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**The Year 2000 Problem and Ethical  
Responsibility: A Call to Action**

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## **The Year 2000 Problem and Ethical Responsibility: A Call to Action**

### **Abstract**

Many organizations have made substantial progress on solving the year 2000 computer problem while many others lag perilously behind. With the year 2000 deadline looming ever closer, this article examines several key issues including: the nature of the year 2000 problem itself, its potential to do harm, the progress that organizations have made to date on this issue, and factors that have worked to inhibit or facilitate organizational responses to this problem. An ethical analysis of the year 2000 problem is presented that reveals that both top management and IS professionals have an ethical responsibility to act on this issue. Organizations are urged to make the completion of their year 2000 problem efforts a top priority, because it is their responsibility and it serves as an investment for the future.

"Failure to achieve compliance with Year 2000 will jeopardize our way of living on this planet for some time to come."

- *Arthur Gross, Chief Information Officer, U.S. Internal Revenue Service*

"From our vantage point..., we are concerned that there are many enterprises that have not yet recognized the commitment necessary to address the significant technology challenges involved in resolving the Year 2000 Issue."

- *American Institute of Certified Public Accountants' (AICPA) letter to the U.S. Securities and Exchange Commission about Year 2000 Disclosures, December 1997*

"The stakes for the government are high... systems that are most critical in supporting major programs may fail and could affect public health and safety and other essential services to the public... confidence in the public service may also be at stake."

- *Report of the Auditor General (Canada) on the year 2000 issue, October 1997*

"I do not see the sense of urgency that should exist."

- *Rep. Stephen Horn (R-Calif.), Chairman, House Subcommittee on Government Management, Information and Technology, on the status of Year 2000 efforts in U.S. federal agencies*

## **Introduction**

As the observations above suggest, confronting the year 2000 problem is critical for organizations. The stakes are high and the lack of action may threaten an organization's very survival. Yet, rather surprisingly many enterprises have not taken sufficient action to prevent year 2000 disaster and the time to do so is quickly running out.

The question raised by many people when they first hear of the year 2000 computer problem is: "how did this happen?" Molly Ivans (1997), a Syndicated Columnist, probably speaks for many in saying, "Not being a computer expert, I can't explain why the computers can't figure out the year 2000, except that it seems to be a giant case of 'Oops!'" Another, common reaction to the year 2000 problem by the general public is: "what in the world were those people in information systems thinking when they caused all of this?"

Yet, what will surprise some observers, especially those from outside the information systems community, is the extent to which the year 2000 problem actually resulted from rational decision making. The year 2000 problem arose from the storage of year data by computer systems in two digits rather than four. When many applications were developed decades ago, an important goal was to conserve hardware (e.g., disk space and memory) at a time when these resources were vastly more expensive than they are today. Thus, by representing years in two digits rather than four, many large enterprises saved millions of dollars over the past 30 years (Kappelman and Scott 1997; Kappelman 1996).

The problem with this traditional approach to data storage, however, is that it does not work indefinitely. At some point, systems must be converted or they will not be able to distinguish the year "2000" from "1900" and this can have disastrous consequences. Ideally,

organizations would have begun a systematic approach to make their systems year-2000-compliant at least several years ago. However, many enterprises delayed taking action for a variety of reasons, and now they are engaged in what can best be described as "a marathon race to the year 2000 finish line" (ITAA 1997b).

The cost associated with a year 2000 conversion effort can be staggering, considering that most large organizations have millions of lines of affected code. Chase Manhattan Corp., the nation's largest banking firm, expects to spend \$250 million on its year 2000 conversion, American Airlines, \$100 million, and GTE, \$150 million (Bergen 1997). The Internal Revenue Service budgeted \$815 million on its year 2000 conversion project which includes utilizing 700 full-time employees and 150 contractors to make sure its 90,000 applications are year 2000 compliant (Machlis 1997b). According to a study sponsored by the Society of Information Management (SIM) Year 2000 Working Group, organizations on average will spend about 38% of an annual IS operating budget to solve the year 2000 problem (Kappelman et al. 1997).

The Gartner Group, a large consulting firm, estimates that organizations worldwide will spend between \$300 and \$600 billion on the year 2000 problem, and the SIM study projects costs between \$408 and \$616 billion. Other estimates go even higher. For example, a well-known software consultant, Capers Jones (1997), estimates that the global costs could exceed \$1.5 trillion. According to a recent Standard and Poor's DSI study commissioned by *Business Week*, the year 2000 problem will also lead to lower economic growth, lower productivity, and higher inflation. This study estimates that the economic growth rate of the United States will be 0.3 percent lower in 1999 and 0.5 percent lower in 2000 and early 2001 due to organizations diverting resources to fix the year 2000 problem (Mandel 1998).

