ORANGE COUNTY AND THE YEAR 2000 COMPUTER PROBLEM

SUMMARY

The Year 2000 computer problem, Y2K or Millenium Bug, can affect all Orange County agencies, cities, schools and districts. The Grand Jury queried Orange County organizations to assess whether they had plans and actions to mitigate the potential effects of the Y2K problem.

Orange County will probably not be disrupted by the Millenium Bug in such functions as public safety, payroll, and other essential services. In the vital public safety arena, the Orange County Sheriff-Coroner Department's Computer Aided Dispatch and Records Management System (CAD/RMS) is at risk. An interim fix is planned. The long-term solution is replacement of the CAD computer. Other agencies, school districts and municipalities, with some exceptions, have plans in place to fix the Y2K problem for mainframes, networked systems and personal computers that are date-sensitive. None of the exceptions are critical to overall County operations and safety. However, a lack of compliance may be disruptive to local operations in some cities and school districts. Some school services are at risk because of a late start in recognizing and planning for the Y2K problem.

It is unclear how well interfaces and embedded systems will work. First, no one knows for sure how county solutions to the Y2K problem will affect state and federal agencies and *vice versa.* Orange County cannot dictate solutions to state and federal agencies. Second, embedded systems are integral to many environmental, mechanical and safety systems. Embedded systems are microprocessor-based; the software is contained within the microprocessor hardware. Their specifications are not generally published and are not readily accessible. A Y2K compliant system may receive and interact with data from non-compliant systems and crash.

Findings include:

- Embedded systems are largely ignored by most cities and agencies.
- Orange County and its agencies have addressed the problem for years. Awareness of the potential of the Y2K problem has been an agenda item for the Chief Executive Officer for Information Technology since 1997.
- The Sheriff-Coroner Department Computer Aided Dispatch/Records Management System is at risk but fixes are planned.
- State-issued guidance to school districts was forwarded by the County Superintendent of schools, Orange County Department of Education (OCDE), in a letter dated January 4, 1998.

- Five cities have not demonstrated a formal plan or documented an approach to solving the Y2K problem.
- Ten city police departments in Orange County are dependent on a contract with the West Covina Police Department to provide the Y2K fix to their Computer Aided Dispatch Systems.
- Two large agencies, the Orange County Fire Authority and Transportation Authority, have well documented, well staffed, and adequately funded remediation plans in place and in operation.

INTRODUCTION AND PURPOSE

The focus of this report is to consider the potential effects of the Year 2000 (Y2K) problem on Orange County and to assess the plans of county agencies to mitigate potential problems. This report is limited to considering effects on computers and software owned and/or operated by public agencies in Orange County. Interfaces with federal and state agencies, financial and utility companies were outside the purview of this study.

The Y2K problem is the inability of certain computer systems to distinguish between the twentieth century dates and the twenty-first century dates. Any computer system that relies on dates to do calculations is at risk. Computer responses to the unrecognized years may be unpredictable. For example, some computers may make faulty calculations, some may crash at once, and some may appear to operate correctly but fail to restart when shut down.

METHOD OF STUDY

The Grand Jury mailed a questionnaire to 102 county agencies, school districts and cities, asking them to report on the status of their efforts to mitigate the Y2K problem. (Tables 3-6) In addition, the CEO/I &T reported on the status of the Y2K problem in the 22 agencies under his jurisdiction (see Table 2).

The Grand Jury study included letter requests for information, personal interviews and visits to facilities. Interviews were made by the Grand Jury to about 15% of the agencies surveyed in order to verify that the status reported was indeed achieved.

The responses to requests for information were divided into the following four categories:

1. Orange County and its agencies (Table 2)
2. Cities (Table 3)
3. Orange County Department of Education and school districts (Table 4)
4. Other agencies and districts (Tables 5 and 6)

BACKGROUND

The Year 2000 problem (Y2K) is mainly about dates and how computers handle them. In the past, computer design and developments were driven by the fact that hardware, in the form of computer processors and memory, was expensive. Computers were relatively slow, expensive and contained little memory. Computer programmers, then a relatively inexpensive resource, maximized storage space by using numeric shorthand to signify the date. For example, July 7, 1966 became 07-07-66 (month, date, and two-digit year). The two-digit programming expedient took up slightly less memory space than entering the date as 07-07–*1966* (month, date, and *four*-digit year). Thus, with thousands of programs and millions of lines of code, this "shorthand" saved considerable memory and made the two-digit year pervasive throughout most computer codes. Programmers, at the time, were not concerned about how their programs would interpret dates in the 21st century.

