

# A Program For The Year 2000 Problem

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## Abstract

*This paper addresses the Year 2000 (Y2K) problem and details a program for a firm designed to eliminate or reduce the potential effects. The mission of any firms Y2K compliant program should be to take the necessary measures to ensure that proper topics are addressed. A company should have a comprehensive (global if necessary) Y2K Program in place and be committed as a company to see its success. Management needs to recognize the significant challenge represented by the Y2K problem and anticipate the need of an "all out" effort by all employees to ensure success. Employee involvement can range from those actually writing corrective code, to conducting and facilitating the testing procedures, to those who interface with customers to address and answer questions and concerns.*

## Introduction

The Y2K issue may surface and adversely affect a company's business operations in numerous unforeseeable combinations and in all phases including physical, functional, and financial. Accordingly, a firm's approach should be intended to significantly reduce the number and impact of such issues in key areas.

The basic Y2K issue can be summarized as follows: Throughout the early years, computer-based systems and applications were developed and implemented without a method for addressing the turn of the century. The majority of computer-based systems utilize two-digit instead of four-digit year designations, and consequently, once the year rolls from 99 to 00, their calculations will treat the year internally as "1900" instead of "2000." Also, many systems

will not correctly recognize 2000 as a leap year, and many internal system clocks will not correctly advance past the last day of 1999. Y2K issues are not limited to mainframe and PC-based computer applications, but also extend to embedded microprocessor chips in many items of equipment in everyday commercial, industrial, and consumer use. Potential processing errors may be random and unpredictable.

We can look back to the early days of computer technology (1950's) and find resources such as memory and disk storage space were at a premium. This problem is still valid today; however, the additional costs associated with these items were tremendous (thousands of times more than today) and added significantly to the size of a system. Proper programming techniques called for the conservation of the memory resources and processing time. The programmers and managers begin to search for an easy solution. One place that seemed to be obvious was

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the date. The date code is used in every phase of computing, hardware and software. If 2 digits could be removed from the calendar date, many dollars could be saved.

An example of this technique would have the year 1953 represented as 53 rather than 1953 with the 19 being implied. It was obvious from the context of the system that the 53 referred to 1953. Although programmers thought of the "turn-of-the-century" problems, project managers and industry leaders pushed to keep costs down and instructed programmers to proceed as such. The two-digit representation of years in computer software was also used in date calculations. For example, a computer system might be designed to calculate an individual's age from data stored in computer records. Using the 1953 date as a date of birth, the computers would figure a person's age today to be 45, calculating this by subtracting 53 from 98. In 1999 the calculation method would still hold, yielding a result of 46; however, in the year 2000 this method would fail. The computer system would calculate as follows: 00 minus 53 equals negative 53 and not the correct answer of 47.

This is the basis of the Y2K problem. It is not limited to just this situation. All potential problems and concerns revolve around this basic concept. Many other potential problems can occur within the business environment as well as everyday life. This basic problem is compounded by another date-related problem that was not addressed in the early computer systems. In order to correctly know the proper date or determine the day of the week, computers need to know and be able to determine how the days of the year fall. To do this, the computer needs to know which year a Leap Year occurs and properly account for the additional day. It is generally thought that a Leap Year occurs every fourth year; however, that is not the only stipulation. The actual rule for Leap Years specifies that every 100th year is not a Leap Year, because of the Earth's rotation pattern. However, an exception to this rule occurs every

400th year and that year is a Leap Year. The year 2000 is a multiple of 400; therefore the year 2000 is a Leap Year. This rule was incorrectly implemented and interpreted by early programmers consequently many neglected to include the year 2000 as a Leap Year.

#### **Other Year 2000 Problems**

Many have stated their skepticism about the "reality" of this Y2K problem. Some observers have even stated that it is a hoax by either the government or other private institutions designed to create panic and havoc. Daily we see the affects that this "problem" is having on the economies of our nation as well as of the world. Firms are spending millions of dollars addressing these problems, causing a decline in earnings as well as placing a tremendous burden on the individuals within these organizations.