## **The Year 2000: How Computer Programs are Likely to Do Harm**

While the year 2000 problem is commonly perceived as only affecting mainframe legacy systems, its potential effects extends much farther than this to packaged software, operating systems, customized applications, and embedded systems in buildings and equipment, including elevators, bank vaults, security systems, heating controls, navigational systems, medical devices, telephone systems, and many other systems. Any computer system that makes use of dates is potentially at risk, and that is most of them.

In business enterprises, the lack of a timely response to the year 2000 problem compromises systems quality, which may result in significant financial losses, business failure, or significant harm to stockholders, employees, customers, trading partners, the general public, or other parties. For example, a bank program that uses two-digit year fields for a 30-year mortgage begun in 1995 and ending in the year 2025 could calculate the instrument's time period to be negative 70 years (i.e., 25-95) resulting in potentially large losses. Systems problems such as this may be so compounded and severe that they could lead to business failure. In fact, year 2000 consultant, Peter de Jager (1996), forecasts that shortly after January 1, 2000 a major company will go out of business based on financial losses resulting from a year-2000-related failure in a mission-critical system.

Beyond an organization itself, the year 2000 problem can have "ripple effects" on a firm's trading partners, since many enterprises are linked through extended supply chains with their vendors, suppliers, customers, and other parties. If systems are not made year-2000-compliant, an enterprise could corrupt the systems of other organizations with which it exchanges data,

leading to various problems such as improper billings, the unavailability of parts and supplies, and stalled production.

Many other "nightmare" scenarios can result if year 2000 problems are not corrected in systems that involve embedded computer chips in buildings and equipment. For example, elevators may cease to function, production systems could shut down or throw away newly produced inventory (thinking it is obsolete since it was produced in "1900" instead of "2000"), bank customers may not be able to use ATMs since the machine "thinks" the year is 1900 and their accounts do not yet exist, bank vaults and security systems could become inoperable raising financial and safety risks, medical devices in patients may fail, telephone systems may shut down, or airline navigational systems may not work. It is interesting to note that KLM Royal Dutch Airlines is considering not flying its aircraft on January 1, 2000 due to potential year 2000 threats to aircraft or flight-control systems (Brislen 1997). In addition, year 2000 concerns have led Colin Latham, CEO of Maritime Tel & Tel in Nova Scotia to prohibit his employees from taking vacation for two weeks beginning on January 1, 2000; Mr. Latham reasons that if the year 2000 problem does create a problem, he does not want to be missing a single skill set (Schneiderei 1997).

In governmental entities, the year 2000 problem can lead to losses to taxpayers and hardship to citizens, such as the non-payment or delay of social security checks, welfare checks, and other essential payments. Most importantly, the year 2000 issue raises a threat to public safety, since computer programs that utilize dates also control nuclear power plants, water and sewer plants, chemical factories, petroleum pipelines, and weapon systems (Scheier et al. 1996/1997). For these systems, potential year 2000 impacts include serious injuries, the loss of

human life, or environmental damage. For example, when Phillips Petroleum ran year 2000 simulation tests on an oil and gas platform in the North Sea in Fall 1997, they found that an essential system for detecting harmful gases such as hydrogen sulfide failed (Mandel 1998).

### **Legal Concerns**

Based on the serious, potential consequences of the year 2000 problem, it is not difficult to imagine that some of these ills could lead to criminal charges or civil liability. Organizations could face product liability lawsuits for year-2000-related systems failures, or corporate directors and officers could be liable to shareholders if they do not fix year 2000-related-problems or fail to disclose them properly (Scheier 1996). GIGA International, a U.S. research firm, estimates that year-2000-related litigation worldwide could top the \$1 trillion mark (Ditchburn 1997). Lou Marcoccio, Year 2000 Research Director for the Gartner Group, comments, "I will be surprised if there are less than 100 lawsuits filed where people are suing vendors, vendors are suing other vendors, and everybody is suing everybody else. There will be equipment failures, and companies will be looking to blame somebody for it" (Mukherjee 1997).