Progress in technology produced less expensive computers with far greater memory, but the original software dating strategies did not change. "Patching" or upgrading software incrementally was found to be easier and cheaper than rewriting it. Some of our most advanced computers today still run software that may include the programming shortcuts taken 30 years ago. For example, the Basic Input/Output System (BIOS) of a PC could misinterpret 01–01–00 (January 1, 2000) as January 1, 1900. Computer manufacturers and software developers provide upgrades to older systems to test for Y2K compliance. New systems are designed to be compliant. Older systems with obsolete software and hardware require modification or replacement.

There may be a related problem as early as 1999. Some dates may be interpreted as 9999, which some software recognizes as "end of data file" and signals the computer to permanently close files for that item. For example, two dates, April 9, 1999 (the 99th day of 1999) and September 9, 1999, can be interpreted as 9999.

POTENTIAL PROBLEMS

Any computer and software program that relies on dates to do calculations could be confused and fail to work correctly. This could apply to 1) mainframe systems, 2) networked systems , 3) personal computers (PCs), 4) interfaces, and 5) embedded systems. Remediation may be available for the first four items but not for the fifth which usually requires replacement of the embedded system.

MAINFRAMES

The mainframe computers are the chief data processors for the County. The County Accounting and Personnel System (CAPS) is hosted on a mainframe. Failure here could be disruptive for the financial operations, such as payroll, vendor payments, budget preparation, fund accounting, personnel actions, receivables and payables. Other mainframe operations and areas of possible impact include:

- Municipal Court System (MCS)–traffic ticket processing and traffic court operations
- Assessment Tax System (ATS)–County tax rolls

- Case Management System/Child Welfare system (CMS/CWS)–system accounting and payments

NETWORKS

Networks consist of computer work stations linked together by cables to a high capacity server that does the bulk of the data computation. Examples of County networks with potential problems are the Health Care Agency, the Probation Department, the Sheriff/Coroner, and the Automated Jail System.

PERSONAL COMPUTERS (PCs)

PCs are stand-alone computers at individual desktop work stations. PCs are the most common type in the County, capabilities continue to evolve and grow. PCs can also be networked. All older PCs are at risk.

INTERFACES

Interfaces are "connections" that move data to and from remote systems external to one other. Examples are the State Department of Motor Vehicles, and Department of Justice, Internal Revenue Service, Social Security Administration and health care providers. Interfaces must be capable of handling four-digit year dates in a manner compatible with four-digit data. The correction of computer coding to reflect four-digit year data is not necessarily difficult. However, the identification of **all** relevant interfaces, the coordination and standardization of all the interfaces, and the necessary testing—forward and backward—will be difficult.

EMBEDDED SYSTEMS

Embedded systems are contained within devices that control environmental, mechanical and safety systems. An embedded system is a microprocessor-based system wherein the software is contained within the microprocessor hardware. The following are examples of embedded systems that may be most relevant to County operations:

TABLE 1

EXAMPLES OF DEVICES INCORPORATING EMBEDDED SYSTEMS (NOT INCLUSIVE)

• Lights (Interior, Exterior)	• Elevators, Escalators	• Badge Readers
• Security Systems	• Power Generators	• HVAC Controls
• Alarms	• Fax Machines, Phones	• PBX Systems
• Traffic Signal Systems	• X-Ray Machines	• Backup Lighting & Generator Systems
• Auto/Bus Engines	• Aircraft Avionics	• Time Clocks

Many products with an embedded microprocessor are at risk. Estimates are that between 2 to 20 percent of embedded systems could fail to function properly because of the Y2K date problem. Four factors make it difficult to quantify the Y2K risk of embedded systems:

1. Specifications of embedded systems are not generally published.

2. Embedded systems are not reprogrammable by the end user but they may be replaceable. Knowledge of how to test for Y2K compliance resides with the manufacturer of the equipment. Embedded systems may be inaccessible in some devices; therefore dealing with them may be difficult.