The misinterpretation of a date can cause havoc and result in a plethora of expected and unexpected circumstances that we rely on daily. Examples to illustrate this point include:

- Government entitlement agencies might miscalculate the age of citizens, causing payments to be sent to people, who are not eligible, while those who are eligible might not receive their payments.
- Taxing agencies might miscalculate the allowable deductions on income tax returns.
- Air traffic controllers might generate erroneous flight schedules, misguiding aircraft and causing takeoff and landing conflicts.
- Medical records might become corrupted, leading to improper care for patients.
- Credit cards and ATM cards with expiration dates after 1/1/2000 might be treated as "expired" and not honored.
- Telephone companies might record dates incorrectly, causing billing and connecting errors or lapses of services.
- Security firms and insurance companies may produce erroneous records of stock transactions or insurance premiums.

- Businesses of all types might experience errors in planning, budgeting, payroll, accounting, or inventory causing general problems throughout the economy.

Additional problems include equipment/system failures within the company's line of products and services, to problems with our suppliers products and services. By taking a proactive approach to handling the potential venter problems and working with vendors to increase awareness of possible problems, one can assist them in addressing the problems. One must to realize problems within and outside of the company can affect delivery of products and services to customers. If a firm's key suppliers for a major product line were to have Y2K problems that hampered their ability to deliver raw materials, the firm would not be able to deliver this service to its customers. This failure would be as dramatic as it would have been had the firm had a problem.

**Year 2000 Program**

The Y2K program uses a department's structure to share ideas and oversee the implementation, thereby, ensuring success. The program divides the company into Business Units. Each Unit is composed of Trackers, Assessors, Remediators, and Management. Definitions of the general terms are below, further details of the program can be found in the Program section.

**Business Unit (BU)**

Any equipment, component, system, software package, firmware, or hardware that is required to be Y2K ready in order to perform

business in the usual manner must be in compliance. The unit is the lowest level of reporting and recording Y2K progress and status. In some circumstances, an audit trail below the Unit level may be required where it is necessary to ensure components of a Unit are compliant. The seven basic categories under which Business Units are classified are:

- Alliance Team Members - The Alliance member is responsible for the completeness and accuracy of the Unit Inventory generated by the assigned Trackers. In general, each Alliance Team Member will be responsible for a category.
- Tracker - Trackers are appointed by an Alliance Team Member and are responsible for creating the Reliance Unit Inventories and tracking the progress of the BU as it pertains to his or her work process.
- Assessor - Selected by the Reliance Unit Owner to assess whether or not a particular Reliance Unit is Y2K compliant. Assessment of a Reliance Unit may or may not require tests depending on the criticality of the Reliance Unit. In addition, in the case of commercially available products or services, letters of compliance or documented test results offered by the supplier may establish assessment of compliance.
- Remediate - To repair, replace, or retire a Reliance Unit (component, system, software, firmware, or hardware) with the known Y2K problems.
- Remediator - The individual assigned to remediate the Reliance Unit
- Criticality - Defines how critical a Reliance Unit is to performing tasks as usual. Three categories Low, Medium & High have been established and are defined as follows:

<u>High</u>	<u>Medium</u>	<u>Low</u>
Severe impact to a BU operation	Financial impacts	Output quantities lower
Significant Environmental impacts	Regulatory impacts	Task efficiencies lower
Significant Regulatory impacts	Environmental impacts	Workarounds implemented
Impacts to servicing Customers needs		

### **Program Strategy**

A firm's Y2K Program is designed to achieve a state of the Y2K readiness in all of the key business operations, including all products and services. Systems and items which are anticipated to remain in use internally and which could be affected by the Y2K problem will be tested and remediated if needed. In some instances, "workarounds" may be used to be Y2K ready. It is impossible and impractical to identify or remediate every imaginable Y2K related issue. This position is consistent with the U.S. Securities and Exchange Commission's June 1997 Report to Congress, which states: "It is important that one essential principle be understood: It is not, and will not, be possible for any single entity or collective enterprise to represent that it has achieved complete Y2K Compliance and thus to guarantee its remediation efforts. The problem is simply too complex for such a claim to have legitimacy."

Customers and clients must be informed of the company's efforts in this program. A firm should feel confident in stating to customers and clients that they are doing what is reasonably necessary to achieve Y2K readiness in applicable products and services without wasting time and other resources.