At least three year-2000-related lawsuits have already been filed. They are being closely watched by legal observers since they could set precedent for other cases. In August 1997, Produce Palace International of Warren, Michigan filed a \$100,000 lawsuit against Tec-America and its local service vendor All American Cash Register, Inc., claiming that the cash register system sold to them did not accept customer credit cards that expire in the year 2000. As a result, Produce Palace allegedly experienced more than 100 system crashes and cash register failures that led to lost business and customer goodwill. The plaintiff alleged fraud, that the

service vendor knew of the non-year-2000-compliance but sold it anyway (*Century Date Program News* 1997b). This case was settled out of court.

A second year-2000-related lawsuit was filed by Atlaz International, a small New York computer equipment seller, against California-based, software vendor Software Business Technologies (SBT). This \$50 million class-action lawsuit alleges that SBT improperly required its customers to pay substantial fees to purchase upgrades to fix year 2000 bugs in its software, while other software companies correct such problems for free (Mukherjee 1997). A similar lawsuit was filed in February 1998 against Symantec alleging that it charged customers to purchase upgrades of its Norton Anti-Virus software (prior to version 4.0) because this software could not recognize and process dates starting in the year 2000 (*Reuters News Wire* 1998).

Liability concerns about the year 2000 issue have prompted some state lawmakers to take action. In July 1997, Nevada passed a law that protects state agencies from lawsuits arising from year 2000 failures; the law declares these failures to be "acts of God" so the state will not be liable (Kabler 1997). A bill is also expected to be introduced in West Virginia that would protect the state from class-action lawsuits filed by residents such as welfare recipients who do not receive state services because of a year 2000 systems failure (Kabler 1997). A proposed California bill would protect the state's software industry by limiting the punitive damages available in year-2000-related lawsuits to bodily injuries or the costs to repair or replace hardware or software (Hoffman 1997b).

Even though organizations may get hit with costly lawsuits over the year 2000 problem, they should not expect their insurers to bear much of these costs. Insurance companies reportedly have made changes to general property and liability policies to make it virtually

impossible for customers to collect year 2000 damages (Scheier and Thibodeau 1997). Although such issues may also find their way to court. While specific year 2000 policies are available, insurance companies are very selective in terms of granting them (Hoffman 1997c).

### **Who is Responsible for Addressing This Problem?**

While the business and legal motivations to act on the year 2000 problem are compelling in themselves, another important question is whether organizations have an ethical obligation to address the year 2000 issue. If they do, a key question is: *who* in organizations has a responsibility to act on the year 2000 problem -- top management or information systems professionals? A closer look at this issue suggests that the answer is both.

**Top management.** Top management's responsibility for acting on the year 2000 problem is rooted in agency theory and is supported by deontological and utilitarian ethics. Agency theory recognizes that the owners and managers of a business are usually separate and distinct parties. Thus, top management, i.e., boards of directors and corporate officers, have a fiduciary responsibility to exercise reasonable care and diligence in managing the business and safeguarding assets (Sawyer 1988). In a market driven capitalist society, top management has a duty to take the actions necessary to assure the survival and long-term profitability of the organization in the interests of stockholders (Badaracco 1995). Top managers also have a prima facie duty to avoid doing harm to others and, as an earlier section of this paper showed year 2000 computer programs are likely to do harm (Ross 1930). From a utilitarian ethical perspective, agents need to weigh the consequences of different alternatives and choose the action that produces "the greatest good for the greatest number."

As noted earlier, remedying the year 2000 problem in an organization is not without its costs. It requires a substantial outlay of money and manpower, and it diverts resources away from other important projects. However, considering that the alternative (i.e., not acting) can produce such disastrous consequences as threats to public welfare and safety, financial losses, business failure, and hardship to organizational constituents, the choice is very clear. Top management, as the agents of owners, has a duty to provide adequate resources for year-2000-conversion efforts and to ensure that they are accomplished in a timely, effective manner (Badaracco 1995).

**IS Professionals.** The responsibilities of information systems professionals, be they Chief Information Officers, IS managers, or systems developers, to act on the year 2000 problem are founded largely upon "deontological" ethical considerations. This perspective emphasizes the duties or obligations of agents (actors). The ethical codes of conduct promulgated by several prominent computing organizations establish certain ethical duties and expectations of IS professionals. The most well-known and detailed of these ethical codes is the Association of Computing Machinery (ACM) Code of Conduct. This code contains several provisions that suggest IS professionals have an ethical obligation to act on the year 2000 problem. These responsibilities of IS professionals are identified below.

ACM General Moral Imperative 1.1, Contribute to society and human well-being: "minimize negative consequences of computing systems, including threats to health and safety."

ACM General Moral Imperative 1.2, Avoid harm to others: "The computing professional has the additional responsibility to report any signs of system dangers that might result in serious personal or social damage. If one's superiors do not act to curtail or mitigate such dangers, it may be necessary to 'blow the whistle' to help correct the problem or reduce the risk."