3. Interoperability of many embedded systems yields the concept of "no system stands alone." For example, a microprocessor that controls an HVAC system may be Y2K compliant in itself, yet may shut down the HVAC system if it receives erroneous information from another system on which no maintenance has been performed for years.

4. Technicians may not be aware of embedded systems in the equipment they operate. Some technicians may be aware of the embedded systems but only in the superficial sense of how to turn the systems on and program daily operations.

California's Department of Information Technology (DOIT) has established, under the aegis of their California 2000 Program, an embedded systems data depository and technical assistance center. There is a California State Internet listing (http://www.cesac.com/) that provides the Y2K status of embedded systems. The site requires an identification and password for inquiry functions. Orange County cities and agencies may use identification "zzorange" and password "carry444" to access the system.

REMEDIATION STRATEGIES

The first four systems mentioned above (mainframes, networks, PCs and interfaces) are amenable to Y2K remediation. The remediation process for computer systems is correction or replacement of software coding and hardware. The only remediation for Y2K-faulty embedded systems is replacement.

The remediation process usually has four phases: assessment, planning, hardware modifications and software fixes, and testing. In addition to the large computer and software companies (IBM, UNISYS, Microsoft, DEC), a cottage industry has grown up around remediation for the Y2K problem.

These companies can be located and accessed through the trade journals, computer periodicals and the Internet. For example, the Information Technology Association of America (ITAA) is a clearinghouse for such companies and their services. Care must be taken in engaging such services because the quality of services provided varies greatly.

Troubleshooters and programmers capable of solving the Y2K problem in the field are ripe for poaching by competitors. A company that is well staffed during a proposal phase for remediation may have been raided and decimated by the time the contract is signed.

DATES

Date remediation strategies refer to the representation of dates so there is no ambiguity about the century. There are five commonly used date strategies to solve the Y2K problem.

1. **Conversion to full four-digit format** This solution requires change to both the data and programs by converting all date references to 4-digit format.

2. **Conversion to integer dates** Some programming languages allow integer dates that are offset from some base date to be stored in files, databases or passed as parameters between programs. For example, an arbitrary date is chosen as the computer's starting time. Subsequent internal computer time is counted from that date in integer days. Computer operations involving dates are then done by comparing the integer dates rather than the calendar date directly.

3. **Fixed window** This solution uses a fixed 100-year interval that generally crosses century boundaries. For example, if the window is 1960–2059, program logic must be used that evaluates 2–digit years and determines that any year in the range 00–59 is in the 21st century whereas all others are in the 20th. At least one Orange County agency utilizes such an expedient.

4. **Sliding window** This is similar to the fixed window solution but self-advances every year. Every time the system year advances, the window advances as well.

5. **Encoding and Compression Schemes** This solution encodes dates in 2-digit format using numbering schemes that provide unambiguous dates. This requires conversions of all data and programs and conversion of all applications and references. For example, a 2-digit hexadecimal representation can accommodate up to 255 years.

LEAP YEAR

Leap year determination is another wild card. If a year is divisible by 4, and a century year is divisible by 400, they are leap years.

OTHER FACTORS

Orange County and its agencies, districts and municipalities are a crazy-quilt patchwork of overlapping jurisdictions and functions. There are no universal standards for computer and software utilization. The autonomy of many small districts has allowed them to provide their own solutions for fixing the Millenium Bug that sometimes has an internal coherence. These districts or agencies are exceptions to the rule.

To compound the problem, those county groups that interface with state and federal agencies have an additional level of frustration. State and federal solutions have been late or inconsistent. It is difficult or impossible to force change *up* through a higher governmental entity. County groups will need to construct a firewall to insulate their own

solutions from these external interfaces. Inconsistent data may contaminate otherwise Y2K compliant systems.

ORANGE COUNTY STATUS

Agencies just now beginning to plan for the Y2K problem are finding that they are very late. Some computer applications are already beginning to exhibit the bizarre behavior symptomatic of an inability to cope with the year 2000.

