

INPUT

MARKET ACTION PROJECT

Y2000 Preparedness and Its Impact on the Federal Government

Electronic Government Program

1 9 9 7

Y2000 Preparedness and Its Impact on the Federal Government

INPUT[®]

Frankfurt • London • New York • Paris • San Francisco • Tokyo • Washington D.C.

Researched and Published by
INPUT
Suite 250
1921 Gallows Road
Vienna, VA 22182-3900
United States of America

Electronic Government Program

Y2000 Preparedness and Its Impact on the Federal Government

Copyright © 1997 by INPUT. All rights reserved. Printed in the United States of America. No part of the publication may be reproduced or distributed in any form, or by any means, or stored in a database or retrieval system, without the prior written permission of the publisher.

The information provided in this report is proprietary to INPUT. The client agrees to hold as confidential all such information, and control access to the information to prevent unauthorized disclosure. The information shall be used only by the employees of and within the current corporate structure of the client, and will not be disclosed to any other organization or person including parent, subsidiary, or affiliated organization without prior written consent of INPUT.

INPUT exercises its best efforts in preparation of the information provided in this report and believes the information contained herein to be accurate. However, INPUT shall have no liability for any loss or expense that may result from incompleteness or inaccuracy of the information provided.

Abstract

Never in the history of computing has an issue been so pervasive yet so misunderstood as that of the year 2000 century date change issue.

Doomsayers offer that with the arrival of the new millennium, even the most insignificant application with an improper date reference could spell disaster for a system and the agency it supports.

INPUT estimates that it will cost the federal government approximately \$10.9 billion to fix the problem, considerably more than current government projections. Also, federal agencies are expected to divert 46,000 full-time equivalent federal employees from their normal IT functions to deal with the conversion effort. All in all, the problem will consume a great deal of federal resources over a relatively short period of time.

Despite all of the resources the Y2000 problem will consume, the government is still not expected to be finished with the conversion by January 1, 2000. The result will be the potential failure of critical government systems and possible collapse of the business process in many agencies. The problem will be compounded by an overall lack of "triage" aimed at dealing with failures.

This report provides vendors with strategic insights into issues surrounding the century date change as well as how federal agencies have progressed in addressing them. The report also presents strategies agencies plan to employ to accomplish their conversion efforts in a timely manner. Though not a tutorial, this report is intended to provide a conceptual framework to help vendors develop a Y2000 marketing plans.

To develop this project, extensive interviews were conducted with Y2K program managers at federal agencies as well as developers, IRM officials, and executives in IT-related functions.

This report is written for IT vendors trying to better understand the government's Y2000 problem and develop a plan for addressing the market. Vendors are presented with agency timelines, costs and other information which could impact successful completion.

This report also examines strategies agencies have employed to deal with the problem, as well as descriptions of toolsets, lessons learned and advice to other agencies.

The report contains 183 pages and 49 exhibits. A related Year 2000 White Paper are also included as an appendix.

Table of Contents

I	Introduction	1
	A. Purpose of the Report	1
	B. Objectives	1
	C. Scope	2
	D. Methodology	3
	E. Report Organization	4
	F. Related INPUT Reports	5

II	Executive Summary	9
	A. Policy and Guidance	11
	B. Current Agency Status	13
	C. Market Size	14
	D. Cost Evaluation	15
	E. Varied Corrective Approaches	17

III	Conversion Status	19
------------	--------------------------	-----------

IV	Approaches to Problem Resolution	33
	A. Approaches	33
	B. Code Decisions	35
	C. Tools	41
	D. In-House vs. Outsourced	43

V	Vendor Analysis	49
	A. Critical Skill Sets Required by Agencies	49
	B. Deciding to Outsource	52
	C. External Service Provider Skill Requirements	54

VI	Y2000 Conversion Funding	61
	A. Market Overview	61
	B. Overall Federal IT Market	62
	C. Federal Y2000 Estimates	69

	D. INPUT's Y2000 Cost Estimate	72
	E. Personnel	75
<hr/>		
VII	Civilian Agency Analyses	79
	A. Department of Agriculture	79
	B. Department of Commerce	81
	C. Department of Education	82
	D. Department of Energy	84
	E. Department of Health and Human Services	86
	F. Department of Transportation	87
	G. Department of the Treasury	89
	H. Department of Veterans Affairs	90
	I. National Aeronautics and Space Administration	91
<hr/>		
VIII	Defense Agency Analyses	95
	A. Department of the Air Force	95
	B. Department of the Army	96
	C. Office of the Secretary of Defense	96
	D. Department of the Navy	98
<hr/>		
IX	Conclusions and Recommendations	103
	A. General Observations	103
	B. Specific Conclusions	105
	C. Recommendations	107
	D. Closing Remarks	109
<hr/>		
Appendices		
	A. Y2000 Services Schedule Holders	111
	B. User Questionnaire	115
	C. Definitions	129
	D. Glossary of Federal Acronyms	149
	E. The IT Industry and the Year 2000: A White Paper	171

List of Exhibits

I			
	-1	Methodology	3
II			
	-1	Status of Preparation	14
	-2	Source of Funding for Y2000 Preparation	16
	-3	Estimate of Cost	17
	-4	Preferred Approach to Resolving the Issue	18
III			
	-1	Number of Mission Critical Systems	20
	-2	Individual Agency Timelines	22
	-3	Status of Repair on Mission Critical Systems	27
	-4	Year 2000 Report Card	29
	-5	Status of Preparation	31
IV			
	-1	Preferred Approach to Resolving the Issue	34
	-2	Planned Y2000 Approach for Mission Critical Systems	41
	-3	Project Management Providers	44
	-4	Transition Methodology	44
	-5	Inventory Providers	45
	-6	Proposed Source of Support for Various Functions - I	46
	-7	Proposed Source of Support for Various Functions - II	47
V			
	-1	Critical Skill Requirements and Their Importance	49
	-2	Federal Government Vendor Past Performance Criteria	50
	-3	Critical Skill Requirements	51
	-4	Range of Ratings for Different Categories of Outsourcing - DoD	53
	-5	Mean Ratings of Different Categories of Outsourcing - Civilian	54
	-6	Importance of Skills in an External Service Provider	57
	-7	Vendor Importance Ratings	59
VI			

-1	U.S. Market for Y2000 Conversion Project Components	62
-2	IT Markets, FY 1997-1999	63
-3	Professional Services Market	64
-4	Professional Services Market - All Segments	65
-5	Professional Services Submarkets	67
-6	Agency Y2000 Cost Estimates (\$M)	70
-7	Sources of Funding for Y2000	71
-8	Cost Per Line of Code on Various System Types	72
-9	INPUT's Y2000 Cost Estimate (\$M), 1997-1999	73
-10	Breakdown of Y2000 Costs	74
-11	Federal Market for Y2000 Conversion Project Components	75
-12	Number of Employees Diverted for Y2000	76
-13	Diverted Employees by Selected Agency	77

VII

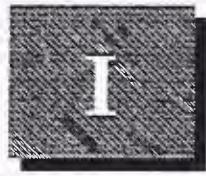
-1	USDA's Y2000 Cost	80
-2	DOC's Y2000 Cost	82
-3	Repair Status of Education's Systems	83
-4	Education's Y2000 Cost	83
-5	Energy's Y2000 Cost	85
-6	HHS' Y2000 Cost	87
-7	DOT's Y2000 Cost	88
-8	Treasury's Y2000 Cost	90
-9	VA's Y2000 Cost	91
-10	NASA's Y2000 Cost	93

VIII

-1	DOD's Y2000 Cost	98
----	------------------	----

B

-1	Information Services Industry Structure	134
----	---	-----



Introduction

This section describes the purpose and scope of this report. It presents the research methodology and lists related reports published by INPUT.

A

Purpose of the Report

The Year 2000. Never in the history of computing has an issue been so pervasive yet so misunderstood. Doomsayers offer that with the arrival of the new millennium, even the most insignificant application with an improper date reference may bring a system - and, potentially, an entire federal agency - to its knees. Conversely, many IS professionals are in denial regarding just how all-encompassing the problem may potentially be.

With the popular press reporting estimates currently hovering in the half a *trillion* dollar range for worldwide "Y2K" conversion expenditures, there is cause to be aware for both vendors of the technology and agencies considering a Y2000 conversion. This report describes the critical issues surrounding the "problem of the century," including an in-depth analysis of agency preparedness and gives both systems planners and vendors insights into potential backlash, legal issues and market trends.

B

Objectives

This report had the following major objectives:

- Provide an objective synopsis of the problem, its scope and potential costs
- Assess the overall preparedness of federal agencies in meeting the Y2000 problem
- Help senior information resource management officials dealing with software, systems and professional services issues understand the market for Y2000 conversions

- Describe the current of level Y2000 conversion activity and forecast future trends
- Outline an approach to the Y2000 issue for agencies considering conversion
- Forecast potential Y2000 expenditures by agency
- Analyze the potential backlash on expenditures and the overall federal information technology budget
- Prepare both agencies and vendors for the legal issues arising as a result of the Y2000 problem

This report is written for agency information technology officials and policymakers trying to better understand the Y2000 problem and develop a plan for addressing the issue. It is also intended for the contractor community to help them identify federal market opportunities, agency requirements and means of differentiation.

C

Scope

This report provides federal IT professionals with strategic insights into issues surrounding the century date change as well as how to address them. The report also presents guidelines for a conversion strategy and suggestions for a smooth transition. Though not a tutorial, this report is intended to provide a conceptual framework to help agencies develop a Y2000 conversion plan. Coupled with these assessments is an overview of federal expenditures on the Y2000 problem as well as an analysis of the conversion's impact on the overall IT budget.

The research behind the following content focuses on all department-level agencies within the federal government as well as their supporting sub-agencies. Extensive interviews were conducted with Chief Information Officers and senior information resource management officials, as well as developers, managers, and executives in existing/potential Y2000 solution applying companies. The vendors included are prominently recognized providers of Y2000 consulting services, tools, clock simulation, full conversion service and/or an integrated Y2K conversion toolset.

Likely purchasers of the technology surveyed were all department-level federal agencies with a reliance on information technology solutions to conduct core business functions. This includes the cabinet departments and their sub-agencies as well as large independent agencies with substantial information technology budgets.

The time scale addressed is 1997 to 2000. Given the rapid, ongoing development of Y2000 solution packages, greater emphasis is given to the near term of early 1997 to 1998.

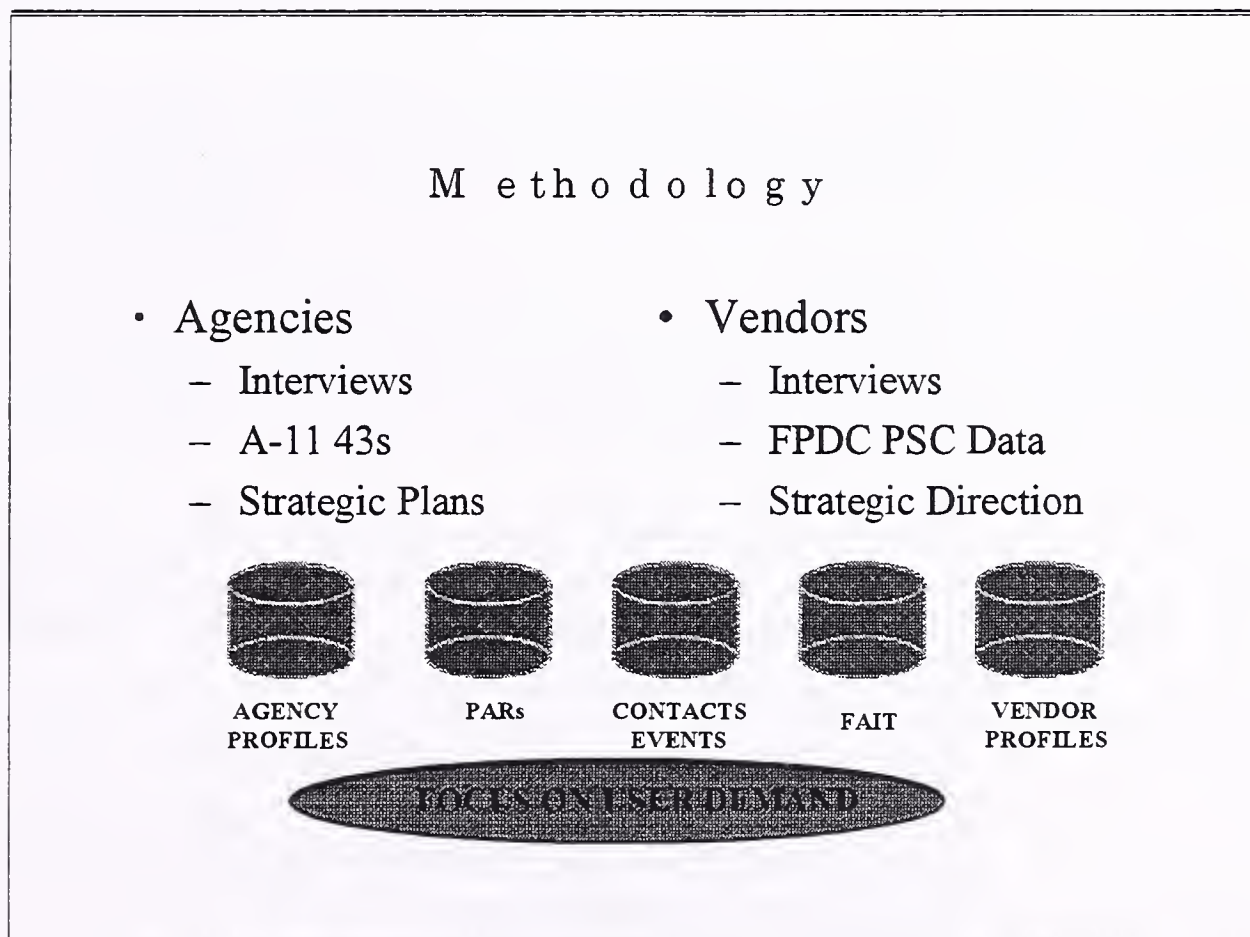
D

Methodology

The research relies on interviews with knowledgeable entities within pertinent Y2000 solution supplying/applying organizations. The insights solicited from all major government agencies are analyzed in detail. Spending estimates of Y2000 solutions were submitted to the Office of Management and Budget as a supplement to the A-11 Exhibit 43 IT spending data. This data is used to forecast federal spending levels on Y2000 problem resolution. Reviews of published materials, on-line resources and case studies were also conducted to compile this report.

Both agency and industry perspectives are gathered (see Exhibit I-1) to create a government user demand profile.

Exhibit I-1



Source: INPUT

E

Report Organization

The following is a brief description of the organization of this report.

- Chapter II is an *Executive Summary* providing a summary of the research findings, analysis, conclusions and recommendations of the report, including an overview of the solution provider market as well as cost evaluations and the OMB and GAO models.
- Chapter III, *Government Conversion Status*, presents an analysis of the current federal level of activity in addressing the problem, as well as an analysis of the stages of conversion.
- Chapter IV, *Approaches to Problem Resolution*, provides an evaluation of popular methods employed to address the Y2000 issue, including individual agency progress and highlights in the resolution process.
- Chapter V, *Vendor Performance Analysis*, establishes how much of an agency's Y2000 related activities it intends to solicit from external service providers (ESPs) and what particular skills and services are being sought.
- Chapter VI, *Y2000 Conversion Funding*, reports INPUT's findings regarding Y2000 conversion cost estimates, including estimates submitted by each agency to OMB, and breaks them down into several components. It also addresses how agencies are funding their conversions and their expected timeline for completion as well as the effects on the agency's overall IT budget. This chapter also outlines a federal conversion completion timeline and provides forecasted expenditures for dealing with the problem.
- Chapter VII, *Civilian Agency Analyses*, provides information about skill sets of individual civilian agencies as well as lessons learned and the agency's advice to other organizations. User satisfaction with Y2000 solution vendors is also examined.
- Chapter VIII, *Defense Agency Analyses*, provides skill set information about the Department of Defense and its component agencies, including the military services as well as defense support organizations. It also details agency requirements and possible pitfalls agencies may face in the conversion effort, as well as an assessment of lessons learned and each agency's thoughts on the future of Y2000.
- Chapter IX, *Conclusions and Recommendations*, addresses the overall federal preparedness in meeting the deadlines for Y2000 conversion, along with a forecast of conversion costs by agency and the impact that funding will have on the overall information technology budget for those

agencies. Finally, the readiness and feasibility of vendor solutions is discussed, as well as legal issues surrounding the Y2000 problem.

- Appendix A, *Y2000 Services Schedule Holders*, provides information about those vendors who currently hold Federal Supply Schedules for Y2000 services.
- Appendix B, *User Questionnaire*, contains a sample of the survey used to collect the data analyzed in the creation of this report.
- Appendix C, *Definitions*, provides descriptions of terms used in the federal market.
- Appendix D, *Glossary*, provides definitions of commonly used federal agency acronyms.
- Appendix E, *The IT Industry and the Year 2000 - A White Paper*, presents a synopsis of the Y2000 issue. It summarizes major points presented in popular press and offers a broad perspective of the Y2000 conversion playing field. It also briefly describes some of the associated legal considerations.

It is intended for those who have not yet become familiar with the Y2000 problem and how it may impact their particular organization. For those readers who fall into this category, it should be read before the body of this report.

In addition, INPUT reviews vendor strategies in its Vendor Analysis Program. During the course of the year, INPUT issues monthly Research Bulletins. INPUT also provides vertical market forecasts and industry reports.

F

Related INPUT Reports

Related current reports from the Electronic Government program of interest to the reader are as follows:

Current Federal Reports

- ☐ Federal Information Systems and Services Market, FY 1997-FY 2002
- ☐ Federal Information Systems and Services Market, FY 1996-FY 2001
- ☐ Impact of Procurement Reform on the Federal IT Market
- ☐ Evaluation of Federal Program Budgets - 1998

- ☐ Federal Professional Services Market, 1996-2001
- ☐ Financial Management Systems Market, 1996-2001
- ☐ Federal Telecommunications Market, 1996-2001
- ☐ Federal Imaging Market — 1996
- ☐ Federal IT Procurement Program, Procurement Analysis Reports
- ☐ Federal Document Management Market — 1995
- ☐ Federal Computer Security Market, 1995-2000
- ☐ Federal Wireless Technology Market, 1995-2000
- ☐ Federal Electronic Commerce/EDI Market
- ☐ Client/Server Trends in the Federal Market
- ☐ Business Process Re-engineering in the Federal Government
- ☐ Federal E-mail Market
- ☐ Federal High-Performance Computing Market
- ☐ Geographical Distribution of Federal IT Spending

Future Federal Reports

- ☐ Benchmarking of Government Systems Integrators
- ☐ The Impact of Network Computers on the Federal Market
- ☐ Federal Agencies Market Briefs and IT Forecasts

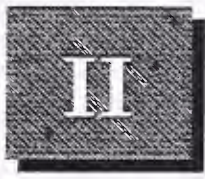
Commercial Reports

In addition to the federal reports listed, the following commercial reports cover various aspects of the research conducted for this project. Commercial reports are available from a wide range of program choices including Electronic Commerce, Electronic Banking, Enterprise Applications Solutions, Internet/Intranet Technologies and Solutions, Customer Services and Support, Operational Services and IT Vendor Analysis.

- ☐ Y2000 Service Opportunities
- ☐ Customer Satisfaction with Systems Integration Vendors
- ☐ Impact of the Internet on Systems Integration and Professional Services Markets

- ☐ Pricing and Marketing of Professional Services
- ☐ Strategies for Successful Alliances
- ☐ Opportunities for Outsourcing Supply Chain Management
- ☐ Impact of the Internet on Outsourcing and Processing Services
- ☐ Benchmarking of U. S. Outsourcing Service Providers
- ☐ Outsourcing Vendor Performance Analysis
- ☐ Outsourcing Services Competitive Analysis
- ☐ Desktop Services Opportunities for the U.S. - 1997
- ☐ Evaluation of Internet Integration Opportunities
- ☐ Evaluation of SAP Service Providers in the U.S. - 1997
- ☐ IT Vendor Analysis Program - 1997-98
- ☐ Electronic Commerce and Enterprise Application Integration

(Blank)



Executive Summary

The looming year 2000 (Y2000) problem may be summarized in a general sentence: programs utilizing conventional date formatting may perform calculation errors or cease functioning altogether on January 1, 2000. This can have dire consequences for the overall federal government as well as citizens and may ultimately precipitate the failure of a core business function.

In more specific terms, the year 2000 date change will hit the government hard. Agencies such as the Department of Defense, responsible for the oversight of the military and the protection of U.S. global interests, may experience trouble with any number of weapons systems, as well as communications and logistics systems. Agencies such as the Department of Veterans Affairs and the Treasury Department, whose core functions include the issuance of checks and management of large financial systems may be faced with systems that are incapable of performing these essential tasks. The Department of Transportation may experience failure of large forecasting and scheduling systems for air traffic and railroads, placing the public in an inconvenient and potentially dangerous situation.

The Social Security Administration (SSA) was praised for its early detection and assessment of the problem. SSA began to focus on the critical nature of the date change as far back as 1989. However, this early start has proven that time is of the essence. It was not early enough. In an October 1997 General Accounting Office Report to Congressional Requesters, SSA was praised for quickly initiating "early awareness activity and has made significant progress in assessing and renovating mission-critical mainframe software than enables it to provide Social Security benefits and other assistance to the public." The report highlights SSA as a federal leader in addressing the issue of Y2000 conversion. Despite this, SSA still remains at risk. The report points out that SSA will still not be able to realistically convert all necessary software before December 31, 1999. Many of the mission critical systems in the State Disability Determination Services have not yet been assessed. SSA is also challenged with ensuring compliance between other state and federal systems with which SSA systems must

interface. SSA serves as an example that the most prepared agencies still have a long way to go.