ACM Specific Professional Responsibility 2.1, Strive to achieve the highest quality...in ... professional work: "The computing professional must strive to achieve quality and to be

cognizant of the serious negative consequences that may result from poor quality in a system."

ACM Specific Professional Responsibility 2.5, Give comprehensive and thorough evaluations of computer systems and their...risks: "Computer professionals are in a position of special trust, and therefore have a special responsibility to provide objective, credible evaluations to employers,

clients, users, and the public... any signs of danger from systems must be reported to those who have opportunity and/or responsibility to resolve them."

Two other professional codes of conduct also suggest that IS professionals have an ethical obligation to act on the year 2000 issue. The Code of Ethics of the Association of Information Technology Professionals provides that IS professionals have a responsibility to management "not to misrepresent or withhold information concerning the capabilities of equipment, software, or systems" and to "protect the proper interests of my employer at all times." The Association of Systems Management Code of Ethics, holds that IS professionals have an obligation "to maintain and improve sound business practices."

The "bottom line" of these ethical codes is that IS professionals have responsibilities to: avoid doing harm to others, strive for high quality systems, thoroughly evaluate the impacts and risks of systems, look out for the business interests of their employer, maintain sound business practices, and communicate any significant systems' risks to management. These duties, whether considered singularly or together, suggest a need for IS professionals to address the year 2000 problem. Perhaps most importantly, since IS professionals are technical experts in positions "of special trust," they need to make a concerted effort to educate management about year 2000 risks and create a sense of urgency to act on this issue. Without adequate resources, a year 2000 conversion effort will fail. If top management refuses to take appropriate action, despite the best

efforts of IS management, the ACM code even suggests that "whistle blowing" may be in order; however, the specific responsibilities of IS professionals in this regard are uncertain and controversial.

An interesting development in this arena is the recent establishment of Project Damocles by prominent year 2000 consultant, Peter de Jager. This "whistle blowing" service allows a tipster with first-hand knowledge of a year 2000 problem that a company is ignoring to report it anonymously at [www.year-2000.com/y2kdamocles.html](http://www.year-2000.com/y2kdamocles.html). Information that is received by Project Damocles is then passed on to the company's legal department via registered mail. If a court case ultimately arises over a systems failure that has been reported, a copy of the report will be released to lawyers as part of the discovery process. de Jager says that he founded Project Damocles after people told him "dark secrets" about their companies' year 2000 problems which, if not corrected, would lead to serious consequences (Hoffman 1998).

It should be noted that a third ethical "school of thought" suggests that both top management and IS professionals should act on the year 2000 problem. This ethical perspective, rooted in the works of Aristotle, speaks of the "ethics of virtue." According to this view, agents should constantly pursue "virtues," or important qualities that relate to character. Two of the virtues identified by Aristotle that particularly suggest action on the year 2000 problem are: (1) prudence -- being careful, wise, well-informed, having foresight and a vision of the future, and being ready for the unexpected; and (2) courage -- overcoming fear and being ready to face conflict and danger in the pursuit of an important, legitimate goal (Mason, Mason, and Culnan, 1995).

Responding to the year 2000 problem requires prudence since it entails seeing potential future risks and having the foresight to take timely action to avert danger. An effective year 2000

response also involves courage since it requires substantial resources and there are others in the organization who may fight it. Among the greatest sources of protests are from people in organizations who think that other IS projects should take priority or those who think that year 2000 risks are overblown by the media and consultants. It is up to top management and IS professionals to stand up to these pressures in order to meet their year 2000 responsibilities.

### **Progress to Date**

Regrettably, organizational responses to the year 2000 issue have been uneven at best. A survey conducted by the Society for Information Management (SIM) Year 2000 Working Group in the Summer of 1996 revealed that about one-third of enterprises were making reasonable progress in their year 2000 efforts, one-third were running behind but will eventually catch up, and the remaining third were "simply headed for disaster" (Kappelman and Keeling 1997; Kappelman et al. 1996). These mixed results are borne out by other studies and expert opinions.

For example, a Cap Gemini America survey of Fortune 500 companies showed that as of August 1997: only 16% of companies had begun "a full-fledged year 2000 strategy;" just 24% had "a detailed plan in place;" 56% had "fully assessed the systems impact" of this issue; and 96% said "business management has raised the issue" (Scheier 1997c). In testimony to a Senate Banking Subcommittee about the year 2000 issue in August 1997, Larry Martin, President of Data Dimensions, reported that only one-third of U.S. companies and government agencies had seriously begun work on solving the problem, and in the United Kingdom, this figure was less than one-fifth (*Century Date Program News* 1997a).

