific Societies, by the Committee on Research Integrity (CRI), Association of American Medical Colleges (Washington, DC, 1997, \$25, plus shipping and handling). To order, contact AAMC Section for Publication Orders, 2450 N Street, NW, Washington, DC, 20037; (202) 828-0416; Fax (202) 828-1123. This document was produced by CRI, the committee that advises the Association on policies and initiatives pertinent to the responsible conduct of research. After much deliberation and consultation, this group determined that scientific societies have a critical role to play in promoting responsible research practice. One mechanism at their disposal, the CRI found, is the creation of codes of ethics, which serve an important educational function and promote a sense of professionalism within the membership of societies. At present there is little guidance of which societies may avail themselves when choosing to draft a code of ethics in research. It is this observation that prompted the CRI to create this resource. The document is not intended to mandate production of a code or to prescribe any particular approach, but rather to convey useful information for societies that decide to take on this task. It highlights topics that societies may wish to address in their codes, discusses special issues like format and enforcement, and includes an annotated bibliography of materials that can serve as paradigms or provide useful background. As such, the document may also be of benefit to medical schools and teaching hospitals that are considering the development of institutional codes of scientific conduct. In addition, it may be useful in the training of scientific talent to alert them to the ethical issues they will face in their careers.

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Advisor, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering, by the Committee

on Science, Engineering, and Public Policy (COSEPUP), National Academy of Sciences (Washington, DC: National Academy Press, 1997, Single copy \$7.95; 2-9 copies \$6.50 each; 10 or more copies \$4.95 each). This guide offers helpful advice on how teachers, administrators, and career advisers in science and engineering can become better mentors to their students. It starts with the premise that a successful mentor guides students in a variety of ways: by helping them get the most from their educational experience, by introducing them to and making them comfortable with a specific disciplinary culture, and by offering assistance with the search for suitable employment. Other topics covered in the guide include career planning, time management and professional development, responsible scientific conduct, and writing. It includes a valuable list of bibliographical and Internet resources on mentoring and related topics. COSEPUP has also developed a sample form to help evaluate faculty mentors. The form can be adapted by individual institutions to suit their own needs. The version of the form offered here is most appropriate for use by advanced graduate students (for example, third-year and higher PhD students), postdoctoral fellows, and recent doctoral-program graduates who have had a long relationship with a mentor. The book and the form are both at the following WWW address: <http://www.nap.edu/readingroom/books/mentor>.

ANNOUNCEMENTS

The Societal Dimensions of Engineering, Science, and Technology Program (SDEST) is issuing a **call for proposals for the February 1, 1998 target date**. In SDEST, the Ethics and Values Studies (EVS) component focuses on developing and transmitting knowledge about ethical and value dimensions associated with the conduct and impacts of science, engineering, and technology. The Research on Science and Technology (RST) component supports research to improve approaches and information for decision making concerning management and direction of research, science, and technology. The program has approximately \$1 million to support awards from the proposals submitted. Information about the program and submission procedures can be found at <http://www.nsf.gov/sbe/sber/sdest>. You can also get an electronic copy of the announcement by sending an e-mail message to getpub@nsf.gov. In the text of the message, write "get nsf9728.txt" and it will be sent to you. Once you have reviewed the material, if you have ideas that you wish to discuss, contact program directors Rachelle Hollander or John Perhonis, NSF, Room 995, 4201 Wilson Blvd., Arlington, VA, 22230; (703) 306-1743; Fax (703) 306-0485 or 0486; E-mail rholland@nsf.gov or jperhoni@nsf.gov.

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The AAAS Scientific Freedom, Responsibility and Law Program, in collaboration with the Center for Bioethics at the University of Pennsylvania, is convening a special one-day event at the AAAS Annual Meeting in Philadelphia, February 15, 1998 on the **Ethical, Legal and Social Implications of Human Genome Diversity Project**. A morning symposium will discuss the nature and goals of the HGDP, the ethical, legal and social issues raised by such research, and how a recently drafted *Model Ethical Protocol for Collecting DNA Samples* (MEP), The North American Regional Committee of the HGDP, responds to those issues. An afternoon workshop will address provisions of and strategies for implementing the MEP—its scope of coverage and content, its usefulness as a set of ethical guidelines for HGDP researchers and those who evaluate and fund their proposals, and strategies for implementing its specific provisions. Contact *PER* Editors for more information.

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The Council of Biology Editors (CBE) is sponsoring two events in February 1998 in Berkeley, California: **Authorship in Biomedical Publication: Problems and Proposals, A CBE Retreat**, February 20-22, 1998; and **Critical Peer Review of Biomedical Papers, A CBE Workshop**, February 20, 1998. CBE's Authorship Retreat seeks to foster a means of conveying both responsibility and credit for published research. The system used to determine authorship must be fair and equitable, and it should take into consideration ethical and legal issues affecting both scientists and journals. This retreat will explore realistic and ethical criteria for authorship. Small-group discussions and panel sessions will be led by the retreat's resource faculty. This group comprises journal editors who have been at the forefront of recent discussions on scientific authorship, prominent scientific investigators, a physician and representative of the Association of American Medical Colleges who has been a leader in promoting responsible research, and an anthropologist and ethicist. CBE's Peer Review Workshop, organized by Fiona Godlee, Assistant

Editor of the British Medical Journal, and led by members of the retreat faculty, will instruct participants on why journals use peer review, what the role of the peer reviewer is, how to critique various types of papers, what to include in the review, and the practical and ethical pitfalls that exist and how to avoid them. We will explore journals' and editors' expectations of reviewers and the responsibilities and limitations of the peer review process. Experienced editors and reviewers will lead large general sessions and facilitate small-group discussions during a workshop designed for peer reviewers, editors in chief, associate and assistant editors, and editorial board members. Contact Denise Baran, CBE Headquarters, 60 Revere Drive, Suite 500, Northbrook, IL 60062-1577; (847) 480-9080; Fax (847) 480-9282; E-mail cbehdqts@aol.com; WWW http://www.cbe.org/cbe/Retreat_Workshop.html.

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Engineering The Human Germline: An Examination of the Immediate Prospects for Pre-implantation Genetic Therapy is a special symposium being co-organized by The UCLA Center for the Study of Evolution and the Origin of Life for March 20, 1998. This conference is intended to assess the potential of human germline engineering in the coming two decades and to explore some of the challenges the technology may pose. Leading scientists will examine such topics as: how a program for human germline engineering might be structured; what role new in-vitro fertilization technologies might play; what ethical and safety issues need to be addressed; what the human genome project means for the technology; how germline engineering compares with alternatives such as somatic cell therapy and embryo selection; what new approaches to disease diagnosis and treatment human germline engineering may offer; what potential it holds for countering aging and other therapeutic human enhancements. Contact Gregory Stock, Program on Science Technology and Society, UCLA; (310) 825-9715; Fax (310) 825-1170; E-mail gstock@ess.ucla.edu; WWW <http://www.ess.ucla.edu:80/huge/> .