These problems are not restricted to large mainframe-driven systems but may also affect LANs, WANs and even desktop personal computers as well as telecommunications systems used for voice, video and data transmission. Solving the problem may mean examining millions of lines of code for date fields. The core problem becomes one of time rather than complexity. The Social Security Administration, for example, published a White Paper detailing the potential extent of the problem within their agency. SSA has 25 million lines of code at any given time and 25 million more under development. SSA is a relatively small agency in terms of IT installed base. Many of these installed systems have been on "autopilot" for years, even decades. It will take major reprogramming efforts which will require huge amounts of time to adjust just to enable continued operation of the systems.

Having been roused by the cacophony of "Y2000" solutions providers springing from the woodwork, most agencies have at least awakened to face these potentially devastating consequences and begun moving towards developing and administering viable solutions. Or have they?

INPUT research has shown that a substantial percentage of agencies are still just now completing assessment and putting plans into action, and those few that have begun the transition have vastly underestimated the associated time/cost commitment. Few agencies have put together a truly realistic timeline for dealing with the issue and the overall impact of the problem will vary from agency to agency. Most importantly, however, is the projected dramatic impact on the overall IT budget for most agencies.

On the whole, awareness is on the rise. However, many critics feel that the government will not be ready for the new millennium, claiming that federal agencies have not done enough to ensure implementation of a successful conversion plan and the timely fulfillment of the plan. The opportunity for the private sector is great in this endeavor. This report seeks to examine the benefits and costs to both the agency and the vendor communities.

The information in this report is organized to answer the following questions for the reader:

- How prepared are agencies for the year 2000 date change?
- How long will it take agencies to implement Y2000 fixes?
- What have agencies already accomplished?
- How will agencies choose to fix their systems to ensure Y2000 compliance?

- What role will the private sector play in the fix?
- What are the legal pitfalls surrounding the year 2000 problem?
- What are the overall expenditures on the problem and how will these expenditures impact each agency's information technology budget?

A

Policy and Guidance

GSA was one of the first government entities to acknowledge the problem and they have taken up the cause of increasing awareness governmentwide. Also, the CIO Council has formed a subcommittee on year 2000 aimed at taking a global agency view of the problem and its potential impact. GSA is joined, however, by powerful policymaking agencies such as GAO and OMB in the hopes of addressing the problem before it becomes a reality.

According to a report released by the Congressional Committee on Government Reform and Oversight, with the year 2000 only 25 months away, the federal government has little hope of preparing all of its existing computer systems for the year 2000. Accordingly, in the September 1996 report entitled *Year 2000 Computer Software Conversion: Summary of Oversight Findings and Recommendations*, the Committee recommended that agencies prioritize systems that need fixing so the most critical systems are corrected on time.

The report sparked the publication of a General Accounting Office report entitled *Year 2000 Crisis: An Assessment Guide*. The guide, released in February 1997, identifies the five steps involved in properly addressing and resolving the year 2000 issues:

- awareness
- assessment
- renovation
- validation
- implementation

OMB then devised a milestone model to guide federal agencies in their conversion process. OMB mandated that by December 1996, all agencies should be aware of the problem. As explained further in Section C, all agencies have completed this phase. Phase II, assessment, was broken into two parts. The first, inventory and scope, requires agencies to physically inspect and inventory current systems and devise a relative assessment of the scope of the problem. This phase should have been completed by March

1997. Agencies were then required to develop schedules for corrective action and have them approved by their respective CIOs by June 1997. All new coding should be complete by December 1998. Validation of the renovated systems should then take place over the following month and by November 1999, each agency should perform integrated testing. Agencies are also directed to examine potential triage strategies.

Along with this implementation plan, OMB also set some governmentwide guidelines to complement the efforts of individual agencies:

- Federal groups were tasked at raising the awareness of high-level agency IT officials. A result was the formulation of the President's Management Council, which includes the chief information officers.
- The CIO Council and the Interagency Working Group on the Year 2000 were encouraged to promote the sharing of information and strategies among agencies.
- Reforms to the acquisition regulations are promoting future purchases of only Y2000-compliant technology. Recently, a Federal Acquisition Regulation (FAR) clause was developed which deals with the purchase of year 2000 compliant products from the private sector. It mandates that agencies must use year 2000 compliance as a deciding factor in awarding contracts for outsourced IT.
- OMB is asking for the removal of barriers in an effort to save time. This may be done by standardizing such things as date field formats across the federal government to facilitate the progression of a learning curve in solving the problem. A contractor working on date conversion for multiple agencies will progressively work faster if the date format is the same among those agencies.
- Quarterly progress reports enable all agencies as well as the oversight groups and the President to track progress and completion.

Furthermore, OMB Circular A-11 provides guidance on the submission of spending estimates for each agency in the federal government. All agencies are required to submit an Exhibit 43, *Agency-Wide Summary on Obligations for Information Technology*. Currently, agencies are also under regulation to provide ancillary data relative to the cost of year 2000 activities. According to the A-11 Circular, "the estimates will cover the costs of identifying necessary changes, evaluating the cost-effectiveness of making those changes (fix or scrap decisions), making changes, testing systems and contingencies for failure recovery." OMB continues by directing agencies not to "include obligations for upgrades or replacements that would otherwise occur as part of the normal system life cycle." All agencies have 30 days annually following their Exhibit 43 submission to provide Y2000 cost data.

B

Current Agency Status

The awareness phase has already passed. Many of the legacy systems now in place were originally designed to last one or two decades. As agencies and vendors have begun to realize the tremendous implications presented by the year 2000 on computer systems in the government and commercial world, awareness of the problem has not been an issue of late.

The government has now entered the assessment phase. Agencies are becoming aware of the fact that the problem is not just one of hardware and software and are slowly beginning to realize and focus on the potential impact of the failure of core systems on business processes. This leads to the selection of one of three main courses of action: conversion, replacement or retirement. Conversion involves changing the existing code to account for a four-digit year field. Replacement involves the acquisition, installation, startup and maintenance/testing of new systems capable of handling the twenty-first century and retirement is the disposal of non-mission-critical systems.

According to an August 15, 1997 report by OMB entitled *Progress on Year 2000 Conversion*, 62% of mission critical systems in the federal government are being repaired. Only 13% are being replaced and 5% are being phased-out or retired. The remaining 19% of systems are already Y2000 compliant.

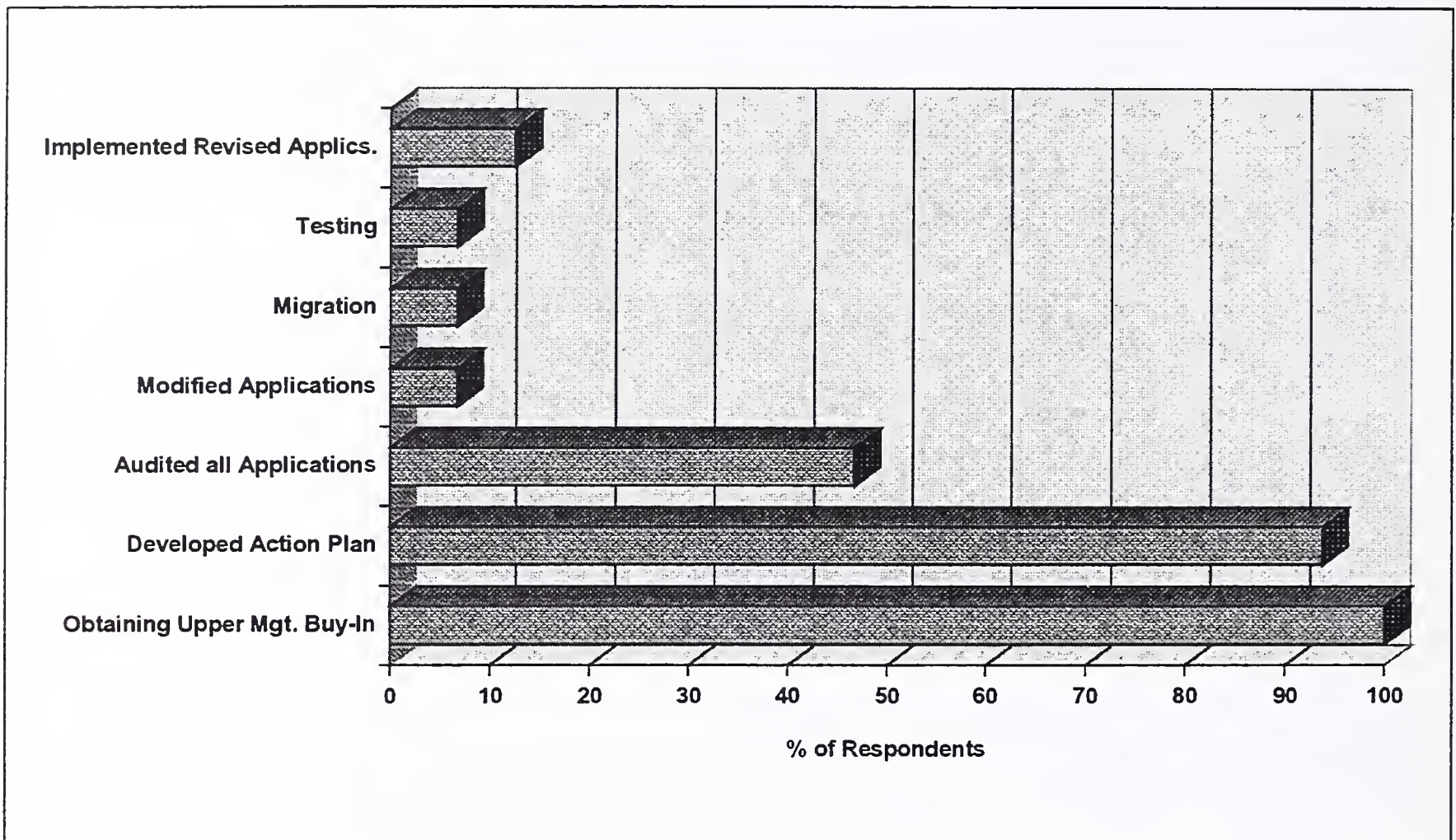
A report card issued on September 15, 1997 by the House Subcommittee on Government Management, Information and Technology details that 12 of the 24 major agencies that were graded have completed the assessment phase. Most of the agencies with large information technology budgets and the greatest numbers of mission-critical systems have not yet completed this phase. Most notable are the Department of Defense, Department of the Treasury and the Department of Transportation. Also trailing are NASA and the Department of Veterans Affairs. The Department of Justice, however, has completed the assessment phase even though it houses one of the largest installed bases of IT equipment in the federal government.

Exhibit II-1 represents the status of preparation among federal agencies. The assessment phase begins with developing a plan of action and ends when all applications have been audited. Modification of applications is classified as renovation while migration and testing are part of the validation process.

100% of responding federal agencies stated that they have moved into the assessment phase. Only 44% of respondents have made it to the auditing stage and a mere 12.5% have implemented any revised applications.

Exhibit II-1

Status of Preparation



Source: INPUT

C

Market Size

INPUT research has shown that during the period 1997-1999, federal agencies anticipate spending \$14.2 billion on professional services to support information technology. Most of the funding for the year 2000 problem (application management and support, software services, etc.) will come from the professional services segment of the IT market. If estimates of \$10.9 billion for the Y2000 conversion hold true, agencies will be left with very little funding for non-Y2000 projects.

Impacts on the information technology budgets for federal agencies will be dramatic. Resources required by the year 2000 issue will preclude spending on other programs and the fastest growing segment of the IT market, professional services, will take a major hit.

D

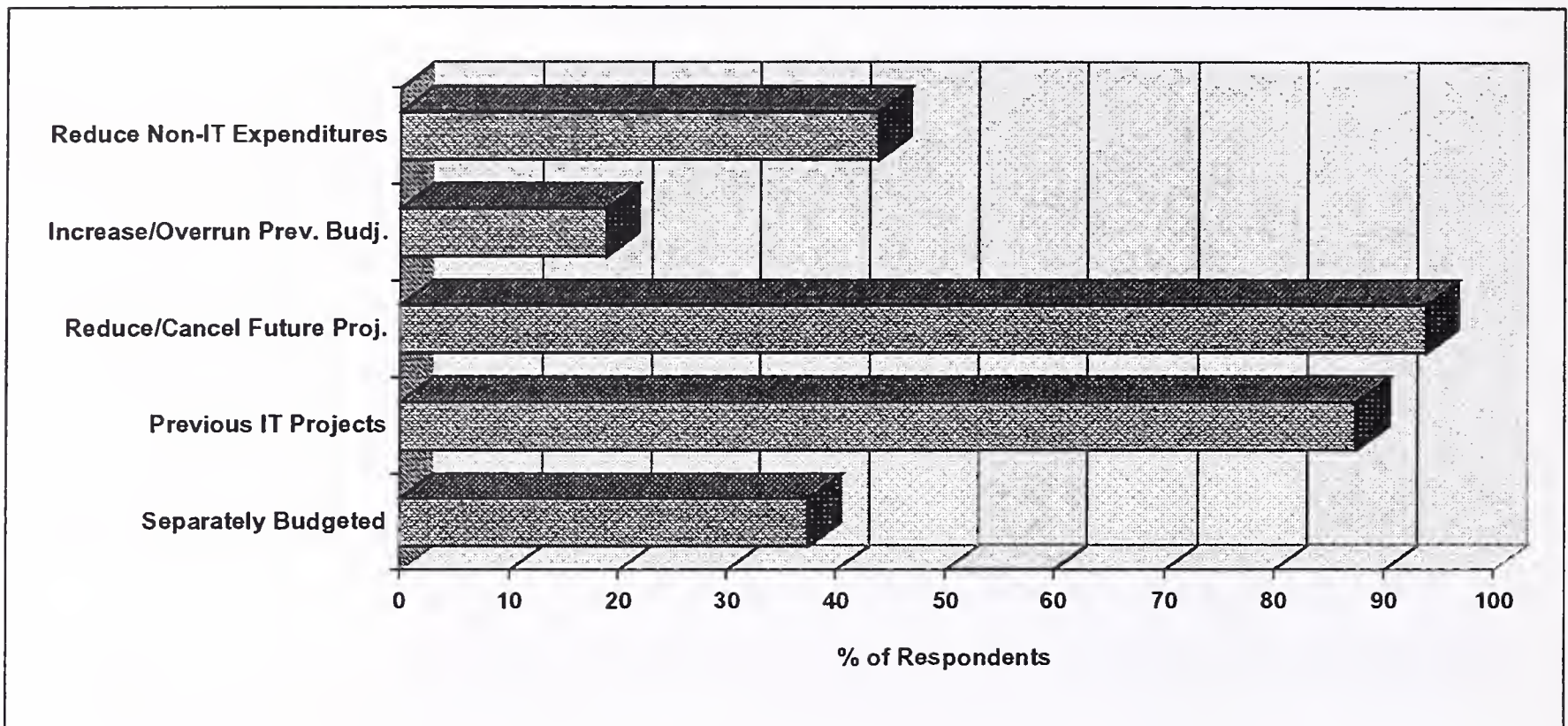
Cost Evaluation

The vast majority of agencies have included Y2000 conversion expenditures in their annual budget submissions to the Office of Management and Budget. In examining the sources of the Y2000 funding, 37.5% of respondents said that they expect the year 2000 problem to become a separately budgeted item over the next few years. However, an overwhelming 94% of those agencies who responded expect that the agency will either reduce or cancel other IT projects currently slated for implementation. Some of the overlap results from agencies which expect portions of the Y2000 cost to become a separately budgeted item, while other portions are funded through the cuts made in other IT projects. On the whole, agencies expect some decline in IT purchasing and implementation for non-Y2000 projects in order to fund the problem. 88% of agencies have already included some portions of the Y2000 cost in previous IT projects.

Almost half of the responding agencies (44%) foresee cuts in non-IT projects in order to fund Y2000 conversion. Some agencies did state that they have already requested or plan to request additional IT funding from OMB in order to address the problem. The Department of Defense pointed out that an organization as large as DoD will need to look at all sources of funding for the problem due to the size and complexity of their systems and the extent of IT usage. Exhibit II-2 represents the sources of funding that agencies will draw upon in order to correct date-change issues.

Exhibit II-2

Source of Funding for Y2000 Preparation



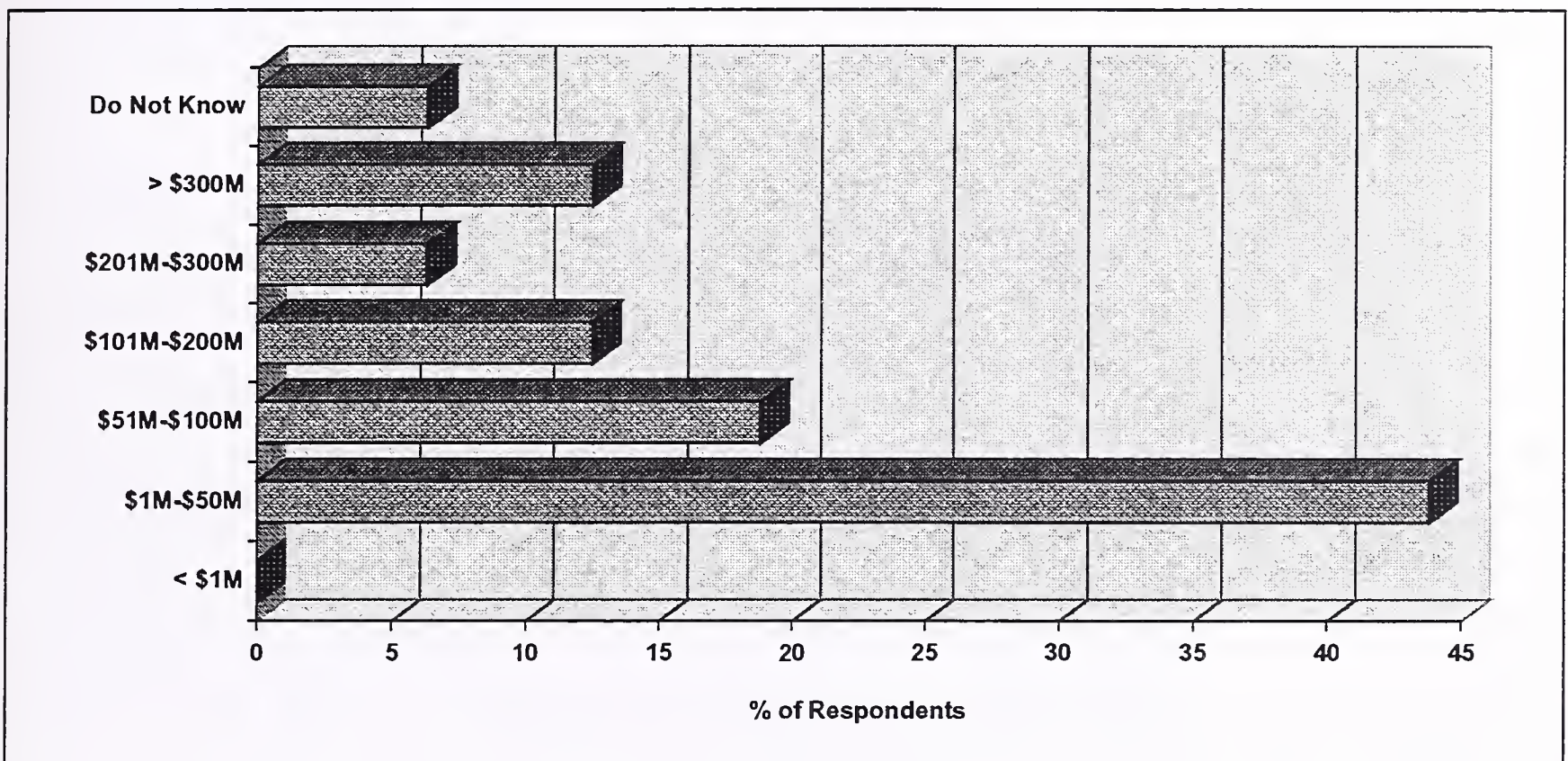
Source: INPUT

In terms of cost to the government, 44% of respondents believe that the endeavor will cost between \$1 million and \$50 million and only 6.3% believe that it will cost over \$300 million. The majority of estimates (63%) are in the \$1 million to \$100 million range.

The overall size of each agency and the reliance on computer systems for core business functions must be taken into consideration. However, these estimates still appear low in reference to estimates made by the private sector. Overall, the government's estimate for Y2000 cost is only about 1/3 that of the industry estimates, an overall discrepancy of about \$7 billion.

Taking into consideration that the federal government is made up of 26 major agencies and using the weighted average cost per agency of \$103.8 million, the federal government estimates add to roughly \$2.7 billion overall - across the 26 major agencies. This figure is derived by taking the average value for each of the surveyed ranges. For example, the \$1M to \$50M range averages to \$25.5M. Using the high end of each surveyed range, the average cost per agency becomes \$143.3 million and the overall federal cost reaches \$3.7 billion. The government's official estimate is about \$3.8 billion. Cost estimates for the federal government are graphically represented in Exhibit II-3.