Every agency surveyed seems to be at risk from unknown embedded systems that could fail because of the Y2K bug. The effects of these failures (2% to 20% are potentially at risk) will probably be annoying environmental inconveniences rather than catastrophic failures.

Quantitative assessments of remediation progress were spotty. Responses ranged from detailed plans with milestones through non-specific comments like, "We've got everything under control" to "We're starting to work on it." Some agencies and cities were reluctant to commit to calendar milestones and dates. The Grand Jury found certain allegations of progress were optimistic, milestones allegedly achieved were not actually achieved, and testing was underemphasized.

AGENCIES

Agencies and entities that established plans to mitigate the Year 2YK problem two to three years ago or earlier, are reaping the fruits of that foresight. Those that did not are starting to scramble but may not be compliant in time. That is, no matter how much time and effort are now being applied to mitigate the Y2K problem, the year 2000 will be upon them before the remediation efforts are identified or are in place.

The County's preparation for the Y2K problem has been delegated by the Board of Supervisors (BOS) and their Chief Executive Officer to the Assistant Chief Executive Officer for Information and Technology (CEO/I&T). According to the CEO/I&T the County has been aware of the Y2K problem and has been working on solutions since 1986. The CEO/I&T provided the following information regarding County computer systems. Considerable resources have been spent to remediating the Y2K problems from 1995 on. Y2K has been an agenda item since 1997.

- **Mainframe Systems** operate at the County Data Center on IBM and UNIX mainframe computers. The mainframes provide services such as County payroll, vendor checks, budget preparation, funds accounting, traffic ticket processing, and certain Sheriff Department applications.
- **Departmental Systems** operate in departments and agencies on a variety of platforms, including mid-range computers (mini-computers), network servers and stand-alone PCs. Some services provided include: death statistics, immunization histories, probation accounts receivables, Sheriff's computer aided dispatch, and automated jail system for tracking inmates.
- **Environmental, Mechanical and Safety Systems** are where most of the embedded devices reside. They control air conditioning, badge readers, elevators, gate controls, lighting, sprinkler and environmental systems, as well as other systems.

- **External Interfaces** move data to and from external systems, including federal and state governments and vendors.

The County will have spent, exclusive of staff hours, on the order of $15 to $17 million to mitigate the Y2K problem by the year 2000. The County hosted a workshop on September 2, 1998 on the Y2K problem. Invitees included representatives of major suppliers to the County (*e.g.*, Edison International, Pacific Bell, General Telephone and Electric, Southern California Gas) and 31 County cities.

DEPARTMENT OF EDUCATION AND SCHOOL DISTRICTS

The Orange County Department of Education (OCDE) sent Y2K guidance to all school districts by letter dated January 4, 1998. The guidance included a State plan that had been sent to the County by letter dated November 24, 1997. A follow-up letter, which included essentially the same information, was sent to all districts by letter dated May 13, 1998.

OCDE operates one BULL mainframe utilizing the GCOS8 operating system and 2 BULL ESCALAS utilizing the UNIX operating system, plus various PCs for office applications. The mainframe provides payroll and application services for all 36 school districts. The ESCALAS provide financial applications for 15 school districts.

CITIES

The 31 municipalities in Orange County do not have a centralized Y2K planning agency. Guidance is available through the California Department of Information Technology (DOIT). DOIT reports are directed at state agencies, but guidelines provided therein are generic enough to provide blueprints for Y2K remediation. Twenty of the 31 invited cities in the County participated in the workshop of September 2, 1998, hosted by the CEO/I&T. The workshop was not intended to be a "how to" conference, but it became one as agencies described their remediation approaches for the various types of services they provided.

FINDINGS

Under *California Penal Code* Sections 933 and 933.05, responses are required to all findings.

1. Orange County and its departments have addressed the Y2K problem for years. Awareness of potential Y2K problems has been an agenda item for the CEO/I&T since early in the decade. A comprehensive plan with guidance has been provided to County agencies through the offices of the Chief Executive Officer for Information Technology since 1997. The County will have spent from $15 to $17 million (not including staff hours) on Y2K remediation by the time the Year 2000 arrives.

   (A response to Finding 1 is required from the **Chief Executive Officer**.)