According to major consulting companies such as the Gartner Group and the GIGA

Group, many European organizations are behind their U.S. counterparts on the year 2000 problem, because this problem has taken "a backseat" to the problem of converting systems to handle the new euro currency (Wilson 1997). Capers Jones estimates that Western European organizations will not achieve year-2000-compliance for 65% of their systems (Mandel 1998). Meanwhile, the falling currency crisis in Asia may result in enterprises in those countries not expending sufficient resources to solve the year 2000 problem (*Reuters Limited* 1997).

In many cases, medium and smaller-sized organizations have also made less progress than larger ones on solving the year 2000 problem. According to Joe Smialowski, Chief Information Officer at Sears, larger enterprises tend to be in better shape because they have better technical resources, while many mid-sized companies (\$100 million to \$2 billion in sales) do not understand the problem (Hayes 1997). Consultant Peter de Jager (1997) observes that many organizations, especially smaller ones, have taken little action on the year 2000 problem because they are expecting "a silver bullet," a magic solution that will quickly solve all of their year 2000 ills. Incredibly, many people think that Bill Gates will "ride to the rescue," when in reality, much of the year 2000 problem is mainframe-related, and Bill Gate's Microsoft does not develop or sell mainframe software (de Jager 1997, Guterman 1997). Moreover, Microsoft products have year 2000 problems of their own.

In governmental agencies, progress on the year 2000 problem has also been mixed. Larry Olsen, Chief Information Officer for the state of Pennsylvania, estimates that only one-third of state governments in the U.S. are in "decent shape" in terms of their year 2000 conversion efforts (Mandel 1998). A U.S. Office of Management and Budget review of 24 Cabinet agencies conducted in 1997 concluded that that while 8 agencies had the problem "under control," 7 had

made "insufficient progress" on it, and 9 remained "of concern" (*ABC News 1997*). A similar review by the Auditor General of Canada reported that as of the end of April 1997, most Canadian departments and agencies were still in the early stages of their year 2000 projects, i.e., they had have not progressed beyond planning to the actual conversion of systems. This report concluded that "the rate of progress to date has generally been slow and that the residual risks to government systems remain high" (*Report of the Auditor General 1997*).

The insufficient response of many organizations to address the year 2000 issue is particularly disturbing in light of the words of a 1997 National Association of Securities Dealers (NASD) communiqué to its members that year 2000 conversion is "a minefield of hidden surprises" (Cohen 1997). Many organizations are simply running behind in their year 2000 efforts, and there are serious questions about whether many of them will catch up in time to convert even their most important systems. The Gartner Group estimates (with a probability of 0.7) that at least 30% of organizations will not even have mission-critical, customer-focused applications ready by the end of 1999 (Hall and Schick 1996). Capers Jones predicts that at least 15% of software applications in the United States will not be repaired in time (Machlis 1997).

### **Why Hasn't More Been Done?**

A number of important factors have been at work to limit the adequacy of organizations' responses to the year 2000 problem. Several key "inhibiting factors" are described below.

**Perceptions of the issue.** Jones (1991) points out the importance of perceptions in determining behavior toward ethical issues. At least two factors of "moral intensity" identified

by Jones (1991) that appear to explain the varying responses of organizations to the year 2000 issue are: (1) the magnitude of consequences -- the sum of the harms (or benefits) done to victim (or beneficiaries) of the act in question; and (2) temporal immediacy -- the length of time between an act and the onset of the consequences of the act in question (with a shorter length of time implying greater immediacy). In some cases, key decision makers in organizations have downplayed the magnitude of the consequences of the year 2000 issue, believing that they are overstated by consultants who are looking "to make a fast buck." Although management's duty of care and diligence seems to suggest that they should determine the extent of the risk for themselves. Another common problem is that organizations have felt "low" temporal immediacy about the year 2000 issue, thinking that "there is plenty of time left to meet this challenge." Again, prudent and careful management will not leave such assumptions untested.