Exhibit II-3

Estimate of Cost

Source: INPUT

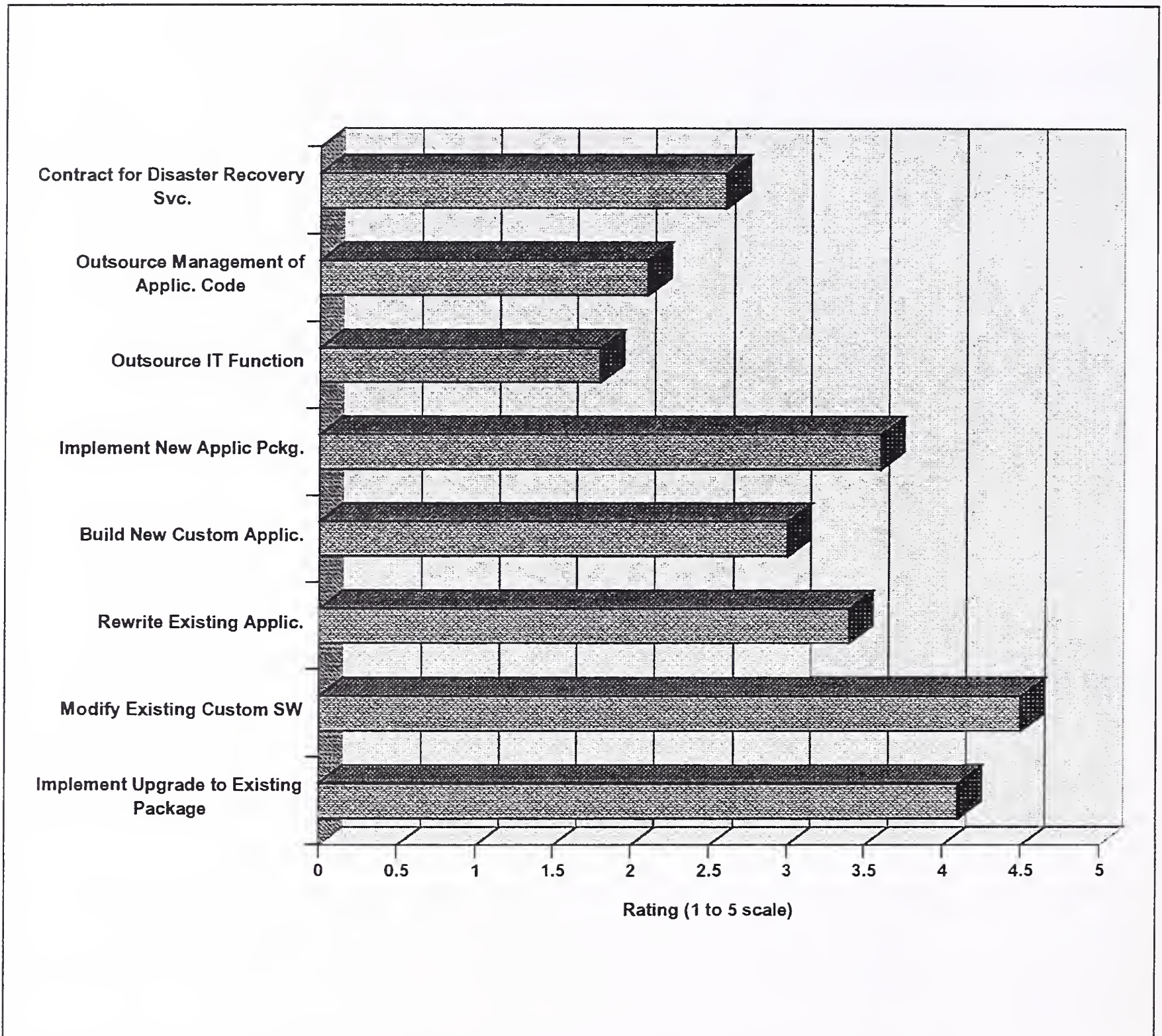
E**Varied Corrective Approaches**

The highest rated approaches to addressing the Y2000 issue are to upgrade existing packages and to modify existing custom software, as shown in Exhibit II-4. No issue stood out as a premium approach for all agencies, nor was any one approach dismissed by the majority of agencies.

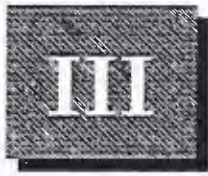
The relatively low level of interest expressed in these conversion processes indicates that solutions are likely to combine several methodologies as agencies address “patchwork” systems, e.g. unique operating systems across an agency.

Fueling this mixed response is also a general lack of understanding regarding the significance of the Y2000 issue and how it is to be properly addressed. Each agency differs in terms of the amount of IT used and the levels to which that IT affects the core business functions. Also, some agencies have more at stake in terms of the year 2000 problem because they have more mission critical legacy systems installed which are not easy to replace or modify. Therefore, agencies have become wary of placing all of their confidence in one solution methodology. The depth of the problem and the specific issues associated with each will drive the corrective action.

Exhibit II-4

Preferred Approach to Resolving the Issue*Source: INPUT*

Despite all efforts to proactively solve the problem, the reality is that all agencies may not meet the deadline. Along with all the planning for correction must be the potential need for disaster recovery. Systems may crash. The reaction is a sound plan to bring them back to a functional state.



Conversion Status

In order to accurately measure the status of agency conversion efforts, it is first necessary to examine the scope of the project. In August 1997, an OMB report detailed agency progress and implementation plans for dealing with the year 2000 problem. Agencies were asked to submit an inventory of their current systems along with the way they plan to deal with those systems. Exhibit III-1 provides the total number of mission critical systems in place at each major federal agency. That total is then broken down into the number of systems that are already Y2000 compliant and those which will require further work.

Exhibit III-1

Number of Mission Critical Systems

Agency	Total Systems	Total Compliant	% Compliant	# being Replaced	# being Repaired	# being Retired	# Undecided
Agriculture	1,239	126	10%	37	932	144	0
Commerce	503	133	26%	118	158	3	91
Defense	3,695	652	18%	267	2,593	183	0
Education	24	10	42%	6	7	1	0
Energy	399	99	25%	170	122	8	0
HHS	434	115	26%	146	166	7	0
HUD	231	51	22%	45	108	27	0
Interior	89	19	21%	15	49	6	0
Justice	190	58	31%	11	118	3	0
Labor	60	9	15%	29	22	0	0
State	72	24	35%	36	12	0	0
Transportation	430	0	0%	19	408	3	0
Treasury	320	39	12%	42	239	0	0
VA	11	1	9%	0	10	0	0
USAID	64	20	31%	30	2	0	12
EPA	61	33	54%	7	21	0	0
FEMA	38	17	45%	3	17	1	0
GSA	58	29	50%	17	11	1	0
NASA	457	184	40%	46	225	2	0
NSF	16	0	0%	4	12	0	0
NRC	7	0	0%	3	4	0	0
OPM	124	17	14%	10	96	1	0
SBA	40	10	25%	30	0	0	0
SSA ¹	29,139	23,456	80%	975	21,884 ²	8	0
Total³	8,562	1,646	19%	1,091	5,332	390	103

¹ Reported as Tracking Modules (units of compiled/assembled code which perform a business function)

² Includes 17,184 modules where renovations are completed

Source: OMB

³ Excludes SSA

In total, the federal government is expected to replace 1,091 systems over the next two years while 5,332 systems are repaired. The Department of Defense leads in the number of systems in place, and they will require a great deal of support considering that only 18% of their systems are currently

Y2000 compliant. Other agencies, such as the Department of Transportation and the Treasury Department, expect to renovate a good number of their systems. Agencies that will require less correction effort include the National Aeronautics and Space Administration and the Environmental Protection Agency. GSA also has a large installed base of systems which are already Y2000 compliant.

19% of all federal systems which are considered mission critical are year 2000 compliant. This leaves 81% of systems in need of some form of support. Factoring out the systems to be retired still leaves an enormous sum of almost 6,500 systems which will require immediate attention. This degree of problematic systems led to the awareness that time is of the essence. In order to implement a workable compliance plan, OMB required that each agency submit its own implementation timeline.

Exhibit III-2 represents data obtained by OMB from each agency in regard to their implementation timeline. Agencies set milestone dates for completion of the final four phases of solving the Y2000 problem. The overall goals set by OMB have become the government standard. OMB mandated that in order to stay on track and successfully meet the Y2000 challenge, all agencies should have their assessments of the problem completed by June 1997. They would then have one and a half years, until December 1998, to renovate those systems which required them to do so. This would be followed by a one month validation period, ending in January 1999. Finally, all implementation should be complete by November 1999 in order to ensure successful conversion.

Many agencies have planned accordingly but others have not. The Department of Defense estimates that their assessment phase will not conclude until December 1997. They are, however, estimating on-time implementation with goals currently set at November 1999. Conversely, smaller departments with fewer mission critical systems, such as the Department of the Interior, actually set more optimistic goals than the Office of Management and Budget. Their assessment period ended in March 1997 and all focus is now on renovation. Many agencies are already falling behind plan and it is still relatively early in the process. The key will be to ensure successful implementation on time or to have a workable contingency plan in place as a precaution.

Exhibit III-2

Individual Agency Timelines

Agency	Assessment	Renovation	Validation	Implementation
Agriculture	6/97	9/98	9/99	10/99
Commerce	3/97	12/98	1/99	10/99
Defense	12/97	12/98	6/99	11/99
Education	6/97	9/98	9/98	3/99
Energy	1/97	9/98	2/99	7/99
HHS	6/97	12/98	1/99	11/99
HUD	6/97	12/98	1/99	11/99
Interior	3/97	12/98	1/99	11/99
Justice	6/97	7/98	10/98	1/99
Labor	6/97	12/98	1/99	11/99
State	6/97	9/98	10/98	8/99
Transportation	12/97	12/98	12/99	12/99
Treasury	7/97	12/98	12/98	11/99
VA	1/98	11/98	1/99	10/99 ¹
USAID	8/97	TBD	TBD	TBD
EPA	6/97	12/98	1/99	11/99
FEMA	6/97	12/98	1/99	11/99
GSA	6/97	12/98	1/99	10/99
NASA	3/97	6/99	7/99	12/99
NSF	6/97	12/98 ²	1/99 ²	11/99 ¹
NRC	9/97	3/99	4/99	11/99
OPM	6/97	12/98	11/99	12/99
SBA	9/96	12/98	12/98	12/98
SSA	5/96	9/98 ¹	12/98	1/99 ¹
Governmentwide Goal	6/97	12/98	1/99	11/99

¹ Date is earlier than reported in May 1997

Source: OMB

² Date is later than reported in May 1997

The Social Security Administration developed a detailed plan of how federal agencies should proceed with the assessment phase. Their steps include the following:

- Define the Problem
- Establish the Project Team
- Obtain High-Level Management Support
- Make a Business Case
- Decide Upon an Overall Approach
- Make Oral and Written Presentations
- Identify Technical and Management Representatives for Each Department
- Move Beyond the IT Community
- Define Terms
- Establish Compliance Standards for New Systems
- Start Preparation of Project Plan

Define the Problem

Defining the problem is a relatively simple concept; however, there are several key areas which must be examined during the definition. The first and most important is time. This is perhaps the most critical component of a Y2000 solution. Agencies must be comfortable with the fact that time is of the essence. This does not just mean that all systems must be converted before the date change. Some systems make projections and calculations based on future dates. Those systems must be accommodated in advance so that these calculations are not disrupted. This is a prime example of how the banking and insurance industries in the commercial marketplace were able to diagnose the potential Y2000 impact first. They rely on systems which make future calculations such as long-term loans. Many of these systems began to fail, alerting these institutions to take immediate action.

During problem definition, federal agencies must also take into account that commercial hardware and software are affected in the same way as federal systems. This must be factored into the solution plan. Any physical systems such as security systems and elevators must also be factored into the equation.

Establish the Project Team

Once the problem has been defined, the agency must focus resources to solving the issues. A full-time project team is a crucial element in successful solution implementation. The team must have general knowledge of the organization and a good technical base of knowledge; however, communication skills are one of the most important characteristics of the team. The team will be responsible for coordination of all impacted parties, including the highest levels of the organization.

Obtain High-Level Management Support

No progress can be made unless all plans are backed by senior management within each agency. Senior support will be essential in pushing through acquisition requests and shifting of resources to meet the needs of the project team. The most critical advocate of the Y2000 effort is the Chief Information Officer due to the nature of the position. This individual is responsible for the overall functioning of the agency's systems and their impact on the business process.

Make a Business Case

A business case is essential in obtaining the support of upper management. The Y2000 problem will be resource intensive for many agencies and in order to obtain necessary resources both in terms of personnel and financing, the project team must rank the importance of different aspects of the solution and must show relevance to the business process for the most important aspects. Upper management must have justification that their funding is being put to good use and is being applied to the overall business process.

Decide Upon an Overall Approach

SSA stresses the importance of developing and holding to a plan. The plan must be known across the organization. It is essential that each agency follow the guideline steps toward problem resolution in order to keep a sense of continuity across the government. The chosen approach must take into account the resources of that particular agency as well as the potential demand for additional resources.

Make Oral and Written Presentations

Presentations offer credibility to a proposed action plan. It is imperative that the project team keep all key players briefed as to the status of their efforts. This allows the key players a chance to ask questions and further develop project specifications. Also, additional communication avenues are necessary such as article publication in technical newsletters and corporate publications, as well as the maintenance of a web site for information

dissemination. The project team may also wish to create a Y2000 mailing list to keep interested individuals apprised of current actions.

Identify Technical and Management Representatives for Each Department

SSA believes that the identification of all critical technical and management personnel is essential to the Y2000 resolution process. This includes system managers, budgeting and resource personnel, legal representatives, senior management and contractors. The Y2000 problem requires a mass coordinated effort. Identification of these personnel reduces duplication of effort and assures that all key players know their role and responsibilities in the process.

Move Beyond the IT Community

Many areas of an agency's business will be affected by the year 2000 problem. Ancillary systems such as security, elevators, utilities, etc., may also experience problems due to the date change as will accounting and personnel systems. The project team and the designated upper management individuals will need to make the possible threat of a system crash known to all personnel who will be affected by those systems. This involves making the accounting personnel, for example, aware of potential system trouble as well as providing them with an introduction to the problem and the proposed solution plan. This enables the project team to have support from all functions within an agency due to the increased level of awareness.

Define Terms

Each agency must come up with a standard glossary of Y2000 terms to be used by all involved individuals.

Establish Compliance Standards for New Systems

The bottom line is that agencies have a standard date format to be used across the agency. This allows for the interaction of all necessary systems without hindrances due to format. One definition of compliance states that compliant systems are those that are capable of correct identification, manipulation and calculation of dates after the year 1999. The federal government's Y2K Interagency Committee has been dealing with the issue of compliance since January 1996. Their goal is to encourage standard formatting across the federal government. The National Institute of Science and Technology has provided a standard format for dates. The international standard includes a four digit year field (YYYY-MM-DD). Ultimately, stresses SSA, the format decisions lie with the system owners; however, these owners are receiving a great deal of encouragement for standardization.

Start Preparation of Project Plan

It is the responsibility of the project team to develop an overall management plan for solving the Y2000 problem. This is done regardless of changing cost and time estimates. Once in place, the plan is revised on a continuous basis. Although initially incomplete, the plan provides overall guidance to all affected and responsible parties.

All of the above steps provide the guidelines for system assessment. Assessment is perhaps the most time-intensive phase due to the excessive inventorying and planning that must be included.

Agencies were required by OMB to break down their number of non-compliant systems into the phases laid out by the General Accounting office, as discussed in Chapter II. The majority of systems have not yet moved out of the assessment phase. This means that, with only two years left, almost half (44%) of the systems are still being assessed. OMB's guidance states that all systems should be renovated by December 1999 and moved into the validation phase at that time. At this rate, assessment has only been completed on 56 % of systems and only 12% of systems have been completely renovated. 88% of the total systems in the federal government have one year to finish renovation in order to stay on a feasible schedule. The prospect of this happening is slim, once again reinforcing the need for sound contingency plans in the event of failure. Data for each agency is provided in Exhibit III-3.

Exhibit III-3

Status of Repair on Mission Critical Systems

Agency	# of Systems	Assessment % Complete	Renovation % Complete	Validation % Complete	Implementation % Complete
Agriculture	932	37%	8%	4%	4%
Commerce	158	80%	15%	6%	5%
Defense	2,593	43% ¹	14%	5%	0%
Education	7	30%	0%	0%	0%
Energy	122	80%	10%	10%	5%
HHS	166	100%	28%	10%	10%
HUD	108	100%	9%	2%	1%
Interior	49	100%	43%	0%	0%
Justice	118	100%	1%	1%	0%
Labor	22	100%	15%	11%	7%
State	12	100%	25%	0%	0%
Transportation	408	66%	0%	0%	0%
Treasury	239	77%	6%	5%	5%
VA	10	85%	51%	28%	13%
USAID	2	80%	0%	0%	0%
EPA	21	80%	33%	28%	28%
FEMA	17	88%	35%	35%	24%
GSA	11	100%	21%	14%	13%
NASA	225	96%	8%	7%	2%
NSF	12	100%	33%	25%	0%
NRC	4	100%	0%	0%	0%
OPM	96	100%	3%	0%	0%
SBA	0	100%	35%	35%	30%
SSA ²	21,884	100%	78%	67%	62%
Total³	5,332	56%	12%	5%	2%

¹ Of Defense's 3,695 total mission critical systems, 60% have completed assessment

² Reported as Tracking Modules (units of compiled/assembled code which perform a business function)

Source: OMB

³ Excludes SSA

The slow start in addressing the Y2000 problem led to the implementation of a grading system by Representative Stephen Horn (R-CA), Chairman of the House Subcommittee on Government Management, Information and Technology. The system measures the progress of major federal agencies on

the Y2000 problem. They are based on information provided to the House Subcommittee by agencies as well as investigative work performed by the Subcommittee on Government Management, Information and Technology as well as the General Accounting Office. On September 15, 1997, the second annual set of grades were released. Horn stated that "less than one fifth of these government agencies have acceptable grades for the year 2000 computer problem." He continued, "as you can see, only one agency received an 'A' and it's an 'A minus' at that. Three received 'B's' with one receiving a 'B minus'. The rest are in trouble. Almost half, eleven 'D's' and 'F's', are failing."

Grading on the whole was lower than the previous year due to the fact that many agencies have made very little progress over the last twelve months; meanwhile, they have been finding more problems which need to be fixed. Also, Horn stated that he feels the current government estimated cost of fixing the problem, \$3.8 billion, is too low.

In his concluding remarks, Congressman Horn reiterated that "January 1, 2000 is the one government deadline that cannot be allowed to slip. The Administration cannot issue an Executive Order postponing the millennium." The deadline for completion of the assessment phase was June 1998. Many agencies are still not finished making these assessments.

It is already anticipated that some systems will fail. However, no agency knows which will fail. Therefore, Congress urges upper agency management to be active about the problem. The grades given by Congressman Horn are represented in Exhibit III-4.

Exhibit III-4

Year 2000 Report Card

Agency	Assessment Completed?	Renovation Completed?	Testing Completed?	Implement-ation?	Grade
SSA	YES	78%	67%	YES	A-
GSA	YES	35%	26%	YES	B
NSF	YES	33%	25%	NO	B
SBA	YES	35%	35%	YES	B
HHS	YES	28%	10%	YES	B-
EPA	NO	33%	28%	YES	C
FEMA	NO	35%	35%	YES	C
HUD	YES	9%	2%	YES	C
Interior	YES	43%	0%	NO	C
Labor	YES	15%	11%	YES	C
State	YES	25%	0%	NO	C
VA	NO	51%	28%	YES	C
Defense	NO	40%	34%	YES	C-
Commerce	NO	15%	6%	YES	D
Energy	NO	10%	10%	YES	D
Justice	YES	1%	1%	NO	D
NRC	YES	0%	0%	NO	D
OPM	YES	3%	0%	NO	D
Agriculture	NO	8%	4%	YES	D-
NASA	NO	8%	7%	YES	D-
Treasury	NO	6%	5%	YES	D-
USAID	NO	N/A	N/A	N/A	F
Transportation	NO	0%	0%	NO	F
Education	NO	0%	0%	NO	F

Source: House Subcommittee on Government Management, Information and Technology

One of the most notable failures is the Department of Transportation. Of the 430 mission critical systems in place at DoT, none are year 2000 compliant. The Department estimated that 408 would be repaired and 19 would be replaced. Currently, DoT, which has one of the largest federal budgets for information technology, has not even completed the assessment phase. Many of DoT's systems perform critical functions such as air traffic management systems at FAA and rail transport scheduling systems at the Federal

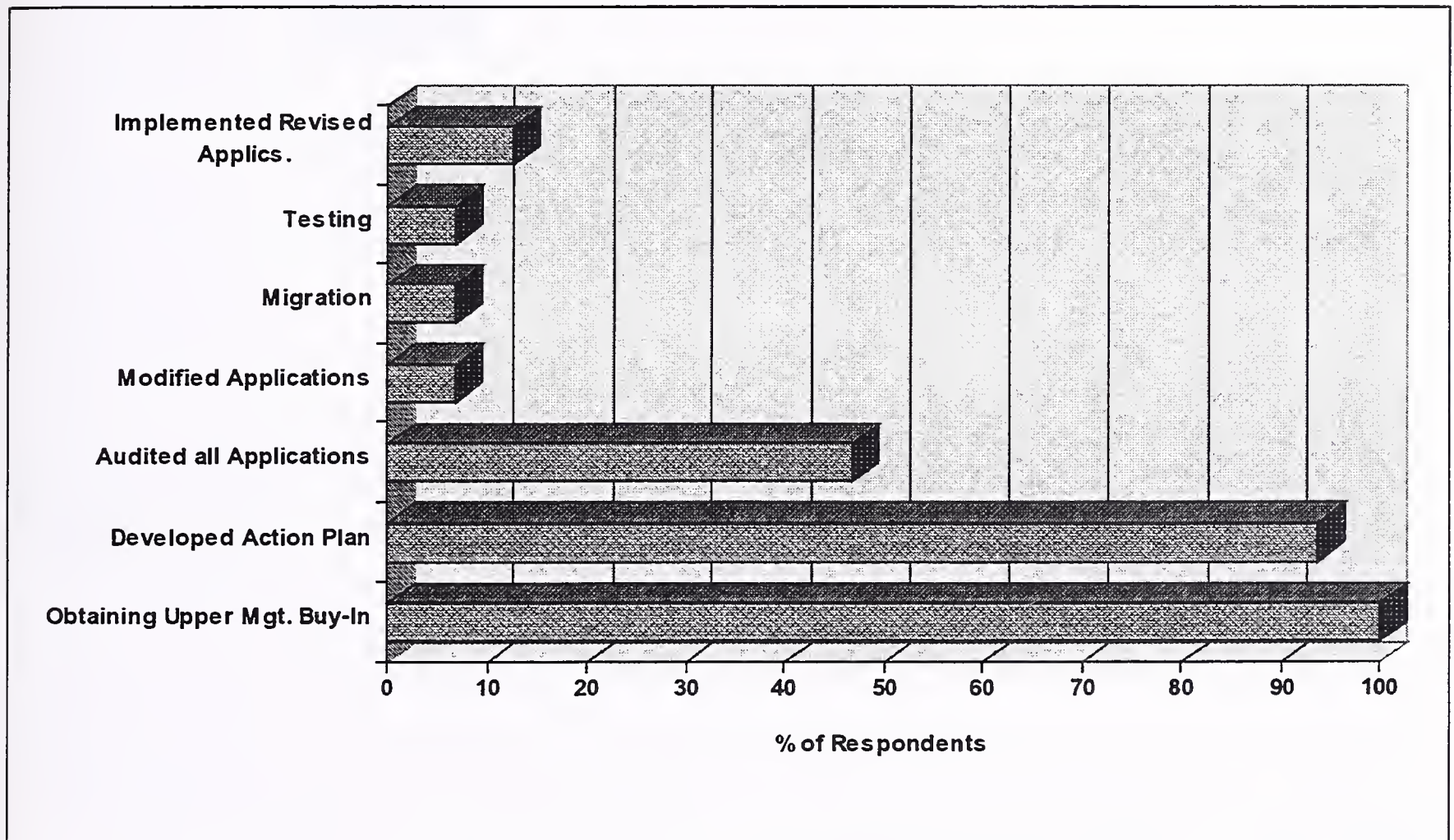
Railroad Administration - systems which could potentially have drastic impacts on thousands of travelers.