A Y2K Program should address key operations and systems in the following areas:

- Products and Services - Products and Service Equipment used in performing everyday functions.
- Suppliers - Minimizing disruptions in key supply chains is of greatest importance.
- Business and Engineering Applications - Where appropriate, applications should be replaced, repaired, or retired.
- Information Technology Systems - Any information technology systems and infrastructure, including wide-area and local-area networks, data communications circuits, servers, mainframe computers, worksta-

tions, and associated operating systems and software.

- Facilities and Infrastructure - Facilities and associated infrastructure systems (including telephone, switchboards, radio, fax, power supply, safety, control, environmental, energy management, maintenance, security, and transportation).
- Joint Venture Projects - Include an assessment strategy evaluation of joint venture projects.

### **Program Approach**

In order to achieve this compliance program, an effective method of managing and reporting are essential. In each area of a firm's operations, the following sequence of events should be implemented:

- Establishment of program team organization.
- Implementation of communication/awareness plan.
- Determination of risks and identification of key requirements.
- Planning of specific remediation, replacement, or workaround approaches.
- Performance of specific remediation, replacement, or workarounds.
- Performance of appropriate tests and confirmation of results."

For a large company, the size and scope of the effort may be simply too large and complex to assign to any one group. The detailed knowledge and expertise required to understand the associated business processes; risks, impacts, and solutions can only come from those individuals in the respective organizations with immediate responsibility for the processes involved.

At the same time, the numerous complexities, including legal issues, associated with the Y2K issue are simply too great to expect multiple parts of the organization to develop spe-

cific Y2K expertise and to address multiple Y2K efforts independently. That approach would result in a great deal of redundancy of effort and cost, could result in incompatible solutions, and would not address our overall corporate responsibility for ensuring Y2K readiness across the enterprise.

Although the firm's overall Y2K Program should be clearly management-driven, the importance of the awareness and participation of every employee is critical. Since it is unlikely that any member of management has 100% knowledge of each and every system and process employed on a day to day basis by the employees under his or her management, it is important to have all employees take part.

Based upon a simple "find and fix" methodology, the fundamental steps in the overall approach are:

- Identify the reliance units and assessment of Year 2000 deficiencies.
- Develop a renovation plan (replace, retire, repair, or workaround).
- Renovation, testing, and re-deployment.
- Certification of Y2K readiness.

The challenge is in controlling the overall process adequately to prevent redundant activity and to ensure maximum awareness and enrollment in the overall Program at a minimum cost. The program also will provide a mechanism to support timely and comprehensive management reporting. The Y2K approach strategy is designed around the concept of a single, global inventory database.

Individuals must be responsible for evaluating a given business function. These individuals would be responsible for executing the following steps:

- Evaluate the respective business processes and identify all associated potential Y2K problems.

- Understand the plan established for each division.
- Wait for the assigned fixit group to perform the renovation and associated unit testing.
- Ensure that the renovated products and divisions are Y2K compliant.

Accomplishment of this set of responsibilities is required in order to ensure that Business Function, Readiness has been achieved for each particular location and function. The reporting system is designed around the assignment of points (weighted system).

By combining the two measurements of Business Function Readiness and Division Readiness it is possible to present an overall representation of Enterprise Readiness. Although there is some overlap between Business Function Readiness and Division Readiness, together they provide an accurate assessment of our overall status as a company and provide reasonable assurance that nothing significant is being overlooked.

#### **Contingency Planning**

The various functions and organizations are responsible for strategy definition and execution. All individuals and organizational units must develop an appropriate understanding of and agreement with the Y2K responsibilities as established by the management. Each group must verify the completeness of the inventory of systems, tools, or devices used by that group in the execution of its business processes. Each group must ensure the timeliness of efforts to identify and address Y2K risks. And each group must be aware of the potential impact of Y2K problems experienced by parties external to a firm, including suppliers, customers, partners, etc.

While being aware that certain issues will not be able to be addressed thereby making 100% compliance impossible to ensure, risk management decision becomes essential in the overall program approach. A contingency plan in philosophy that mitigates the risk associated

with any schedule slippage has been developed. Many systems which are being replaced or upgraded will also have a complete redundant system which will provide a fallback system that will ensure a contingency. This is considered to be a sound investment with high-profile systems that are a must for day-to-day operations. This proactive approach will provide the necessary "safety net" for the business.