2. The Orange County Sheriff-Coroner Department's Computer Aided Dispatch and Records Management System (CAD/RMS) will not function at 0001 hours on January 1, 2000. The Department has a two-pronged approach to this problem. A "window patch" fix to the existing software is scheduled for completion by April 1999. Additionally, the Department is in the process of procuring a new Y2K-compliant CADS/RMS that will eventually replace the entire system. In the unlikely event that all remediation and replacement efforts fail, the Department plans to fall back to a manual dispatch system.

   (A response to Finding 2 is required from **Orange County Sheriff-Coroner Department**.)

3. Five cities do not have, or have not demonstrated, a formal plan or documented approach to solving the Y2K problem. (See Table 3) The cities are: **Buena Park**, **Costa Mesa, Cypress, Laguna Hills**, and **Laguna Niguel**.

   (A response to Finding 3 is required from **Buena Park, Costa Mesa, Cypress, Laguna Hills,** and **Laguna Niguel**.)

4. Ten city police departments are contractually dependent on the West Covina Police Department to provide a Y2K fix to their Computer Aided Dispatch System. The cities are: **Buena Park, Cypress, Fountain Valley, Fullerton, Laguna Beach, La Habra, La Palma, Los Alamitos, Seal Beach,** and **Tustin**.

   (A response to Finding 4 is required from **Buena Park, Cypress, Fountain Valley, Fullerton, Laguna Beach, La Habra, La Palma, Los Alamitos, Seal Beach,** and **Tustin**.)

5. The **Orange County Fire Authority** and the **Orange County Transportation Authority** have well-documented, staffed and funded remediation programs in place and operating.

   (A response to Finding 5 is required from **Orange County Fire Authority** and **Orange County Transportation Authority**.)

RECOMMENDATIONS

Under *California Penal Code* Section 933 and 933.05, The Grand Jury requires responses from the appropriate agencies and officials to each of the following recommendations.

Based on the findings, the Grand Jury recommends that:

1. The **Assistant Chief Executive Officer** for **Information and Technology** should maintain the momentum of the County's Y2K mitigation efforts. The office should ensure that the maximum amount of system testing is accomplished prior to the Year 2000.

   (A response is required to Recommendation 1 from the **Chief Executive Officer**.)

2. The **Orange County Sheriff-Coroner Department** should continue to closely monitor and implement corrections to their CAD/RMS. This is a key public safety issue in the County. (Finding 2.)

   (A response to Recommendation 2 is required from the **Orange County Sheriff-Coroner Department**.)

3. The five cities, **Buena Park, Costa Mesa, Cypress, Laguna Hills,** and **Laguna Niguel**, which have not developed a formal or documented remediation plan, should prepare and implement one as soon as possible. (See Finding 3.)

   (A response to Recommendation 3 is required from the cities of: **Buena Park, Costa Mesa, Cypress, Laguna Hills,** and **Laguna Niguel** .)

4. Ten city police departments, **Buena Park, Cypress, Fountain Valley, Fullerton, Laguna Beach, La Habra, La Palma, Los Alamitos, Seal Beach,** and **Tustin**, should closely monitor the schedule, testing, and milestones of the Y2K fixes developed under contract with the West Covina Police Department. This is a key public safety issue which warrants close liaison between police departments. A valid fall-back plan should be in place in case the optimism about West Covina Police Department's solutions is not warranted. (Finding 4.)

   (Responses to Recommendation 4 are required from the cities of: **Buena Park, Cypress, Fountain Valley, Fullerton, Laguna Beach, La Habra, La Palma, Los Alamitos, Seal Beach,** and **Tustin**.)

COMMENDATIONS

The Grand Jury commends:

- The **Assistant Chief Executive Officer for Information Technology (CEO/I&T)** for his effective and aggressive approach to proactive solutions to the County's potential Y2K problems. (Finding 1.)

- The **Orange County Fire Authority**, particularly the Information Systems staff, for its effective and proactive Y2K planning and actions. (Finding 5.)

- The **Orange County Transportation Authority**, particularly the Information Systems staff, for its Year 2000 compliance plan and implementation. (Finding 5)

APPENDIX

REFERENCES

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