The Department of the Treasury also scored low on the House Subcommittee's assessment. Treasury, another key technology player, has 320 mission critical systems installed, 12% of which are already Y2000 compliant. Core business functions at Treasury also stand to fail unless major progress is made in ending the assessment phase and starting to actually perform the 239 system fixes that they plan.

As shown in Exhibit III-5, most agency officials feel that management has embraced the need for some sort of preventive action and have designated responsible parties for handling different facets of the action. This all goes into establishing awareness of the problem. With the regular stream of guidance on the issue and the media blitz, it is hard not to be aware of a potential disaster. The bottleneck occurs in the assessment phase, when agencies must inventory their systems and put detailed plans in place for accomplishing milestones in a timely manner. Again, time is the most essential element in the Y2000 equation.

As evident below, most agencies have not implemented any modifications on the existing equipment. This is classified as the renovation phase and, according to OBM, it is where all agencies should be focused to date. This has not been the case. Only a small percentage (6.3%) of agencies claim to have made any Y2000 modifications.

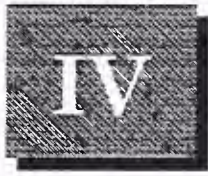
Exhibit III-5

Status of Preparation*Source: INPUT*

Overall, agencies know what needs to be done. The majority of agencies have detailed plans in place. The only challenge will be to act quickly enough to hold to time schedules. This is one deadline that must be met, or the cost will be extreme.

Contingency plans will help to address some of the crashes that can and will occur. It is inevitable that systems will crash. The true test will be the way in which the government chooses to react.

(Blank)



Approaches to Problem Resolution

A

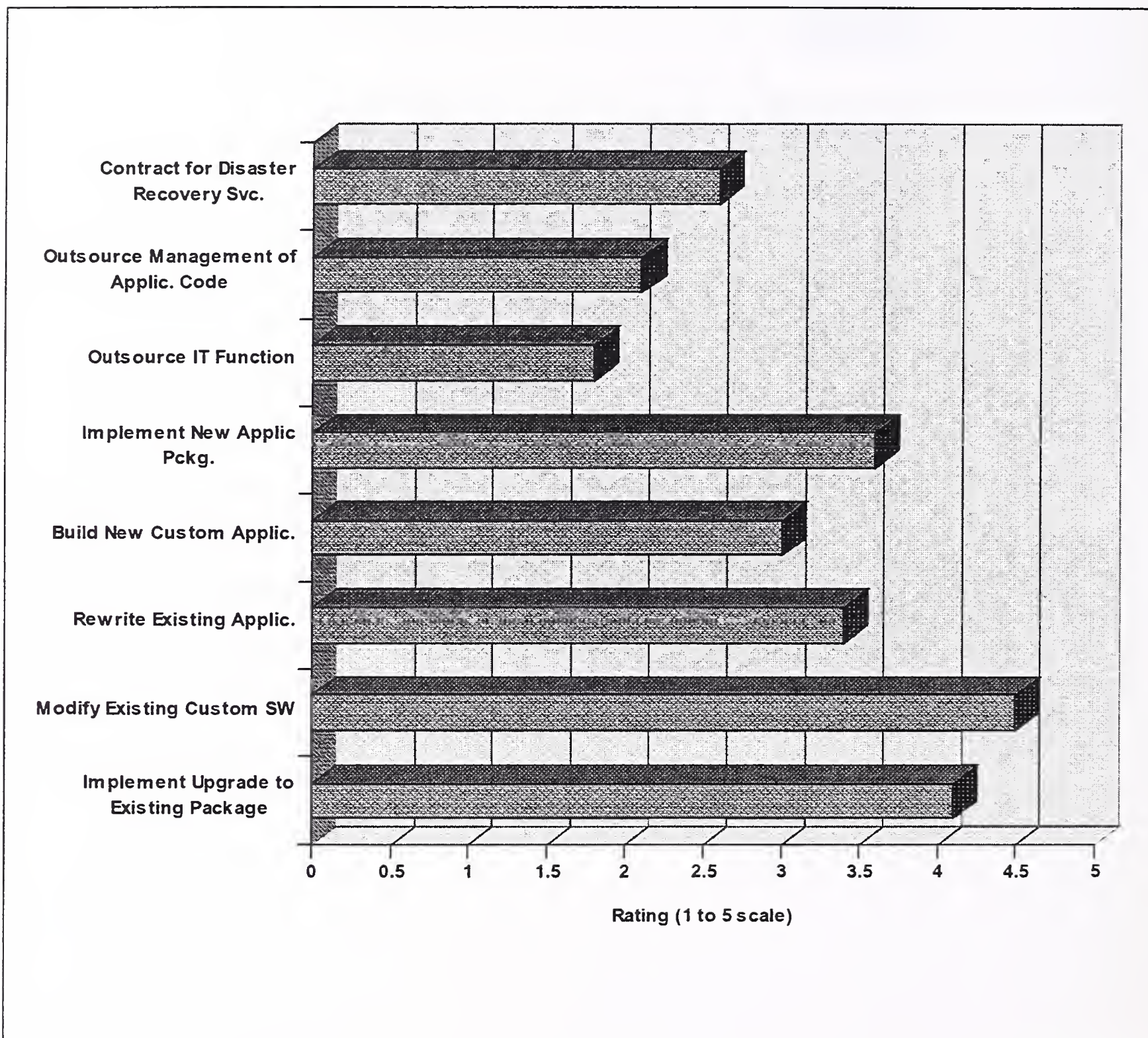
Approaches

Now that the federal community has realized the potential impact of the year 2000 date change, they have been putting plans in place to solve the issue before it becomes reality. Most agencies have inventoried their systems and have measured the scope of the project; however, some agencies have yet to complete this process. The next logical question becomes, "how do agencies solve the problem?" Problem resolution is one of the largest issues facing federal agencies today. In any case, the choices each agency makes must be time-sensitive and immediately implementable.

Exhibit IV-1 shows the possible approaches to solving the problem and their importance to the federal government.

Exhibit IV-1

Preferred Approach to Resolving the Issue



Source: INPUT

Not surprisingly, the majority of users view modification of existing software and implementation of upgrades to existing packages as the most important and feasible approaches. Disaster recovery tends to be a broad category and is often viewed by respondents as a negative, reactive approach. If recovery is necessary, a disaster must have already occurred. The majority of agencies felt that outsourcing the entire IT function was not the best route to take. Agencies tend to be more specific in their requirements than the private sector. There are more specifically tailored legacy systems in the federal government that would take huge amounts of time to port over to an outside

vendor to manage. The government would much rather maintain some level of control over their own systems.

All of the responses fell in close range with each other. This shows that no one method stands out as the end-all solution for federal agencies. The feasibility of a particular approach is directly related to the core business functions performed in a particular agency. Different requirements call for different solutions and each solution must be examined in the context of the agency.

B

Code Decisions

Once agencies have inventoried their systems and have counted code, they must make decisions about how the code correction must be approached. SSA, in its blueprint for performing a correct assessment, presents the following alternatives to federal agencies:

- Code Modification
- Code Reengineering
- Replacement
- Retirement

Code modification involves making all necessary changes to the system to handle the date change without making any modifications to the structure of the code. As few changes as possible are made in order to ensure that coding and testing time is kept low. Critics argue that this will turn the Y2000 project into an oversized maintenance effort due to the fact that the code is not enhanced in any way. The level of modification will be different between dissimilar applications. According to the Department of the Army's guidance on the validation phase, modification can take one of the following forms:

- Expansion
- Sliding Scale (Windowing)
- Relative Dates
- Encapsulation
- Bridges/Filters

Expansion

The most simple form of modification is expansion which basically involves expanding the year field in lines of code to four characters rather than two. Date calculations can then be made across centuries without fear of error. This method requires very limited amounts of procedural change and the fix tends to be more permanent. However, fine tuning may be necessary. Screen and print reports may need to be reworked to accommodate a longer year field. Also, this method will require additional storage capabilities.

Sliding Scale (Windowing)

The sliding scale method takes a different approach. With this procedure, no data conversion is required. Using algorithms, the systems are taught to interpret the century based on the last two digits of the date. For example, if the last two year digits fall between 50 and 99, the system assumes that the century is 19, however, if the year digits fall in the range of 00 to 49, the system interprets this as the 21st century. The century split may be set at any pre-determined point. This method also takes minimal time to implement; however it is more procedural in nature.

Relative Dates

By using relative dates, a pre-determined start point is set at a time in the past and dates become a count of days from that start point. For example, if a start point of December 1, 1997 was set, December 5 would be represented as 4 - or the number of counted days from the start point. Associated logic utilities would then convert the count into a meaningful date for purposes of output and reporting. The drawback is that this method requires data conversion and the building of common date utilities. Relative dating is, however, a plus in terms of requiring minimal software modifications, little to no procedural changes, and no additional storage capacity.

Encapsulation

Encapsulation is the process by which all dates are rolled back by 28 years to account for the day of the week. In other words, January 1, 1998 is a Thursday as was January 1, 1970. Logic is then employed to present the correct date on reports and output screens. This means that system dates will only be xx/xx/72 in the year 2000 and the Y2000 problem is skirted for another 28 years. The approach requires minimal testing and time than others.

Bridges/Filters

Bridges and filters are employed to ensure that applications that are Y2000 compliant and those that are not will coexist in the overall environment.

Under the assumption that all applications and systems will not be reconfigured all at once, different systems will still need to interact regardless of conversion status. A bridge or filter usually takes the form of a table which each system uses to check status. If a system has not yet experienced any conversion and it needs to interact with one that has, the bridge is invoked which interprets the dates and resolves them across both platforms.

The greatest risks, and conversely the greatest rewards, stem from code reengineering. Instead of just making modifications to the existing code, the agency redevelops the system by employing new technology, such as client-server applications. Money spent on such an effort goes into the proactive endeavor of building a new, state of the art system rather than wasting those resources by pouring them into keeping an antiquated system running. This also has its share of risk. Replacing an entire system takes time - a resource which agencies do not currently possess. Time is of the essence which may lead many agencies to make the basic necessary code changes in order to keep the current systems functional.

Replacement involves the purchase of COTS software and installing it in replacement of the existing system. This approach may hold more credence in the commercial sector. The federal government tends to be more dependent on legacy systems installed for a specific purpose to perform directed tasks. Many COTS products will not support the core business functions of a number of government agencies.

INPUT synthesizes the problem into two different approaches: date field expansion and date field interpretation. These are defined as follows:

- Date field expansion - expanding the existing two-digit year fields to accommodate four-digit year fields.
- Date field interpretation - incorporate work-around logic into programs to convert two-digit year date fields into four-digit year date fields.

There are six general conversion strategies that incorporate these two approaches:

- Date Field Expansion Strategy
- Smart Century Digit Date Field Strategy
- Century Window Strategy
- Datastore Duplexing Strategy
- Standard Date Routine Strategy

- Bridging Strategy

Date Field Expansion Strategy

The date field expansion strategy involves expanding an existing date field that does not contain a century indicator (e.g., *mmdyy*) to one that supports multi-century date values (e.g., *mmdccyy*). From a programming perspective, expanding the date fields is the most straightforward approach as well as the easiest to test. However, it is also the hardest to implement. This is due to the fact that all application components related to a specific date field must be modified at the same time the file is expanded to accommodate the expanded definition.

The massive synchronization of changes to the programs and files required to implement the date field expansion strategy is extremely difficult. It introduces project management problems such as requiring all source code to be frozen for long periods of time to prevent any further maintenance activities until these changes are complete. It also introduces difficulties associated with managing parallel development functions.

Smart Century Digit Date Field Strategy

The smart century digit approach, also known as "date value encoding," uses an encoding scheme to represent the century value, usually as a one byte indicator. Although any unique character can be assigned to represent a specific century value, the most common scheme is shown below:

Code	Century	Value
0	19th century	18
1	20th century	19
2	21st century	20

Source: INPUT

Organizations should select the code value that ensures proper sort sequencing (i.e., 1 is less than 2). This date field conversion technique is most appropriate when the existing date format has an unused byte that can be used to indicate the century code (e.g., 1="1900", 2="2000"). This situation occurs when a six-digit date field is stored in packed storage format. The smart century digit approach requires that the physical data and all logic based components that access the date fields be converted in a single effort (e.g., this approach requires both data and program changes).

The introduction of processing logic to interpret the century codes adds to the program maintenance burden. If subsequently the date fields in the file are expanded, then all of this processing logic must be removed and the program retested. This strategy is best implemented as a temporary or short-term solution due to the increased overhead in processing and date access.

Century Window Strategy

The century window strategy establishes a base “bridge” between the two centuries. Date years that are greater than or equal to the base year are considered to be within the current century. Date years that are less than the base year are considered to be in the next century. For example, if the base year is 1930, then a two-digit date year value of 31 would be interpreted as the year ‘1931’ while a two-digit date year of 29 would be considered to represent ‘2029’.

A two-digit value of 30 would be interpreted as the year ‘1930’ given that the rule is “greater than or equal to” the base year. In other words, the strategy involves nothing more than a floating century window which allows years from two consecutive centuries to be represented by their last two digits and be protected against replication. Note, the interpretation rules must be consistent in all programs for a specific date field within the organization, as well as externally if the data is shared with other organizations.

Typically, an organization can use the century windowing technique to avoid or postpone physical field expansion by supporting multi-century date processing past December 31, 1999. Organizations whose applications use date fields that contain year values spanning more than one hundred years cannot use the century window technique. For example, birth dates and insurance policy start/end dates may span three centuries.

Datastore Duplexing Strategy

The datastore duplexing strategy involves the creation of a “duplicate” file/database so that one datastore contains unexpanded records (two-digit year date fields) and the second contains expanded records (four-digit year date fields). This technique uses an external process to copy an existing file and creates a year 2000 compliant format of the same data. Both year 2000 compliant and non-compliant programs can then process the data without any code modifications. The duplicated datastore can be deleted following the completion of the last processing job provided that it is recreated in each processing cycle.

Datastore duplexing is most applicable to batch processing - this technique is not easily deployed for files/databases that are maintained by on-line transaction processing. Depending on the type, size, and usage of the data store, this option may provide a more controlled conversion. The data duplication (date expand/contract) utility step can be migrated down the batch processing stream as each subsequent program is converted to read the new expanded date file. Typically this is a temporary solution and is usually coupled with field expansion and century window strategies. Very large files/databases are not good candidates for data duplexing as their duplication may require too much disk and CPU resource. The creation of

large duplicate files may also adversely impact batch processing timeframes/windows.

Standard Date Routine Strategy

In conjunction with the other year 2000 conversion strategies, one or more standard date routines may be used as well. The standard (common) date routines can be developed in-house or commercially purchased. If an existing in-house date routine is not year 2000 compliant, the conversion effort involves the modification or replacement of the current program logic (i.e., call logic) to call a new date routine at the appropriate points within the program logic flow. The degree of code change depends on the structure of the program logic and date routine call parameters.

Bridging Strategy

The bridging strategy is a combination of date field expansion and century window techniques that enables date field definitions within programs to be expanded without requiring the simultaneous expansion of their related files/databases.

This strategy involves the same modifications of the program logic to accommodate expanded year 2000 compliant date fields as in the date field expansion strategy. Additionally however, interpretive logic is incorporated within the program to check whether or not the program requires the bridging technique. The bridging routine determines if input or output records contain compliant (four-digit year) or non-compliant (two-digit year) date fields immediately after a datastore read or before a datastore write. The "I/O bridge" logic then expands or contracts the date fields appropriately based on the current status of each specific datastore being accessed.

The key advantages of this dynamic bridging strategy is that individual programs can be upgraded to support expanded date fields, validated, and then put back into the production environment "ready" for the future conversion of the physical datastores.

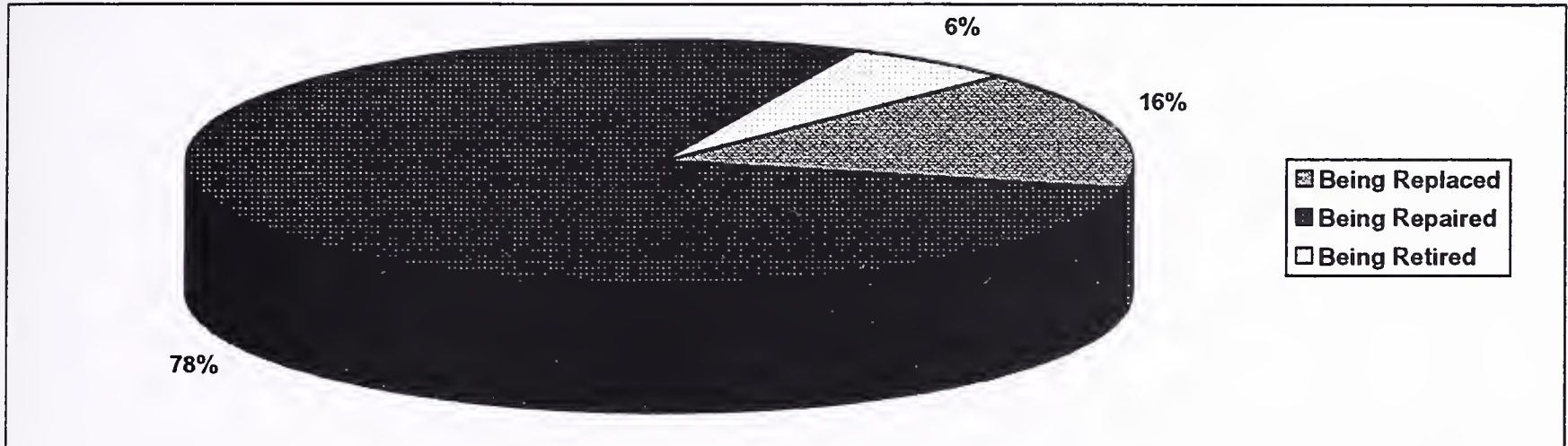
This approach is best suited for critical on-line transaction processing environments as it enables large numbers of programs to be upgraded over a period of time in preparation for the conversion of the master file/database over a weekend window.

Finally, once agencies have performed system inventory and mapped that inventory to the business function each system supports, it may be determined that a particular system is no longer needed. These types of systems can be retired and the resources can be shifted to fulfill other needs. Current estimates show that 5.6% of all mission critical government systems will be retired.

Planned approaches for government systems are illustrated in Exhibit IV-2.

Exhibit IV-2

Planned Y2000 Approach for Mission Critical Systems



Source: OMB

The majority of systems in the federal government will be repaired. In order to do this, agencies must know the market and must be prepared to utilize the tools available to them.

C

Tools

Solutions require tools. Regardless of how agencies choose to approach the year 2000 problem, they will still need to have a plan in place which utilizes tools to resolve particular issues. The Department of the Army's Software Technology Support Center has compiled a list of tools related to the Y2000 date change. They classify these tools into the following categories:

- Software Slicing Tools
- Data Name Rationalization Tools
- Other Year 2000 Related Tools

Software slicing tools are designed to allow the overall system code to be broken down into modules which are affected by particular data fields or common functionality. The tools assist in examining both the structure and flow of a program and helping to visualize the core components of the application. Overall, slicing enables agencies to compartmentalize business functions so they can be worked on individually in order of critical need.

Data name rationalization tools categorize certain data fields by their location, use and description. They are designed to find and group similarities in the data in order to make changes quickly. Data which is

grouped by a particular data field, such as date, can be corrected much faster than data fields which are arbitrarily buried in millions of lines of code.

Other year 2000 related tools include anything that does not fall into one of the other two categories. These types of tools may include solutions to assist with scheduling, inventory or testing.