**Reluctance to confront the problem with top management.** For years, organizational management responded to the year 2000 problem by demonstrating the same behaviors that people use to cope with various types of personal crises such as divorce or terminal illness. These responses, or "coping mechanisms," include anger, blame, and denial (Kappelman and Cappel 1997; Kappelman and Cappel 1996). Clearly, confronting the year 2000 problem involves a significant amount of "pain" for most organizations. The substantial commitment of time and resources required will likely have some negative impact on short-term profits, so many organizations evaded this issue for years. IS management did not raise the issue with top management out of fear of being blamed for a problem that appears to have been preventable. Moreover, a year 2000 conversion effort represents a maintenance expense, or a non-value added activity, that is required just for an enterprise to stay in business. IS professionals, who are

allured by new technologies and "glitz," preferred to develop new systems that utilized these technologies and could demonstrate business value. As a result, too many enterprises lingered in a stage of denial about the year 2000 problem for too long and placed their IS priorities on other matters.

**Lack of external pressure.** Through the mid-1990s, the year 2000 issue received little attention in the popular general or business press. This led to a lack of awareness among managers, lawmakers, regulators, trading partners, stockholders, and the general public about the importance of this problem and its potential impact. Consequently, these parties raised few calls of alarms about the century date problem even though it had the power to cause them significant harm.

**Other competing priorities.** Organizational forces such as the increasingly competitive business environment, downsizing, reorganization, mergers and acquisitions in recent years have forced a sea of change on IS departments and have brought about pressure "to do more with less." IS functions have had many other important projects to accomplish besides year 2000 conversion efforts. Many enterprises have implemented client/server systems designed to improve their competitiveness, while systems integration projects have been common in some industries such as financial services where many mergers and acquisitions have occurred. These competing priorities, coupled with limited IS staffing levels, have made it difficult to give the year 2000 problem its due attention.

### **Forces of Change**

In the late 1990s, competing forces have emerged to push more organizations toward a

more effective year 2000 response. These key "facilitating factors" are described below.

**A change in mindset.** As the next millenium grows ever closer, more organizations have gained an enlightened view of the year 2000 issue. They have "come to grips" with the fact that the "old excuses" for avoiding this problem are no longer tenable. There are a number of factors that can be credited with helping to change the perceptions about the year 2000 issue including increased press coverage of the issue, rising pressures from external sources, and a growing availability of year 2000 problem-solving resources.

**Growing press coverage about the issue.** Beginning in 1996, the year 2000 problem received significantly more attention in the media. Stories about this issue were increasingly found in the popular press, the business press, and even on television and radio new reports. Coverage of the year 2000 problem in the information systems press rose even more dramatically. IS trade publications, such as *Information Week* and *Computerworld*, began providing regular stories, columns, and updates about the latest year 2000 developments. This publicity heightened the awareness of management and IS professionals about the year 2000 issue, and it helped to communicate a sense of urgency about this problem to those who may have previously doubted its importance.

**Legal pressures.** As noted previously, the year 2000 problem threatens to open "a big can of worms" for organizations from a legal point of view. Many scenarios resulting from year 2000 failures are possible that could lead to monetary damages or even criminal charges. Averting these problems serves as a powerful "wake-up call" to many organizations to act on the year 2000 issue. More enterprises have come to realize that the resulting legal costs of not making their systems year-2000-compliant could far outweigh actual systems conversion costs.

**Pressures from auditors and regulators.** Internal and external auditors who are responsible for attesting to the integrity of financial statements and systems are stepping up their efforts to examine systems for year 2000 compliance. An interesting development in this regard is *Staff Legal Bulletin No. 5* issued in January 1998 by the U.S. Securities and Exchange Commission (SEC) stating that publicly-held companies should make financial statement disclosures of their year 2000 costs where they are "material." In addition, regulators in certain industries such as financial services have intensified their year 2000 efforts. For example, the Federal Reserve Bank requires that banks test and certify their systems for year 2000 compliance. The Federal Deposit Insurance Corp. has issued cease and desist orders against three Georgia banks who fell behind on their year 2000 efforts; these orders require the banks to "establish and implement an adequate electronic information system" (Hamblen 1998, p. 96).

**Pressures from trading partners.** Organizations have also been moved to act on the year 2000 problem based on pressures from their trading partners. Many organizations request year-2000-compliance documents from their software vendors and business partners. Patrick Zilvitis, Vice President of Corporate Information Technology at the Gillette Co., points out, "In these days of electronic commerce, we need to be sure our trading partners, vendors, service providers, information providers, and customers -- all the companies we do business with -- are compliant" (Violino 1997). Enterprises have also taken steps to assist their trading partners achieve compliance. For example, the "Big Three" U.S. auto makers are working through the Auto Industry Action Group, a trade association, to monitor the year-2000-readiness of their suppliers so that a year 2000 glitch does not bring down their supply chains (Hoffman 1997a).