### **System Testing**

One could estimate that "testing" would account for between 45%-55% of the cost associated with the Y2K Program. Studies have revealed the majority of the Y2K problems will manifest themselves at the interface level. The rapid growth of telemetry systems and the continuous communications needs is worsening the problem since many communication systems are subsets of the basic system.

The second problem exists in identifying the date information to be tested. Date code can exist over many lines of code within the application and needs to be controlled by utility functions and those less obvious than system level resources like real-time clocks and system clocks. Testing of individual systems and integrated systems is a must to ensure complete compliance. Even if a single system is compliant singularly, it may not be compatible with other systems.

To properly test, it is recommended that the following steps be used:

- Create Isolated Testing.
- Determine Resource Requirements.
- Use system tools.
- Conduct Regression Test.
- Conduct Interaction Tests.

Since there are an infinite number of errors which can be made in any software system, there is no list of things to check which will guarantee defect free systems. Y2K compliant

products and service are only half of the problem. The tools used to test must also be able to work in the next millennium. Testing is not considered complete until a complete system is built and tested with the system clock set forward past 1/1/2000.

### **Remediation Options**

With the task of remediating growing, a firm should use a group of methods to accomplish any remediation process. These processes are designed to handle all the potential problems that exist within systems and equipment. The following are possible methods that could be used as a firm conducts its remediation process:

- Bridging Mechanisms.
- Expanding the Year Field to Four Digits.
- Encoding Century Information in Six Digits.
- Using a 100-Year Logic Window.
- Employing a Data Bridge Using a Logic Window.
- Replacing or retiring the System.
- Upgrade Purchased Products.
- Do Nothing at All, Data Isolation.
- Program Isolation.

As one can see, the many remediation options available address many, if not all, of the potential Year 2000 compliance issues that face organizations. Just as in most business decisions, there are no completely correct or incorrect answers, only best solutions. Each remediation opportunity will be evaluated individually with the best solution being implemented.

### **Summary**

With the Year 2000 approaching, businesses as well as government agencies are scrambling to access and address the potential problems that this may cause. The government of the United States is taking the situation to be serious and has a plan as spelled out by the Assistant to the President and Chair of the President's Council on the Y2K Conversion, Mr.

John Koskinen, that includes a deadline of March 31, 1999 compliance. The problem is not only a technical problem but also a managerial problem as stated by Mr. Koskinen in a recent press briefing regarding the government's program in which he stated:


"The problem is it's a management challenge because when you start talking about millions of lines of code that have to be reviewed to find out where those dates are operating and then correct it, what you have to do is be able to manage that project. And it's a problem, and it's not just the federal government; any organization that has large, complicated, interrelated systems has to fix a line of code, has to check that the program runs, has to check that the software application runs, has to then check the interfaces with all other systems in that organization with whom they relate."

A firm should take a similar approach to that of the government. Realizing that the management function is crucial in this project, a management team should be used to oversee the entire endeavor. A recent Wells Fargo bank survey shows that nearly half of the small businesses even know that the problem exists and of those many do not intend to address it.

The Year 2000 problem is much more far-reaching than just that of Saturday, January 1, 2000. Problems exist now, such as scheduling events and reservation for the year 2000 in a system that is not Y2K compliant. The business sector is already feeling the strains that the Y2K problem can pose. By creating a proactive approach to addressing key supply chains it will keep the customer in true focus. The uniqueness of this challenge is based upon the absolute, immovable nature of the project completion date; it must be completed by 12/31/99.

#### **Suggestion for Future Research**

Any Y2K Program should be designed to address customer concerns in a pro-active

method, eliminating any doubt that the firms products and services will be as ready as possible for the new millennium. The challenge to the corporate world is to recognize that the Year 2000 problems are not one that can be moved or delayed; it will occur on time. The results of the new millennium on our business as well as the worlds business are not known; however, enough evidence exists to cause concern. Future research should be conducted on the implications and solutions for the Y2K problem. The proposed program needs to be tested. 

#### **References**

1. Koskinen, John. Chair of the President's Council on Year 2000 Conversion. "White House Press Briefing on Year 2000 Compliance." July 14, 1998.
2. U.S. Securities and Exchange Commission. "Y2K Compliance." Report to Congress. June 1997.

#### **Notes**

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