Computer Sciences Corporation used a different category breakdown for toolsets. They classify tools into four categories:

- Impact Analysis Tools
- Code Renovation Tools
- Application Reengineering Tools
- Testing Tools

Impact analysis tools find date-related fields across lines of code. They also maintain the capability to support common languages across environments and to integrate well with overall code renovation.

Code renovation tools group lines of code which bear relationships to each other and then allows for global changes of the grouped code.

When selecting a particular tool, factors such as speed, cost, ease of use, flexibility and accuracy must all be considered. Also, a tool must include a degree of support and maintenance capability.

No matter how they are classified, there are two major types of tools: those that change the system date for an overall batch job and those that locate the date fields and possibly group and make changes to them. The first approach is used on non-standard systems such as Department of Defense weapon systems which are specifically designed for a particular function and are the only system of the kind in existence. These systems require individual attention that the first type of tools can provide. The second type of tools are used more in situations where the date fields are standard in a number of systems, such as "yy" or "year." Regardless of which tool is used, there is still no guarantee that the problem will be resolved. In its documentation of what constitutes the "assessment phase," the Social Security Administration reiterates the point that there is no "silver bullet" set of tools capable of solving all of the problems in a particular agency. Some agencies may need to implement numerous tools on various systems in order to account for the date change.

The Social Security Administration includes the analysis of different toolsets as one of the necessary steps in the assessment phase. Agencies are encouraged to learn the market and to get an idea of the tools it will take to

resolve particular issues. Specific tools agencies are planning to use will be discussed further in Chapters 7 and 8.

D

In-House vs. Outsourced

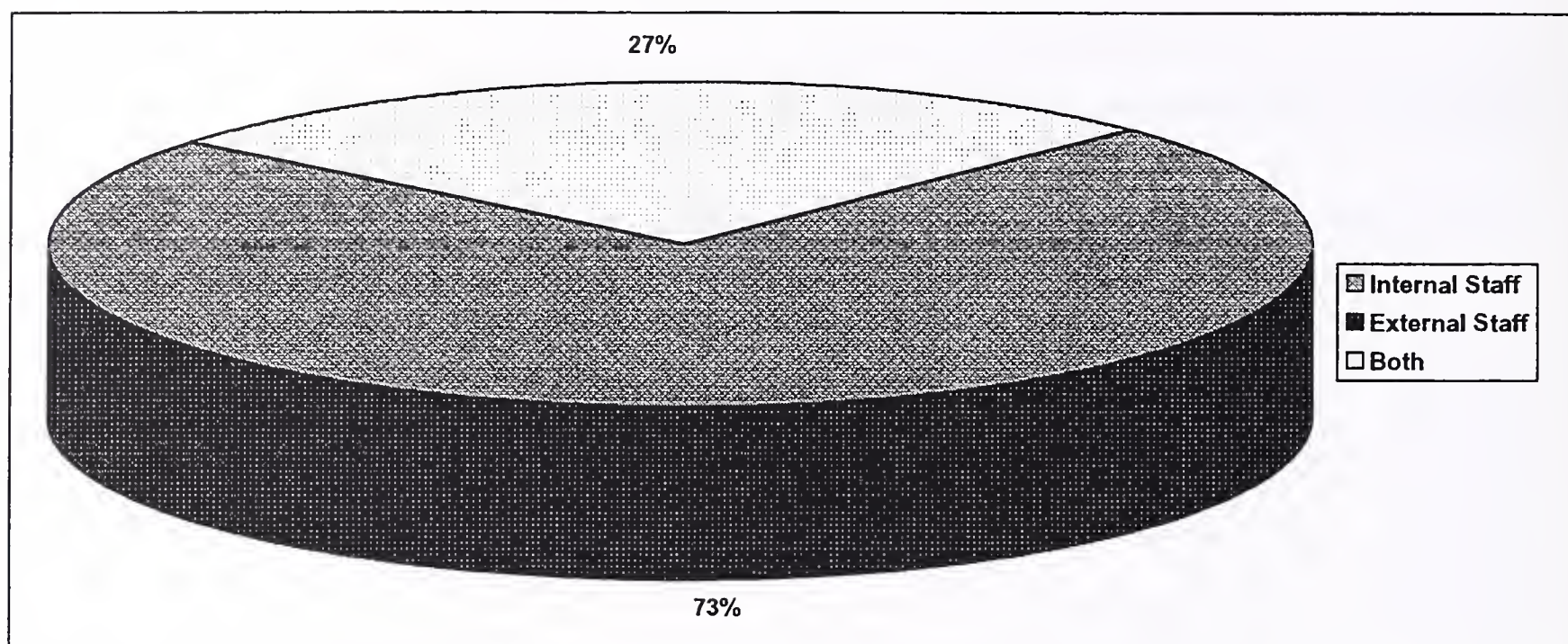
Once an agency knows exactly what needs to be done and has researched the tools which are capable of assisting with the fix, another question arises, "will the agency do the work internally or will they need help from the outside?" To answer this question, the Y2000 conversion process was broken into its core segments:

- Project Management
- Transition Methodology - developing a plan
- Inventory
- Assessment
- Planning
- Migration (rehosting, rewriting, replacing)
- Testing
- Implementation

The majority of project management will be performed internally. 73% of federal agencies feel that their own staffs can handle the direction of the Y2000 conversion efforts. Many agencies have recognized the problem and have dedicated staff members to its correction. The route agencies plan to take in terms of project management are represented in Exhibit IV-3.

Exhibit IV-3

Project Management Providers

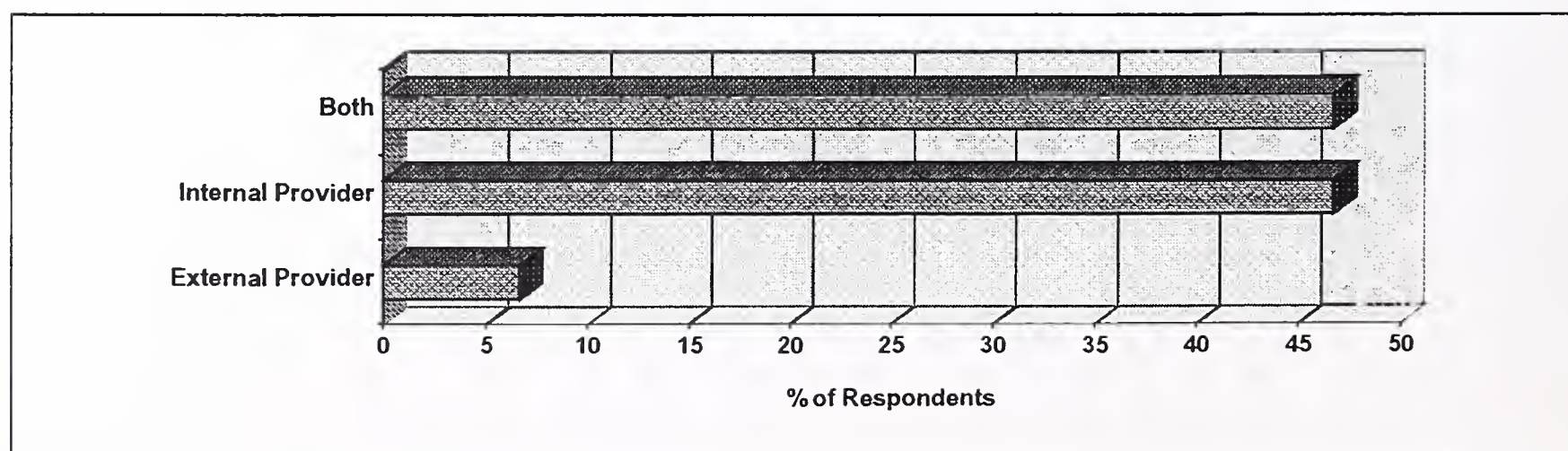


Source: INPUT

Transition methodology entails developing a workable action plan in response to the Y2000 problem. Many agencies have already conducted their assessments and have placed schedules in place. Not surprisingly, most agencies are either doing this completely internally or jointly with outside parties. Very few agencies (7%) are actually outsourcing their plan development. A notable agency which did choose to outsource planning is the Federal Emergency Management Agency (FEMA) which has a limited number of resources for these types of projects. The routes agencies plan to take in terms of transition methodology are represented in Exhibit IV-4.

Exhibit IV-4

Transition Methodology



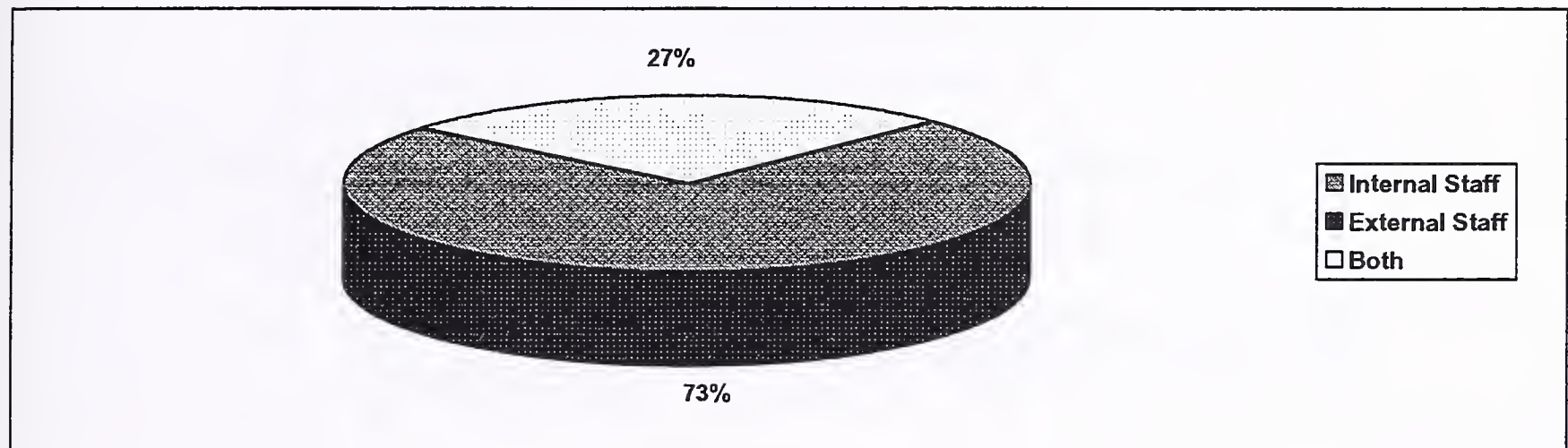
Source: INPUT

In terms of taking inventory of the current systems and the lines of code equated with each, most agencies have shown a preference for in-house

personnel to conduct the actual inventory. Again, many agencies have completed this phase. The preferred inventory providers are represented in Exhibit IV-5.

Exhibit IV-5

Inventory Providers

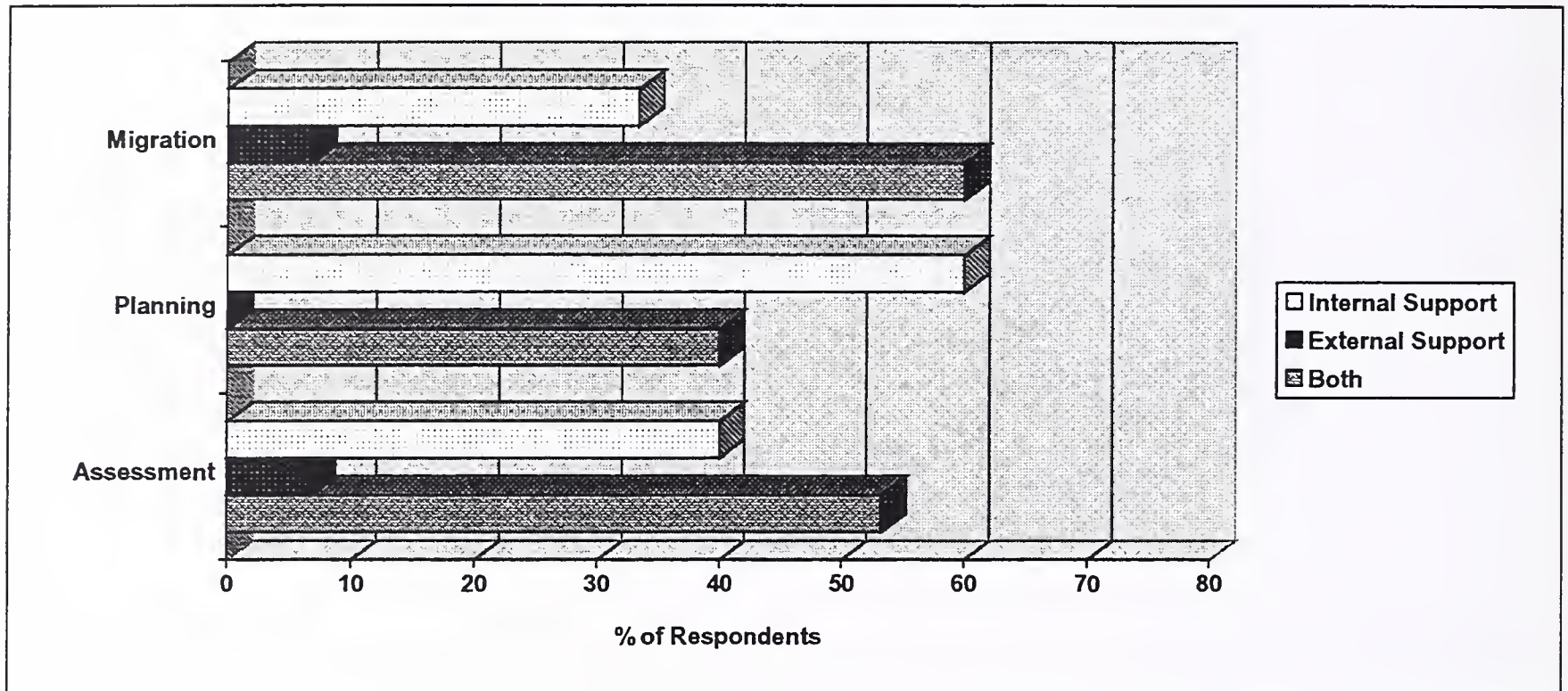


Source: INPUT

Assessment is the evaluation of the inventory to determine which systems are compliant and which will need to be addressed. The majority of agencies are using both internal and external resources for their assessments. Exhibit IV-6 illustrates that the majority (53.3%) of agencies are using the support of both external and internal staffs. In terms of actually planning out the problem resolution, 60% of agencies are using in-house resources.

The next step in the process begins the validation phase - migration of current systems to meet Y2000 compliance. This includes rewriting code, rehosting new software or code on the system platform or replacing the overall system. This is the phase where outside vendors should have the most opportunity; however, less than 7% of federal agencies plan to outsource this entire function to external solution providers. The majority (67%) feel that it will be a combination of both internal and external support.

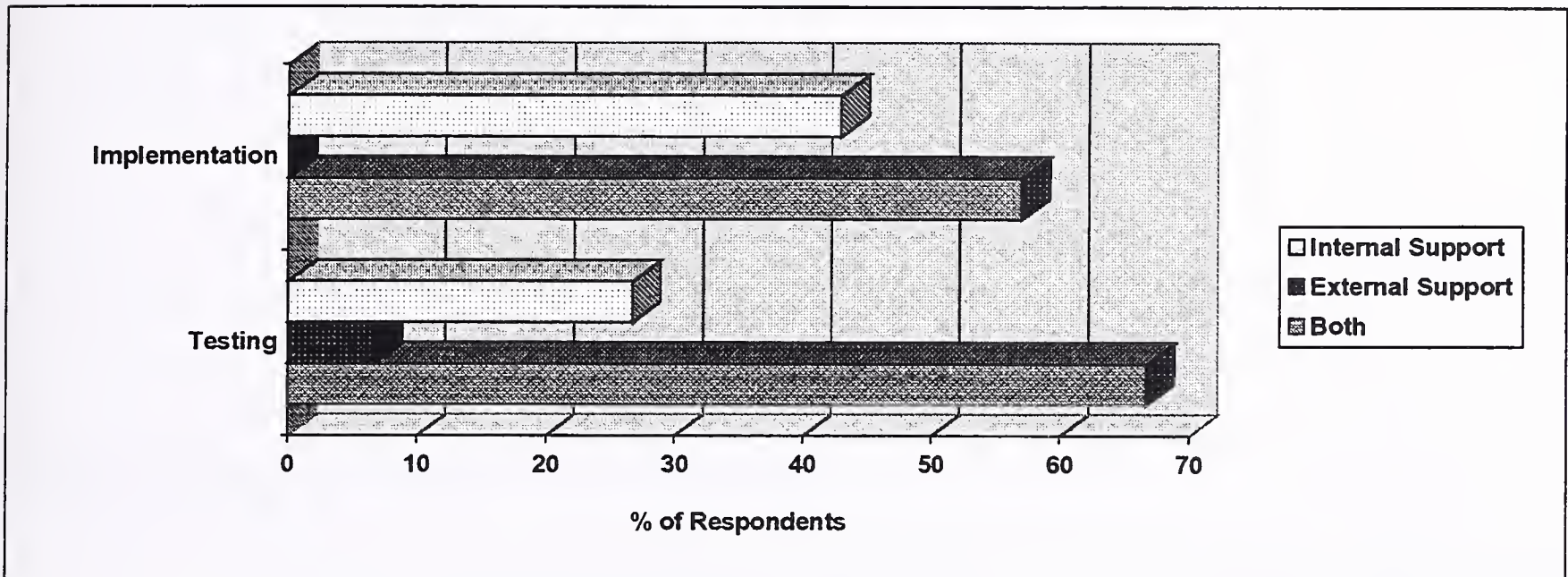
Exhibit IV-6

Proposed Source of Support for Various Functions I

Source: INPUT

The final two functions represent the last two phases of the year 2000 conversion process - testing and implementation. Testing is synonymous with validation - or the process by which renovated and replaced systems are checked for accuracy and compliance. Once tested, systems are implemented and made functional. Most federal agencies feel that the testing phase will be rather timely, as discussed in the previous chapter. On the whole, agencies feel that both external and internal support will be required for these functions. Again, few agencies feel that these entire functions should be outsourced. As shown in Exhibit IV-7, almost 67% of agencies will rely on in-house and outside support for testing and 57% will use both sources of support for implementation.

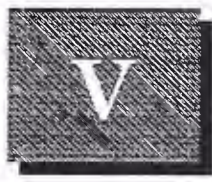
Exhibit IV-7

Proposed Source of Support for Various Functions II*Source: INPUT*

Despite the overall trend of agencies planning to use mainly internal support, there will be a good degree of outsourcing to solve the Y2000 problem.

Vendors in the marketplace have plenty of opportunity to get involved with a solution. Agencies will require specific tools to accomplish certain tasks. The wide variety and numerous amount of systems in place in the government will warrant a vast array of specifically tailored solutions.

(Blank)



Vendor Analysis

A

Critical Skill Sets Required by Agencies

Once an agency performs an assessment of the extent of the Y2000 problem within the agency, requirements must be defined in terms of how the problem will be solved. Overwhelmingly, agencies see project management expertise as the most important and critical skill in the Y2000 solution process. This line of thinking once again supports the fact that time is the most critical issue. Successful project management will cut down on the amount of time it takes a particular agency to renovate, test and implement a system. In a scale of 1 to 5, agencies rated project management at a 4.2 average, as shown in Exhibit V-1.

Exhibit V-1

Critical Skill Requirements and Their Importance

Skill	Average Importance
Project Management Expertise	4.6
Y2000 Audit Experience	3.6
Implementation of Packaged Software	3.6
Previous Experience with Y2000 Changes	3.9
COBOL Program Development	3.75
C Language Development	3.1

Source: INPUT

Agencies also see Y2000 past performance as a major factor in the development of a solution. On the vendor side, past performance has become a major trend in government in the wake of procurement reforms. Agencies, while looking to receive the overall best value from a vendor rather than just a good price, are beginning to place a measurement on a vendor's performance history both in working with their agency as well as others. This is an evolution of the government's need for assurance that the vendor

will not fail to honor obligations. Past performance becomes even more of an issue when it comes to solving the year 2000 problem. As the new millennium draws ever closer, agencies must select a vendor that has a proven track record of holding to schedule. Failure of a contractor to do so will result in extreme consequences for the agency and even legal liability for vendors. Past performance and previous year 2000 experience was rated an average of 3.9 out of 5. In a previous study, agencies responded to the question of overall past performance importance with a mean rating in the range of 4 to 5. Past performance of key personnel within the contractor's organization was rated a 4 average.

Past performance and past Y2000 experience is not limited to vendors, however. Many agencies have internal staff capable of implementing a solution. Their expertise and experience must be assessed. On the same note, other agencies who are marketing their Y2000 solution capabilities must be critiqued in terms of prior history and performance.

Exhibit V-2 represents a breakout of overall past performance and the mean of their importance to federal agencies.

Exhibit V-2

Federal Government Vendor Past Performance Criteria & Importance Ratings

CRITERIA	RATING:
Overall Past Performance	4-5
Quality of Product or Service	4-5
Timeliness of Performance	4
Cost Control	4
Business Practices	3-4
Customer (end user) Satisfaction	4
Key Personnel Past Performance	4
Overall Satisfaction	4

1=not important; 5=very important

Source: INPUT

There was variation across agencies regarding importance levels shown in Exhibit V-2. Some agencies reported high importance across all criteria measured. Other agencies showed a clear preference for importance of some of the criteria but not for others. Other agencies reflected a different level of importance for the criteria depending on the type of official interviewed.