**A growing availability of resources.** Far more resources exist today compared to a few

short years ago to help organizations address the year 2000 problem. These resources include: automated tools designed to streamline the manual effort required for systems conversions; year 2000 books (e.g., Kappelman 1997); World Wide Web sites covering the latest year 2000 developments (e.g., [www.year2000.com](http://www.year2000.com), [www.year2000unt.edu](http://www.year2000unt.edu), and [www.ita.org](http://www.ita.org)); professional conferences held by many organizations (e.g., [www.spgnet.com](http://www.spgnet.com)); domestic and foreign companies offering year 2000 outsourcing services; and consultants who provide various services in year 2000 planning and conversion efforts. So many resources are now available for addressing this problem that organizations who are serious about year 2000 compliance can often still find a way to accomplish it. However, as the year 2000 deadline approaches, the cost of these resources continues to ratchet upward as their availability wanes.

### **What Still Needs to be Done?**

Due to the variation of organizational responses to the year 2000 problem thus far, it is difficult to specify a generic list of steps that enterprises need to follow in the time remaining to January 1, 2000. On the one hand, some organizations have finished or are nearly finished with their coding and testing activities. These enterprises have the luxury to test their systems further or to respond to any unexpected problems that may arise as these systems are tested or placed into production. At the opposite extreme, other organizations have not yet even finished an inventory and risk assessment of their systems, let alone planning activities which must precede conversion and testing. These organizations face the greatest risk of a year 2000 catastrophe. *At minimum*, all enterprises should make sure that they have addressed the following issues in the short time that remains before the next millennium.

**The conversion of mission-critical systems.** Organizations that do not have time to convert all of their systems need to at least ensure that their "mission-critical" systems, i.e., those systems that are essential to the conduct of their business or those that can do the most harm to others are made year-2000-compliant. These systems will have been identified in an earlier stage of a year 2000 conversion project, systems inventory and risk assessment. After these systems have been converted, tested, and placed back into production, organizations can continue to use a "triage" approach by addressing the next most important systems, and so on. For example, the State of Michigan is performing year 2000 conversion work on critical systems, such as criminal justice, payroll, and welfare payment systems first, before addressing management, regulation, and reporting systems that they can get along without converting in the short-run (Thibodeau 1997). Likewise, the state of New York designated about 50 systems as "must fix" while classifying 1400 other systems about evenly as secondary and tertiary priorities.

**The development of contingency plans.** Organizations should expect the "unexpected" in a year 2000 conversion effort. Many potential negative consequences can result from systems failures, and organizations need to have contingency plans in place in case these problems materialize. Ironically, the organizations that need contingency plans the most are the ones least likely to have them, according to Capers Jones, Chairman of Software Productivity Research (Anthes 1998). The importance of contingency planning was pointed out in a U.S. General Accounting Office (GAO) audit of the year 2000 preparedness of the Social Security Administration (SSA). Prior to this audit, the SSA had been widely praised for being proactive in its year 2000 efforts. However, the GAO audit revealed that while the SSA was years ahead of other government agencies in terms of converting its systems, it had not developed

contingency plans in case these systems failed (Anthes 1997).

**Coordination efforts with trading partners and vendors.** The importance of ensuring year 2000 compliance from an organization's vendors and trading partners has already been noted, and it cannot be overestimated. Enterprises are urged to contact their software vendors to get statements of and plans for year 2000 compliance about their products (Jacobs 1996). In addition, enterprises need to contact their trading partners to ensure their systems are compliant and to test the interfaces of these systems with their own.

**Coordination efforts with internal personnel.** IS management should ensure that top management is informed about potential year 2000 problems with embedded chips in buildings and equipment. Accordingly, the personnel responsible for managing these assets, e.g., building and facilities management, need to take proactive measures such as contacting vendors to verify compliance. How large a role IS management assumes in this regard depends upon many factors such as organizational structure and the "charge" given to year 2000 project managers. Nevertheless, the importance of making sure that embedded systems are compliant should not be overlooked.

**The adoption of a "do whatever it takes" attitude.** Most importantly, organizations need to make the year 2000 problem a top priority and devote whatever resources are necessary to solve it effectively. Union Pacific forged ahead of many organizations on the year 2000 problem by making successful year 2000 conversion one of a handful of top business directives. The company's efforts included making quarterly progress reports on the year 2000 issue to the Board of Directors (ITAA 1997d). Equifax, Inc. has been refreshingly more open in its communications about the importance of the year 2000 problem than most companies. The

company announced that it would spend one cent per share in the fourth quarter of 1996 and three cents per share each quarter of 1997 to address the year 2000 issue (*ITAA 1997a*).