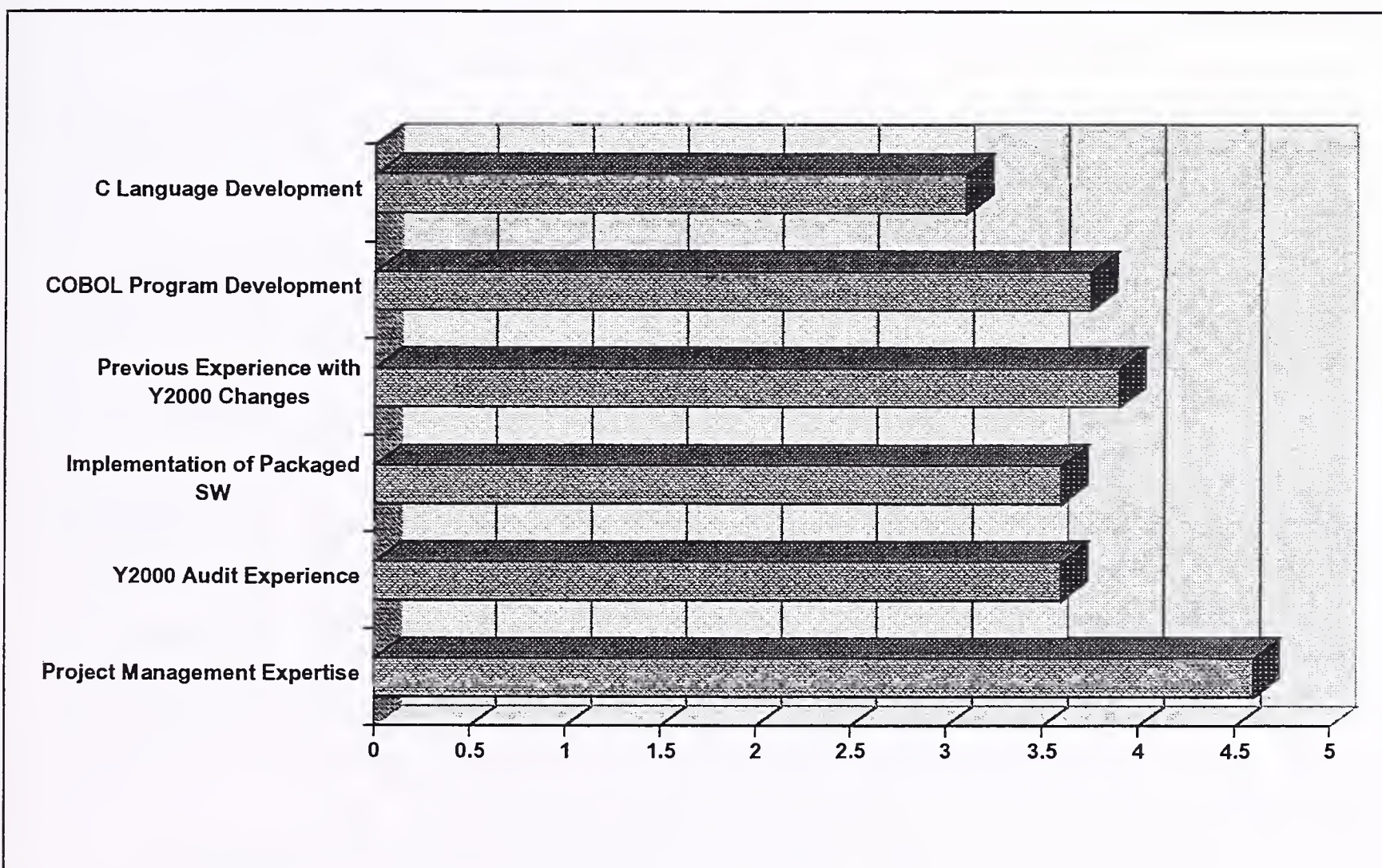
In order to gain a share of some of the Y2000 solution market, contractors must be fully responsible for the quality of their products and services

regardless of the past performance criteria used. This includes warranty and maintenance. They also need to take steps to resolve problems not only in terms of the specifics of the case, but also in terms of improvement actions that will ensure the problems will not reoccur in other situations.

Agencies rated C language development rather low as compared to other skill requirements they use for strategic Y2000 decisions. Ratings for the major criteria are graphically represented in Exhibit V-3.

Exhibit V-3

Critical Skill Requirements



Source: INPUT

Some skills were added by certain agencies on a case-by-case basis. The Environmental Protection Agency gave a rating of 4 to natural languages. The Departments of the Army and Agriculture mentioned the importance of FORTRAN and Army and the Department of Defense cited Ada as another key language for which they will need vendor skill.

EPA and the Office of Personnel Management also consider testing and validation as key vendor selection criteria. Both of these processes are critical in timely correction of the Y2000 problem.

B

Deciding to Outsource

The need to outsource is driven by many factors; however, the most considered factor is time. The agency must be capable of not only implementing a cost-effective solution but also must perform the work under extreme time constraints. The level of outsourcing, however, differs for year 2000 solutions.

Outsourcing levels are expected to climb overall in the federal government. The following factors contribute to the overall level of interest in outsourcing for non-Y2000 products and services. The year 2000 problem poses other factors which take the focus away from large outsourcing projects.

- With the current emphasis on cost control in the government, the need to expend greater amounts of money at first to save money and time later may be a difficult argument to make
- While total agency IT outsourcing remains an unlikely proposition, network management and desktop services are expected to join facilities management as outsourcing candidates over the next several years
- Outsourcing requirements are occasionally embedded in contracts primarily for other services
- One data processing function that is undergoing transition to outsourcing of business operations is setting up customer call centers
- High security concerns are issues that might prevent outsourcing
- The integration of data across the enterprise is considered critical to the mission of an agency. The need for outsourcing this function would have to be compelling before the agency would consider it
- Outsourcing of desktop services is in very early exploratory stages
- Managing data across an enterprise is considered critical to the mission of the agency and prevents serious consideration of outsourcing

The year 2000 problem includes other extraneous factors which makes conventional outsourcing less attractive to agencies. Many agencies will satisfy Y2000 needs through what is commonly known as professional services, explained further in Chapter VI. Basically, some functions will be "outsourced;" however, the government will retain overall control and authority and they will oversee all contractor actions. Nearly all government agencies were against entirely outsourcing the solution to a contractor. Also, outsourcing an entire function is often done to save money rather than time.

The Y2000 problem is critically based on time. Government project management and oversight will assist the contractor in holding to the sensitive schedule.

Agencies rated their levels of "outsourcing" and what they expect those levels to reach by the year 2000. Exhibit V-4 shows the range of ratings for different categories of outsourcing at the Department of Defense.

Exhibit V-4

Range of Ratings for Different Categories of Outsourcing at DOD

CATEGORY	TODAY	FY2000
Total Agency IT Outsourcing	1-3	4
Network Management	1-4	4
Desktop Services	2	5
Platform Operations	1-4	3-5
Application Operations	1-3	2-4
Application Management	1-3	2-4
Business Operations (telephone support, help desk, etc.)	2-4	4-5

1=not important; 5=very important

Source: INPUT

Virtually all technical functions become candidates for outsourcing by the year 2000, although application-based responsibilities received lower ratings.

Civilian agencies also reported variability in their interest in outsourcing. In almost every category of outsourcing investigated, interest ranged from highest to lowest and remained at the same wide range through the year 2000. Exhibit V-5 shows the mean rating for each of the categories across all civilian agencies.

Exhibit V-5

Mean Ratings of Different Categories of Outsourcing at Civilian Agencies

CATEGORY	TODAY	FY 2000
Total Agency IT Outsourcing	2	3
Network Management	3	3-4
Desktop Services	3	4
Platform Operations	2-3	3
Application Operations	2	3
Applications Management	2	3
Business Operations (telephone support, help desk, etc.)	2-3	3-4

1=not important; 5=very important

Source: INPUT

C

External Service Provider Skill Requirements

Once agencies have defined their overall requirements, they can begin to assess all of the options available to them with regard to Y2000 solutions. One path is to outsource the job to vendors and this requires an assessment of the skills that will be most sought in the contractor community.

In assessing vendors, there are certain key criteria that are essential for agencies in the process of solving their Y2000 issues:

- Project Management
- Strategy Consulting
- Application Design and Development
- Test Planning and Design
- Network Planning and Design
- Data Migration/Database Design
- Testing
- Implementation

Project Management

- Provides overall direction of the effort
- Keeps tasks on schedule
- Ensures timely completion of work
- Facilitates the contractor-agency relationship

Due to the time-sensitive nature of the Y2000 problem, project management is a major issue in the agency evaluation of vendors. 60% of respondents stated that a capable vendor would need to possess strong project management skills, as shown in Exhibit V-6.

Strategy Consulting

- Involves strategic planning on both the agency's and the contractor's part
- Vendor plays a key role in deciding how solution meshes with agency's long-term goals

An overwhelming 79% of agencies feel that the vendor performing Y2000 conversion work will need sound strategy consulting skills.

Application Design and Development

- Less of an evaluation criteria than others
- Many agencies would like design process retained internally
- Vendor is more of a "do-er" than planner

38% of agencies felt that they would not seek application design and development skills in vendors. However, there still was a favorable response from the majority of agencies.

Test Planning and Design

- Involves validation planning for repaired or replaced systems to ensure functionality
- Provides early assessment of functionality, leaving time to correct non-functional components
- Large part of the contract award criteria for agencies

79% of agencies feel that this was a very important skill for vendors to possess.

Network Planning and Design

- Marginal importance to agencies

64% feel this would be an evaluation criteria in vendor selection.

Data Migration and Database Design

- Some importance to agencies
- Involves movement of data from an old system to a repaired or replaced system

64% of agencies see this as an important skill in vendors.

Testing

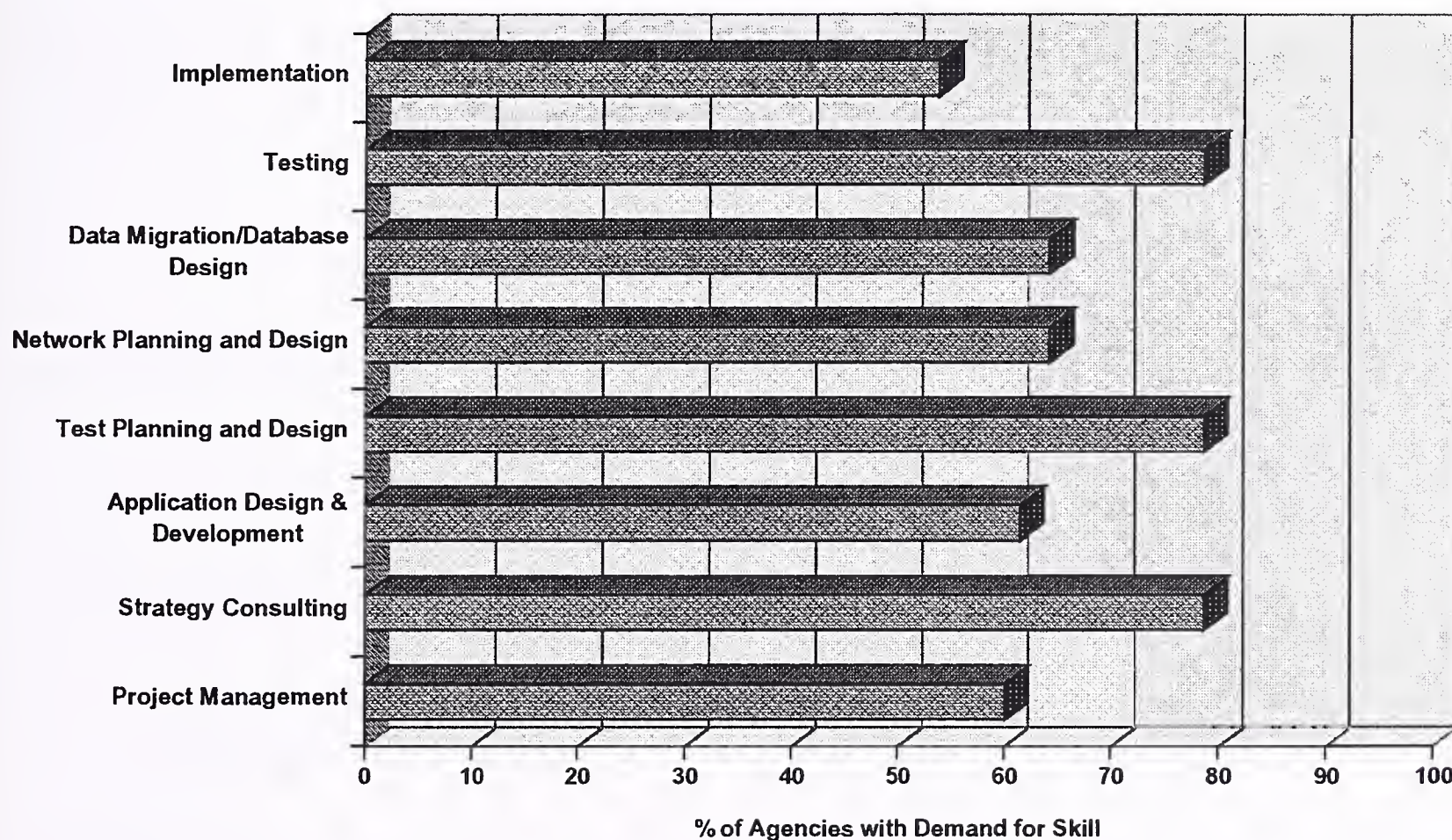
- Most important evaluation criteria for agencies in Y2000 solution acquisition
- Vendors must be capable of performing thorough checks on system integrity
- Follow-up must occur on systems which fail

Implementation

- Moderate significance to agencies
- Goes hand-in-hand with testing
- May require multiple levels as agencies move through the testing phase

Exhibit V-6

Importance of Skills in an External Service Provider



Source: INPUT

Many vendors have placed part of their business focus on developing a year 2000 product or service offering or set of deliverables. Currently, there are 56 vendors with FSS Schedule listing for year 2000 millennium services. A listing of these vendors is provided in Appendix B.

Also, new procurement guidelines incorporate the Y2000 problem. Effective October 21, 1997, under an amendment to the Federal Acquisition Regulation guidelines, all agencies are required to only acquire IT products and services that are year 2000 compliant.

Part 39.002 of this amendment spells out year 2000 compliance in the following way:

Year 2000 compliant, as used in this part, means, with respect to information technology, that the information technology accurately processes date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and

twenty-first centuries, and the years 1999 and 2000 and leap year calculations, to the extent that other information technology, used in combination with the information technology being acquired, properly exchanges date/time data with it.

Based on the requirements of each agency, different types of vendors will be needed for various functions. Some of the typical types of Y2000 vendors include:

- Y2000 Consultants
- Y2000 Tool Vendors
- Outsource/Off-Shore Providers
- Systems Vendors
- Professional Services Vendors

Y2000 consultants include those companies which were formed with the specific intent of addressing the year 2000 problem

Y2000 tool vendors are comprised of companies focusing primarily on providing tools to assist others in the Y2000 inventory, assessment, migration and testing.

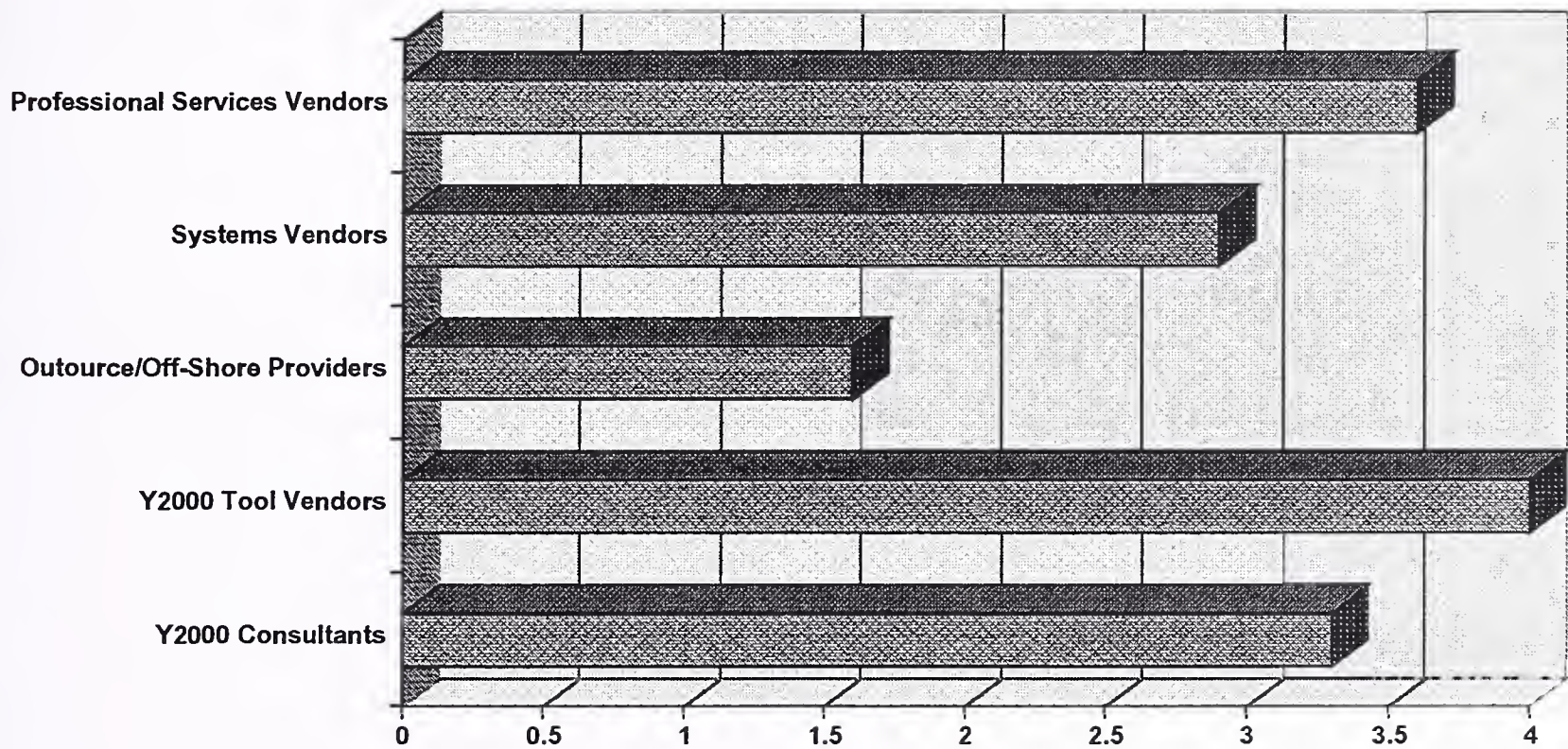
Outsource/off-shore providers are those companies which focus on migrating systems with large labor pools or semi-automated "factories."

Systems vendors are companies that offer both hardware/software solutions and professional services, including systems integration.

Professional services vendors are contractors which offer Y2000 extensions to existing services as well as partnerships with tool vendors.

In assessing the suitability of these types of vendors to provide year 2000 services, most agencies feel that year 2000 tool vendors stand out above the rest. This category of vendors was rated an average of 4 out of 5, with 5 being the most suitable for solving the Y2000 problem within that organization. Agencies believe that off-shore providers are not key players in the solution, only rating them a 1.6 in importance. Professional services vendors were also given a considerable rating, reinforcing the market trend toward professional services - a major IT growth area. Importance ratings for each of the five types of vendors are shown in Exhibit V-7.

Exhibit V-7

Vendor Importance Ratings*Source: INPUT*

(Blank)



Y2000 Conversion Funding

A

Market Overview

The total United States market for information technology software and services is expected to reach almost \$185 billion for 1997 and will grow to about \$255 billion by the turn of the century. Of this total, roughly \$140 billion will be spent over the next three years on Y2000 solutions. This estimate includes internal organizational costs as well as software upgrades, external consultants and developers, new applications packages, education, training and new hardware. This is a considerable market for year 2000 solutions providers - considering that approximately 70% of this total is external cost and is available to vendors. Organizations in the U.S. will spend anywhere from \$70 billion to \$100 billion externally in the conversion effort.

Internal costs are factored-out of the cost estimate because these are expenditures that would have been incurred during the normal course of business and can be viewed as opportunity costs. Internal staff costs are by far the largest component of a Y2000 conversion effort, as reported by approximately 50 corporations facing Y2000 problems. In a close second is the expense associated with upgrades to existing software packages. The commercial market expects to rely twice as much on internal resources than on external consultants.

Y2000 solution vendors should educate the public regarding the exclusive nature of the task in an effort to convince their potential markets that they cannot rely as heavily on internal resources and must thus depend on external specialists to ensure an effective and efficient conversion.

Firms also expect to spend approximately the same amount on education and training and the purchase of new software applications as on hired consultants and developers. On average, the purchase of new hardware is shown to be the least significant expenditure associated with a Y2000 conversion.

The total estimated U.S. market for Y2000 project components is represented in Exhibit VI-1.

Exhibit VI-1

U.S. Market for Y2000 Conversion Project Components

Cost Element	Percent of Total Cost	U.S. Market
Internal staff (Personnel)	29%	\$41B
Software package upgrade (Software)	22%	\$31B
New software application (Software)	16%	\$22B
External consultants/developers (Services)	15%	\$21B
Education and training (Services)	13%	\$18B
New hardware (Hardware)	5%	\$7B
Total	100%	\$139B

Source: INPUT

B

Overall Federal IT Market

The Y2000 problem has some different cost impacts in the federal market as opposed to the total U.S. market. Many agencies will resort to cutting funding for other IT and non-IT related projects in order to fund the Y2000 effort. In order to understand the impact, it is first necessary to examine the total federal information technology market.

The overall market planned for federal acquisition of information systems and services in FY 1998 is \$23.1 billion, forecast to reach \$24.1 billion in FY 1999. This represents a growth of 4.3%, as shown in Exhibit VI-2.

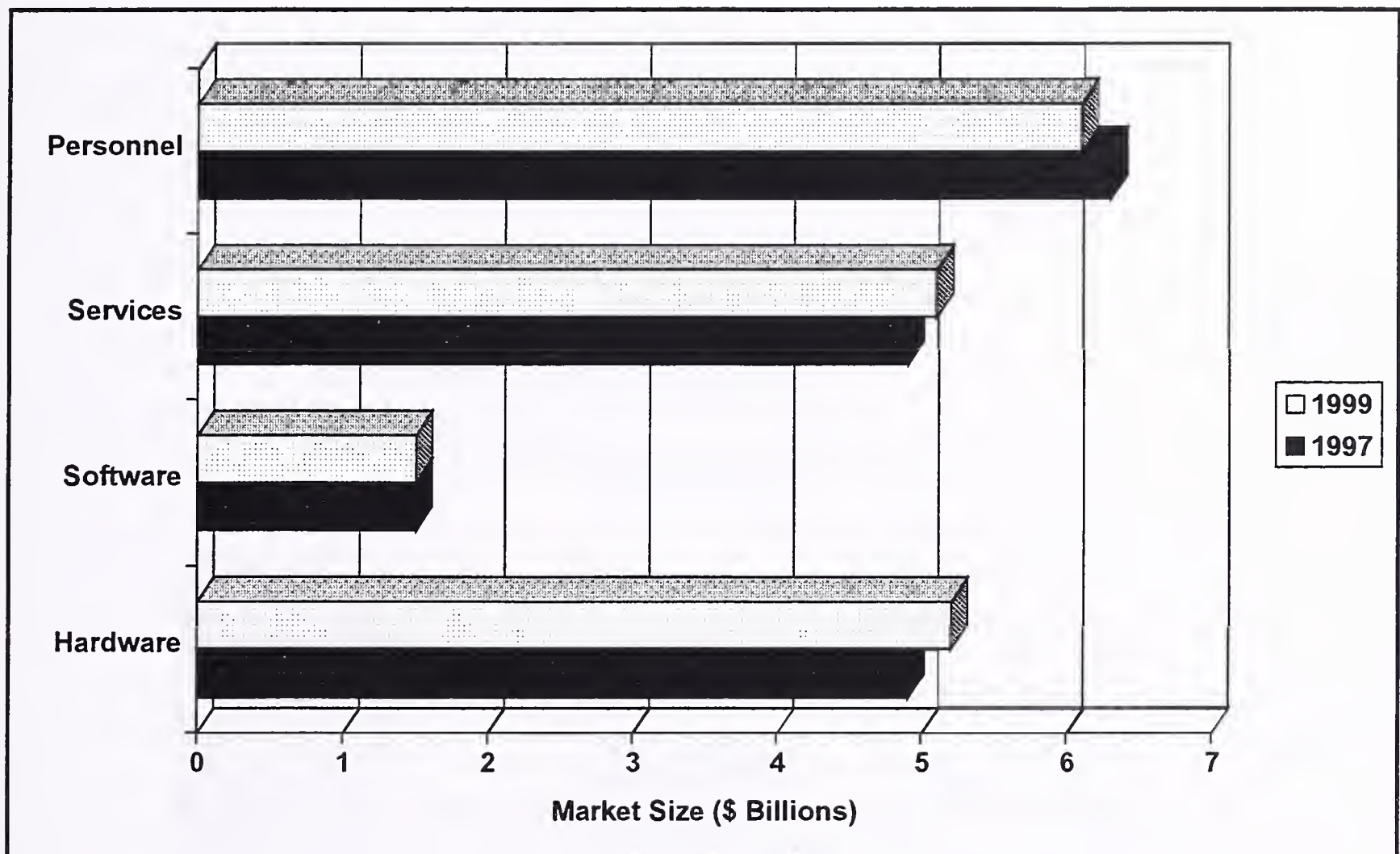
Funding for the year 2000 problem will encompass many parts of the overall federal budget; however, the services segments will be most influenced by Y2000 costs.

The largest component of the addressable information systems and services market in recent years has been commercial services. The FY 1996 spending level for commercial services estimated last year at \$7.0 billion was reported as actual this year at \$7.7 billion. The budget request for FY 1998 is \$8.8 billion, \$556 million more than estimated for FY 1997, with gradual increases in expenditures through FY 2000 expected. Commercial services include professional services, processing services, systems operations and maintenance - all of which will play a major part in the Y2000 effort.

Current agency long-range plans and Y2000 solution strategies, along with downsizing and outsourcing, indicate a continuing need for industry operational support, despite program cancellations and prospects of consolidating computing resources.

Exhibit VI-2

IT Markets, FY 1997–1999



Source: INPUT

The expenditures shown in Exhibit VI-2 are based on those requested by the agencies in their A-11 Section 43 reports.

The professional services segment of the federal IT budget will likely be the most affected by Y2000 costs. Most of the conversion effort will assume software development and programming dollars.

Professional services includes consulting, design, education and training and software development. This segment does not include the professional services associated with systems integration, systems operations and telecommunications.

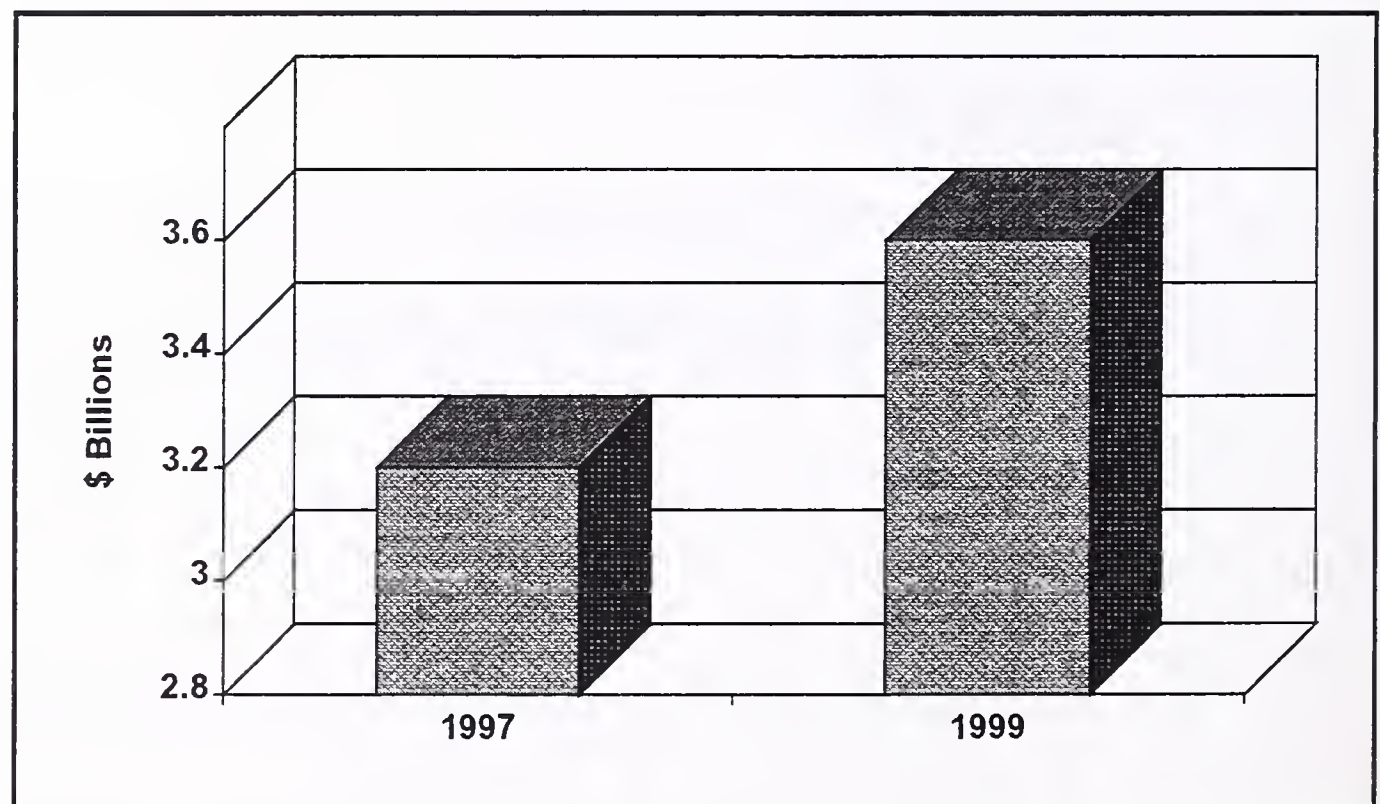
The federal professional services market is growing at an increasing rate. Actual reported spending levels for FY 1996 were higher than estimated last

year by the government. Although higher levels are forecast through FY 1999, the rate of growth dropped from the 9% forecast in FY 1994. The dependency on contractor sources for services is well underway, but threats to reduce program spending levels overall can influence this market. This market is projected to increase to \$3.6 billion by FY 1999, returning to the growth levels forecast in FY 1989, but significantly below the 13% of FY 1988. See Exhibit VI-3.

The projected need for contractor assistance makes the federal government the largest user group for professional services in the U.S. If all of the segments excluded from the basic professional services mode in systems integration and systems operations (outsourcing) were added, the entire professional services market represents a growth from \$6.3 billion in FY 1997 to \$7 billion in FY 1999.

Exhibit VI-3

Professional Services Market



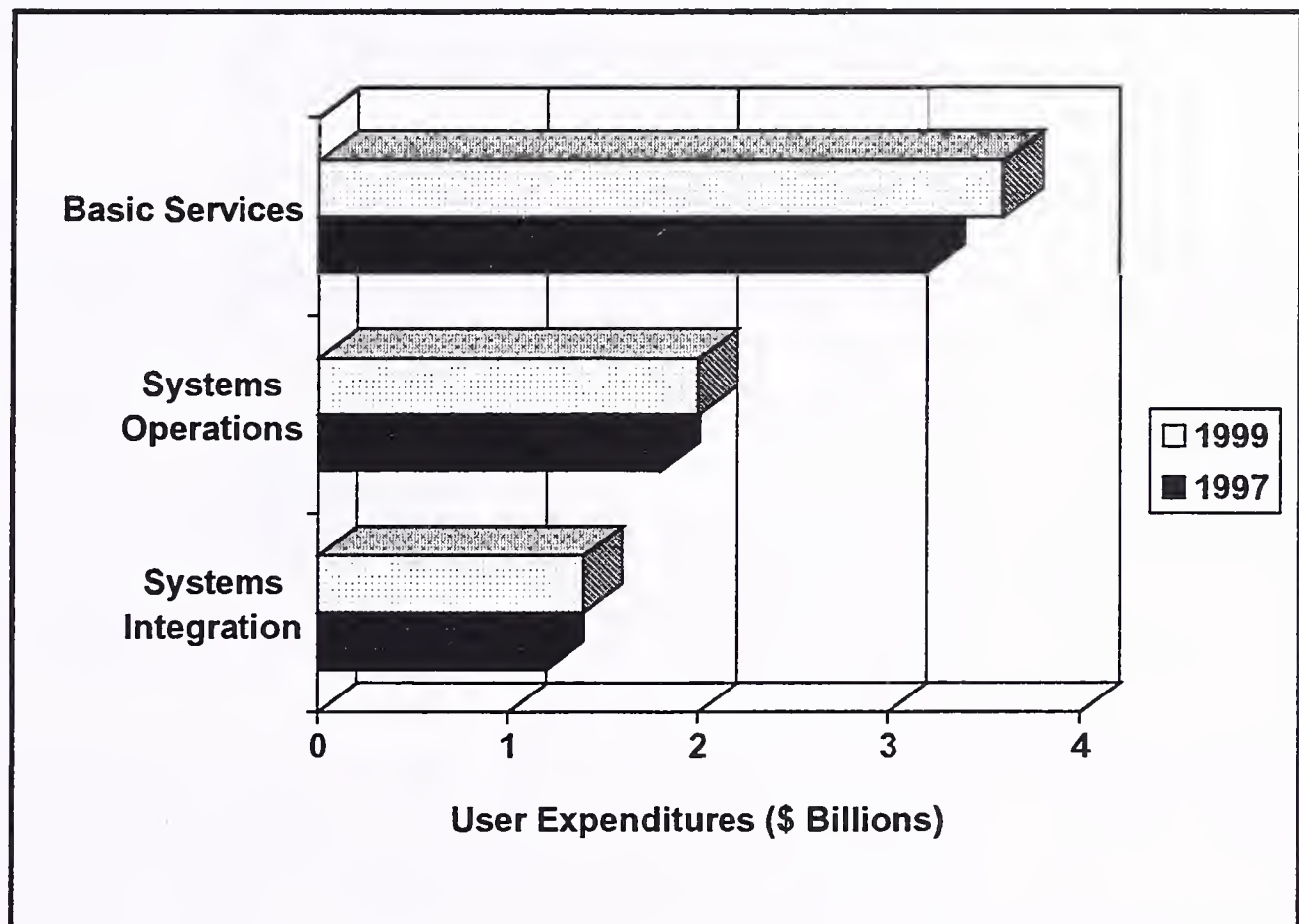
Source: INPUT

The relationship between the distributed modes of the professional services market is illustrated in Exhibit VI-4. The basic services sub-market, composed of software development, design and consulting, and education/training, represents the largest segment of the professional services market. The growth rate is all the more impressive given that it starts with the largest numbers. This year's higher CAGR forecast reflects renewed demands for services to address year 2000 spending. The systems integration component continues to grow in spite of smaller contracts and

commercial product purchasing. Systems operations shows moderate growth, mostly in operations of government-owned facilities.

Exhibit VI-4

Professional Services Market—All Segments



Source: INPUT

1. Programming and Analysis/Software Development

Programming and analysis services, also called software development, is forecast to grow from \$2.0 billion in FY 1997 to \$2.2 billion in FY 1999, as shown in Exhibit VI-5. This is the same as last year's forecast, but it continues to represent a dependency on outside resources for software development. This dependency will continue through the outyears.

The software development submarket includes:

- ☐ Hardware and/or software system design
- ☐ Custom software development
- ☐ Modification of commercial software products
- ☐ Software testing of custom and commercial packages
- ☐ Software conversion
- ☐ Maintenance of custom applications software

- ☐ Independent verification and validation of software packages prepared by other vendors.

The declining availability of programming skills in the federal government is the most significant factor behind the projected growth. Government staffing limits and the backlog of software maintenance tasks at most government data centers contribute to the demand for vendor assistance in this service mode. The need to correct applications for the year 2000 situation will keep this a healthy market.

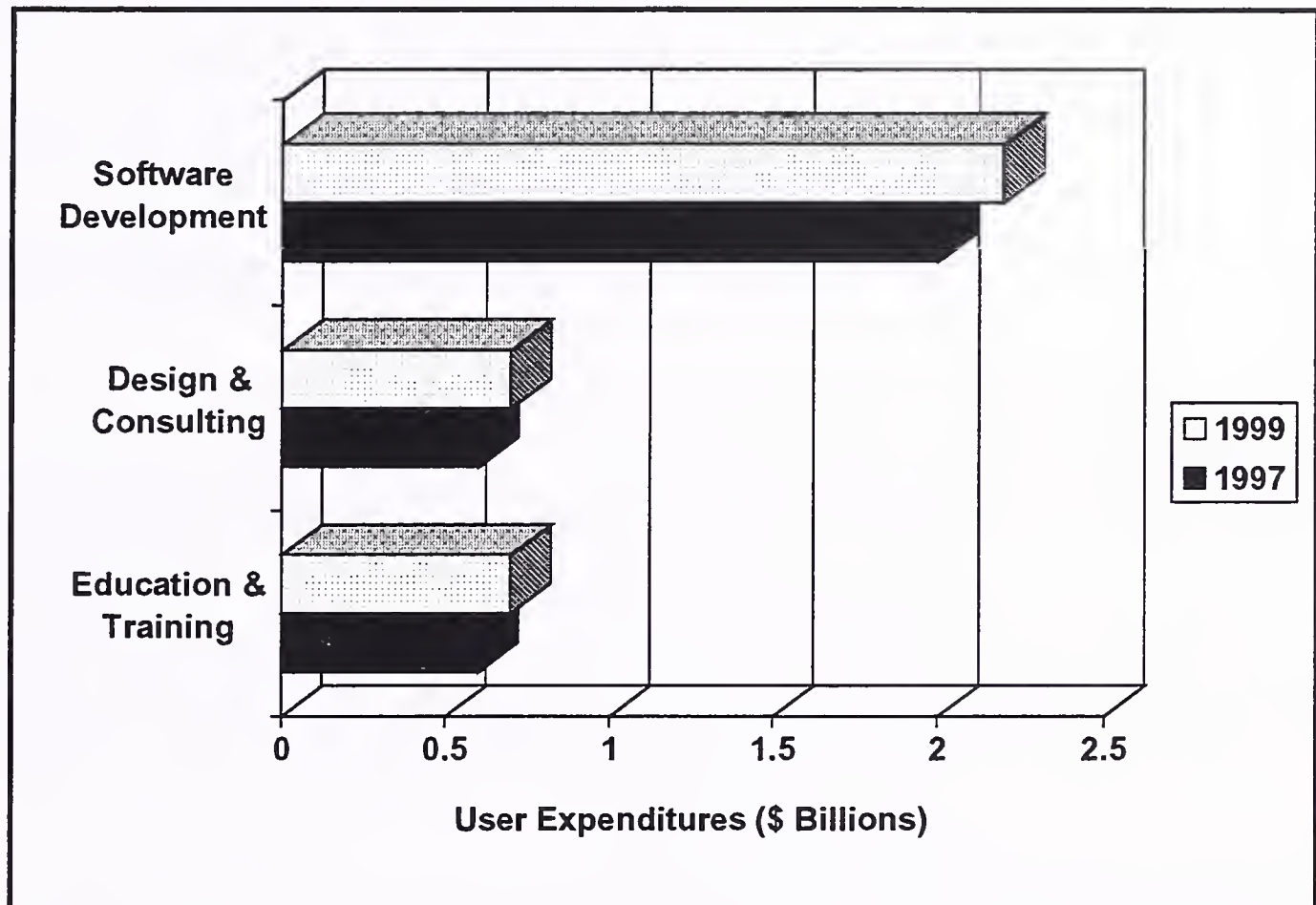
A number of programs planned for near-term procurement should sustain the projected growth. Examples include NASA/GSFC's Mission Operations, Systems Engineering and Support Services, Army/ISC's Information Mission Area Support, AF/ESC's Management Information Systems Technical Support, and Navy's Corporate Information Management Standard Procurement.

Interoperability pressure (more specifically, the ability to exchange data) is the driving force behind the use of contractors in software development. Vendors can more readily provide the expertise needed to knit together different platforms and their applications software to accelerate data interchange.

The government's validation phase guideline estimates that testing of installed or re-vamped systems will account for approximately 45%-50% of the overall Y2000 conversion cost.

Exhibit VI-5

Professional Services Submarkets



Source: INPUT

2. Design and Consulting Services

IT consulting services in the federal market will grow from about \$644 million in FY 1997 to \$724 million in FY 1999. The growth forecast four years ago was depressed by the slowdown in CIM/DISA initiatives, but renewal of systems engineering and development activity for assessing the year 2000 issue, plus the continuing shortfall of systems experts in the federal workforce, contribute to growth in this segment.

The types of services contracted include:

- ☐ Feasibility studies
- ☐ ADP requirements analyses
- ☐ Systems audits
- ☐ Systems engineering and technical direction (SETD)
- ☐ Systems engineering and technical assistance (SETA)
- ☐ Software engineering and technical assistance

The primary demand factor is agency need for assistance in producing the technical justification for planned improvements in information technology resources. Agencies are understaffed in the technical planning and evaluation areas.

In the past, congressional pressure was exerted on agencies to minimize the use of outsiders (and previous government employees) in functions perceived as governmental management. This is no longer an issue. Government agencies are encouraged to rely more on outsourcing services, even in the area of acquisition support.

3. Education and Training

Education and training services relate to information systems and services for the user, including computer-based training (CBT), computer-aided instruction (CAI), computer-based education (CBE), and vendor instruction of user personnel in operations, programming and software maintenance.

The government normally contracts for the following separately from systems integration programs:

- ☐ Training programs
- ☐ Books and manuals
- ☐ Seminars
- ☐ Automated training systems

In previous years, this delivery mode eroded under both budget pressures and inclusion of the services in systems integration programs.

The demand existed for training and education, but stretched IT budgets compromised the training component. Agency officials had to seek funding for training elsewhere, usually from within operating budgets. This submarket is recovering in response to acknowledged demands from the user community for educational services. The user demand grew from implementation of new software, tools and sophisticated hardware.

Computer training on use of desktop technology and LAN administration was provided in-house by a number of larger agencies under their regular training budgets. Courses for user computing, LANs, distributed processing and new software tools are better generated by industry.

Some agencies, notably Social Security Administration, have set up nationwide training programs through video-teleconferencing in order to reduce outlays for travel and temporary duty away from the office. These training expenses appear under systems development rather than education.

The forecast in previous years has been for no growth, maintaining current levels of annual spending. However, with growing client/server capabilities and network operations, the training demand is pushing this submarket upward, relative to other market segments. From an artificially depressed level of \$400 million in FY 1994, the market is expected to grow from \$612 million in FY 1997 to \$673 million in FY 1999.

C

Federal Y2000 Estimates

Each agency in the federal government is responsible for providing a quarterly progress report to the Office of Management and Budget outlining the status of Y2000 conversion efforts. The most recent submission was done in August 1997, in which each agency estimated its cost for the overall Y2000 project.