As the year 2000 deadline approaches, many organizations may find it ever prudent to freeze all new systems development projects in order to complete their year 2000 conversion efforts on time. This approach has been adopted by some governmental bodies. For example, shortly after a state official reported in July 1997 that New York state was only 5% of the way through its year 2000 projects, Gov. George Pataki banned "all non-essential IT projects" (*Guterman 1997*). As a result of an audit of federal agencies, the Office of Management and Budget announced that it would not approve the information technology funding requests of four agencies, the Departments of Agriculture, Education, and Transportation, and the Agency for International Development, for anything other than year 2000 work until those departments could demonstrate satisfactory progress on the year 2000 problem (*Machlis 1997a*).

In the private sector, Bernard C. Harris Publishing, Inc., of Norfolk, Virginia, serves as an excellent example of a company that adopted an "all hands on deck" approach to solving the year 2000 problem. The company postponed other important application development projects, even the final phase of a client/server system designed to improve customer service, to devote all of its IS resources to the year 2000 problem. According to company management, they could have assigned five people to the project for five months or 20 people for two months. The company chose the latter approach, even though they had not yet encountered any year 2000 problems, to make sure that they had ample time to deal with any difficulties that might arise in the conversion process. Commenting on the year 2000 problem, the firm's Chief Information Officer said, "we definitely feel that if you don't address this, you're betting your business"

(Scheier 1997a).

Enlightened organizations have employed various strategies to achieve year compliance. Delta Health Care Systems offered its year 2000 team members a bonus of 10% of their salary for completing coding according to schedule, and the company was able to convert its 5900 programs and about 1 million lines of code in 18 months (King 1997). Great-West Life Insurance Company of Winnipeg, Canada and The Principal Financial Group of Des Moines, Iowa made rapid progress on their year 2000 projects by hiring their own employees on a contractual basis as internal consultants during their off-hours. This approach was successful in saving money compared to the cost of hiring outside consultants, it provided personnel who were already knowledgeable about the company and its systems, and it was financially lucrative to employees. After implementing this approach in 1995, The Principal Financial Group was reported to be 98% done with its conversion in 1997 (Schein 1997). In other cases, organizations have turned to foreign outsourcing. A study of 112 companies funded by Cap Gemini found that the use of offshore resources is a major element of many year 2000 conversion efforts (Saia 1997).

The accomplishments of other organizations provide additional testimony that it is possible "to slay the year 2000 dragon." The Prudential Insurance Company started its company-wide conversion efforts in 1995, and it reports that it is expected to finish converting its mission-critical systems by the first quarter 1998 and all other systems by the following quarter. Prudential set these aggressive targets to have 18 months to perform ad hoc audits and re-certifications of systems receiving modifications or enhancements and to test the connections with outside training partners and suppliers (ITAA 1997c). In 1997, the states of Illinois and Wyoming reportedly became the sixth and seventh states, respectively, to make their financial

management systems year-2000-compliant (Caldwell 1997). The Federal Reserve Bank has also been a leader in its year 2000 conversion efforts. The Fed's year 2000 conversion is expected to be completed in mid-1998, allowing for 18 months for additional systems testing including testing connections with outside parties and contingency planning (Kelley 1997).

### **Conclusion**

In the final analysis, there are strong business, legal, and ethical reasons for organizations to confront the year 2000 issue with a sense of urgency -- i.e., to make solving the year 2000 problem a top priority and to devote whatever resources are required to solve it successfully. Disturbingly, various reports indicate that too many organizations are lagging behind in their year 2000 efforts. In so doing, these enterprises are placing themselves and their constituents in jeopardy, and they are shunting their ethical responsibilities. As noted earlier, top management has ethical obligations to avoid doing harm to others and to take actions that are necessary to ensure the survival and long-term profitability of the organization. This requires that top managers provide adequate resources to address the year 2000 problem and ensure that these efforts are accomplished in a timely and effective manner. In addition, information systems professionals, based on applicable provisions of professional codes of conduct, need to maintain systems quality, ensure that systems do not do harm, and communicate significant systems' risks to management. Being technical experts in positions of special trust, IS professionals must educate top management about year 2000 risks, create a sense of urgency about this issue, and obtain the resources required to meet the year 2000 challenge.

The words of a well-known automobile advertisement, "pay now, or pay later" also

apply to the year 2000 issue. Enlightened organizations are paying now because it is their responsibility and because it also serves as an investment for the future.

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