Not surprisingly, the estimated costs in August were up significantly from those estimated in the May progress reports. INPUT believes that this trend will continue as time goes by and agencies begin to realize that their original projections were significantly underestimated.

Overall, the federal government expects to spend roughly \$3.8 billion on the Y2000 problem. As in the commercial estimate, this cost includes support of internal staff, upgrades to existing software packages, cost of new application packages, spending on external consultants and developers, new hardware costs as well as education and training of the users. A detailed agency breakout is shown in Exhibit VI-6. Federal estimates are broken down by year.

Exhibit VI-6

Agency Y2000 Cost Estimates (\$M)

Agency	1996	1997	1998	1999	2000	Total
Agriculture	5.0	24.6	49.6	25.3	9.0	113.5
Commerce	2.6	11.5	28.0	25.8	6.6	74.5
Defense*	10.6	389.2	659.8	281.1	7.1	1,409.5
Education	0.1	0.6	3.4	4.4	0.2	8.7
Energy	1.8	30.6	54.5	53.2	20.4	160.5
HHS	9.2	25.0	42.9	20.1	0.0	97.2
HUD	0.7	7.6	35.0	15.0	6.2	64.5
Interior	0.2	2.7	5.3	3.9	1.6	13.7
Justice	1.5	8.0	11.5	3.1	0.3	24.4
Labor	1.7	5.3	6.9	3.4	1.1	18.4
State	0.5	47.6	56.4	29.1	1.6	135.2
Transportation	0.6	18.7	107.9	107.4	30.1	264.7
Treasury	1.3	192.5	518.0	265.0	128.9	1,105.7
VA	4.0	53.0	58.0	47.0	0.0	162.0
USAID	0.0	0.2	0.5	0.3	0.0	1.0
EPA	0.8	3.3	6.8	5.6	2.3	18.8
FEMA	3.8	4.4	3.0	3.2	1.2	15.6
GSA	0.2	1.0	1.0	0.1	0.0	2.3
NASA	0.1	8.5	20.5	12.1	2.2	43.4
NSF	0.0	0.5	0.8	0.1	0.0	1.4
NRC	0.0	2.6	2.9	2.9	0.9	9.3
OPM	1.7	2.1	0.3	0.3	0.3	4.7
SBA	1.7	3.3	2.0	0.0	0.0	7.0
SSA	2.2	15.4	9.5	6.0	0.1	33.2
Total	50.4	858.1	1,684.5	914.3	220.2	3,789.2

Defense total includes \$61.7 million that was not allocated by year

Source: OMB

As noted, the most significant spending occurs in 1998. The FY 98 cost of \$1.7 billion represents about 47% of overall Y2000 spending. Surprisingly, FY 00 estimates only make up 6% of the total. This is most likely an understated value considering that FY 00 will have to include the cost of triage and disaster recovery.

The estimate for the Department of the Treasury represents the notion that original government estimates were tremendously understated. The Treasury estimate in May equaled \$369 million and the re-adjusted August estimate tripled, reaching \$1.1 billion. Many agencies will conceivably follow suit in their adjustments as the true scope of the project is realized.

Exhibit VI-7 shows the sources of funding for the Y2000 problem. The most significant response is that 93.8% of agencies expect to reduce or cancel expenditures on other IT projects in order to fund Y2000 conversion. Only about a third of the agencies are going to request additional funding for the problem. This poses a tremendous opportunity to those vendors who have a Y2000 offering in that many IT dollars will be redirected to the effort. However, vendors who depend on billion dollar awards of non-Y2000 contracts may feel the impact of program cuts in their business areas.

Exhibit VI-7

Sources of Funding for Y2000

Source of Funding	Percent of Respondents
Separately Budgeted Item	37.5%
Included in Budgets of Previously Planned Projects	87.5%
Reduce/Cancel Expenditure in Other IT Developments	93.8%
Increase/Overrun Previous Budgets	21.4%
Reduce Non-IT Expenditure	63.6%

Source: INPUT

In addition to the total estimates, some organizations look at the Y2000 opportunity in terms of the number of lines of code currently in place at particular agencies and the cost of fixing the typical line of code. The Gartner Group made an early estimate that every line of code in the government will cost approximately \$1.10 to fix. They later changed this estimate to \$1.70 per line of code.

Mitre also estimated the cost per line of code. Their estimates take into account the type of system being repaired. Mitre's estimates of the cost of correcting code for various types of systems is represented in Exhibit VI-8.

Exhibit VI-8

Cost Per Line of Code on Various System Types

Type of System	Cost Per Line of Code
Ground Airborne Radar System	\$2.02-\$8.52
Communications Processing System	\$1.23-\$5.54
C2 Planning System	\$1.22-\$1.84
Logistics Support System	\$1.02-\$1.39
MIS System	\$0.75-\$1.70

Source: Mitre

Some systems fall below the Gartner estimates, while systems such as Ground Airborne Radar Systems far exceed the estimates - with costs potentially reaching \$8.52 per line of code.

D**INPUT's Y2000 Cost Estimate**

The federal market represents approximately 7.8% of the overall U.S. information technology market. With this in consideration, INPUT estimates that the actual cost of fixing the year 2000 problem will be \$10.9 billion for the federal government. This estimate includes the cost of internal staff. The federal estimate is only about 35% of this number, at \$3.8 billion. In order to arrive at the estimate, factors such as software design and development, system replacement, new hardware acquisition, education and training were considered. However, INPUT is also factoring in a triage cost. Undoubtedly, some agencies will not make the December 31, 1999 deadline of having all mission-critical systems Y2000 compliant. Some systems will fail. The cost of correcting failed systems must be included in overall Y2000 estimates.

The cost per agency is shown in Exhibit VI-9.

Exhibit VI-9

INPUT's Y2000 Cost Estimate (\$M), 1997-1999

Agency	Total Cost	Total External Cost
Agriculture	326.5	240
Commerce	214.3	160
Defense*	4,054.6	3,000
Education	25	20
Energy	461.7	340
HHS	279.6	210
HUD	185.5	140
Interior	39.4	30
Justice	70.2	50
Labor	52.9	40
State	388.9	290
Transportation	761.4	570
Treasury	3,180.7	2,400
VA	466	350
USAID	2.9	2
EPA	54.1	40
FEMA	44.9	30
GSA	6.6	5
NASA	124.8	90
NSF	4	3
NRC	26.8	20
OPM	13.5	10
SBA	20.1	14.9
SSA	95.5	70
Total	10,900	8,100

Defense total includes \$61.7 million that was not allocated by year

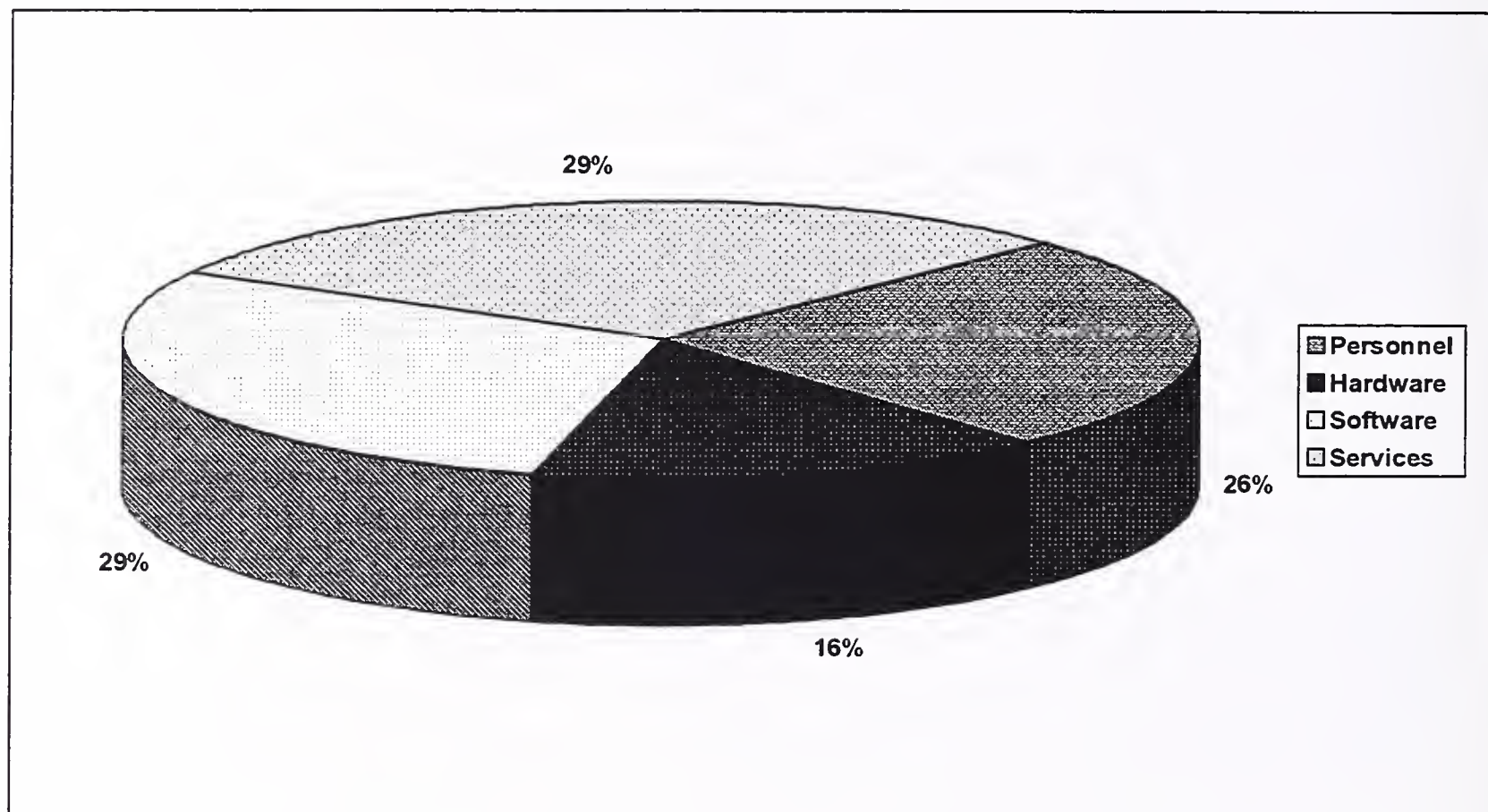
Source: INPUT

External cost represents contract dollars available to vendors. In the federal government, more IT work is outsourced than in the commercial market. Commercially, only about 70% of IT expenditures are external. In the federal market, this percentage is slightly higher at 74.3%. Applied to the total federal cost of \$10.9 billion, the contracted-out portion of Y2000 expenditures

is calculated at about \$8.1 billion. Percentages of internal vs. external expenditures in the federal government are represented in Exhibit VI-10.

Exhibit VI-10

Breakdown of Y2000 Costs



Source: INPUT

The overall Y2000 expenditure represents the cost of internal staff as well as software upgrades, new software, consultant support, new hardware, education and training. Percentages of total cost for each category are shown in Exhibit VI-11. Internal staff costs and external consulting make up nearly half of overall spending, with upgrades to software packages closely following at a \$2 billion cost.

Exhibit VI-11

Federal Market for Y2000 Conversion Project Components

Cost Element	Percent of Total Cost	Federal Market
Internal staff (Personnel)	25.7%	\$2.8B
Software package upgrade (Software)	18%	\$2B
New software application (Software)	11%	\$1.2B
External consultants/developers (Services)	23%	\$2.5B
Education and training (Services)	6.3%	\$0.74B
New hardware (Hardware)	16%	\$1.7B
Total	100%	\$10.9B

Source: INPUT

Overall Y2000 spending will be much larger than current government estimates. As time goes on, federal agencies will begin to realize that triage planning is essential and must be included in cost estimates. Many agencies are expected to realize the understated values and follow suit with Treasury in recalculating cost.

In total, the Y2000 problem will have a major impact on the federal IT budget. Most agencies plan to cut funding for other IT projects in order to cover conversion costs. Vendors are in a prime position to assist in the Y2000 solution; however, they must offer a cost effective, valuable solution, at the same time keeping the risks in mind.

E**Personnel**

Cost is not the only factor which will have a major impact on agencies as they approach the year 2000. Agencies must also be aware of the toll that the conversion effort will take on human resources. Currently, agencies dedicate a certain amount of personnel to its information technology functions. Many agencies are expected to have to divert at least 25%, and possibly more, human resources to the Y2000 effort. This resource diversion will result in the lack of necessary personnel to operate, maintain, and oversee non-Y2000 technologies.

The recent trend in the federal market is toward reduction of the agency workforce. As technology becomes more versatile and widely used and the Administration mandates downsizing as a cost-cutting measure, agencies have had to adapt to carrying on their function with less personnel. The year

2000 is a date that the government can not postpone. Agencies will need to find a way to complete conversion in a timely manner despite limited resources.

The average salary, including benefits, of a member of the information technology staff is shown in Exhibit VI-12. These salaries, when applied to the internal cost estimate of \$2.8 billion, yield the number of full-time equivalent employees (FTE) necessary for agencies to accomplish Y2000 goals. INPUT makes the assumption that most of the internal costs reported by federal agencies will be applied to salaries and expenses of employees.

Exhibit VI-12

Number of Employees Diverted for Y2000

	Average Cost per Employee/Year	Total Y2000 Personnel Cost, 1997-1999	Number of Y2000 Personnel, 1997-1999
Defense	\$49,511	\$1.055B	21,300
Civilian	\$64,131	\$1.72B	24,610
Total	\$63,362	\$2.8B	45,910

Source: OMB, INPUT

As shown in Exhibit VI-13, many agencies will have to divert a significant amount of human resources to the Y2000 effort. Some agencies will utilize 25% or more of their IT resources on year 2000 conversion. These high percentages are not normal and are usually associated with agencies which do not have a significant IT function outside of Y2000. It is therefore easier for some of these agencies to divert resources. Five percent is a normal figure. It basically represents the fact that over the five year conversion period, a typical agency can expect to lose about 5% of its human resources to the Y2000 problem. INPUT anticipates growth in these percentages as the year 2000 nears. Agencies will begin to scramble once time becomes crucial and more personnel will be diverted at the last moment.

Exhibit VI-13

Diverted Employees by Selected Agency

Agency	Total Full Time Equivalents, 1997-1999 (Est.)	Total IT Personnel Cost, 1997-1999	Total Internal Y2000 Cost	Average Cost per Employee/Yr. (Est.)	Number of Y2000 Personnel, 1997-1999
Agriculture	17,809	\$953.4M	\$86.5M	\$53,535	1,616
Defense	184,050	\$9,112.5M	\$1,054.6M	\$49,511	21,300
Education	791	\$53.1M	\$5M	\$67,130	74
HHS	9,792	\$678M	\$69.6M	\$69,240	1,005
Justice	9,324	\$584.5M	\$20.2M	\$62,688	322
VA	16,856	\$844.4M	\$116M	\$50,095	2,316
GSA	6,023	\$450.9M	\$1.6M	\$74,863	21
NASA	4,257	\$279.9M	\$34.8M	\$65,751	529
SSA	15,133	\$827.8M	\$25.5M	\$54,702	466
Total*	529,940	N/A	\$2,800M	\$63,362	45,910

• Total does not include Interior, Transportation, SBA

Source: OMB, INPUT

(Blank)



Civilian Agency Analyses

Unlike large segments of the commercial IT market, the federal market demand for Y2000 products and services is often specific to a certain agency. Often, requirements vary from one agency to the next depending on many factors but, most importantly, on the variance of system types and the unique business functions. It is therefore necessary to examine agencies on an individual basis to provide accurate assessments of their fit into the Y2000 puzzle.

A

Department of Agriculture

1. Organization

The Department of Agriculture has reorganized in order to meet the Y2000 challenge. Oversight for the entire Y2000 project is maintained by the Chief Information Officer. The CIO is responsible for management and planning while the execution is done at the agency level. USDA currently consists of 30 agencies, each at different levels of the Y2000 conversion process.

It is the responsibility of each agency administrator to employ an executive sponsor at the senior level. The sponsor is tasked with overall management and implementation of Y2000 solutions at the agency level and reports to the office of the CIO for USDA.

Finally, each executive sponsor manages a project team of individuals responsible for the implementation of agency-level year 2000 solutions. Each project team will develop action plans with detailed procedural outlines for accomplishing the conversion effort.

2. Status of Conversion

Most organizations at USDA have resolved to meet Y2000 deadlines in order to ensure continuance of the business and support program delivery within the agency. The one setback USDA foresees is that targets could possibly be missed due to staffing and testing issues. A completion date of late 1999 is

still anticipated; however, this target only includes mission-critical systems. Many systems that are not critical to the business function may be corrected after the date change.

As of August 1997, the USDA had begun examinations of different Y2000 toolsets. At that time, no actual performance results of these tools had been documented. In particular, USDA has utilized Computer Associates' Impact-2000 product as well as Viasoft's Enterprise-2000 software. Additional support is being provided by IBM and Unisys.

3. Contingency Plans

The Department of Agriculture does have a contingency plan in place in the event that systems fail on January 1, 2000; however, they are not completely ready to publicize that plan. Final changes are still being made.

4. Cost

The Department of Agriculture estimates the cost of dealing with the Y2000 problem at \$113.5 million. Breakouts for each year are shown in Exhibit VII-1. INPUT estimates USDA's cost at \$326.5 million.

Exhibit VII-1

USDA's Y2000 Cost (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
5	24.6	49.6	25.4	9	113.5

Source: USDA

5. Lessons Learned

- Problem requires good project management skills
- Agency must develop a well-planned budget
- Strategic and tactical planning is essential
- Information sharing is a key factor among agencies
- Contingency planning must be done in advance

6. Advice to Others

Upper management at the Department of Agriculture feel that the two main pieces of advice for solving the Y2000 problem are to start planning early and to have triage as a core component of that planning. One reason the

government is currently scrambling to make up for lost time is delayed planning. Problems of this magnitude must be addressed earlier.

B

Department of Commerce**1. Status of Conversion**

The approach utilized by the Department of Commerce is dependent on a number of factors but mainly the current status of system and the cost-benefit analysis. Some systems were already undergoing migration from mainframe to client/server and the Y2000 problem was taken into account during development.

One advantage to using an external service provider is the available tools to which they have access and can use during assessment. Internal support would have to acquire tools, thereby expending valuable time and resources which can be applied elsewhere.

Current tools in use at the Department of Commerce include Rochade for inventorying data elements and Microsoft Project for scheduling. The assessment phase at DOC was outsourced to OAO Corporation.

The Department of Commerce estimates that all changes will be implemented by 1999. Two factors which could possibly disrupt progress are cost and prioritization.

2. Contingency Plans

As of August 1997, the Department of Commerce did not have a contingency plan in place in the event of a system failure. DOC officials stated that triage planning is based on mission-criticality and would take place according to this criteria.

3. Cost

The Department of Commerce estimates that the Y2000 fix will cost \$74.5 million. Costs per year are shown in Exhibit VII-2. INPUT feels that this number is understated and that Commerce's cost will be about \$214 million from 1997-1999.

Exhibit VII-2

DOC's Y2000 Cost (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
2.6	11.5	28	25.8	6.6	74.5

Source: DOC

4. Lessons Learned

- Y2000 is an extensive problem affecting more than just IT
- The problem requires constant management

5. Advice to Others

The Department of Commerce urges others to make Y2000 a top priority, leaving no stone unturned. Also, project teams should have senior officials sign-off on new or revised systems in order to ensure accurate, up-to-date accountability.

C**Department of Education****1. Organization**

Year 2000 responsibility at the Department of Education rests with the Office of the Chief Information Officer and the Office of Postsecondary Education/Program System Service. The CIO reports directly to the Deputy Secretary of Education on all Y2000 issues.

2. Status of Conversion

In August 1997, the Department of Education reported that the following systems were already Y2000 compliant:

- Direct Loans Central Database
- Direct Loan Origination System
- Direct Loan Servicing Systems
- Postsecondary Education Participant's System
- Multiple Data Entry System
- Payroll/Personnel System
- Integrated Postsecondary Education Data System
- Impact Aid Payment System

Systems in the process of being replaced are:

- Primary Accounting System
- Payment Management System
- Grants and Contracts Management System
- Procurement Documentation System
- Central Registry System
- Central Processing System

The Department of Education has one system slated for retirement, the Institutional Data System. All other systems are being repaired. Exhibit VII-3 shows all systems which are being repaired and their status which was reported in the August 1997 progress report to OMB.

Exhibit VII-3

Repair Status of Education's Systems

System	Repair Status
Campus-Based	Assessed 2/28/97
PELL Grant Recipients and Financial Management System	Assessed 2/28/97
Federal Family Education Loan	Commenced 6/97
National Student Loan Data System	To Commence 9/97
LAN-Based Common Audit Resolution System Training Request Authorization System Property Management Information System	To Commence 9/97

Source: Dept. of Education

3. Cost

The Department of Education's estimates for the Y2000 problem cost is detailed in Exhibit VII-4. INPUT's estimate of cost is \$25 million.

Exhibit VII-4

Education's Y2000 Cost (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
.1	.6	3.4	4.4	.2	8.7

Source: Dept. of Education

D

Department of Energy

1. Organization

Y2000 project oversight for the Department of Energy is provided by the Office of the Chief Information Officer. In conjunction with the CIO, the Y2000 project team has the responsibility of ensuring that the mission-critical system owners have a plan in place for year 2000 conversion. The project team is made up of three levels:

a. Information Management leaders have the responsibility of appointing Y2000 coordinators and supporting the coordinator's attempts to facilitate Y2000 conversion by the system owners.

b. Y2000 Coordinators have the following mission:

- Raising the awareness of the Y2000 problem to all impacted parties
- Identifying owners of all mission-critical systems
- Providing a conduit for information to system owners
- Coordinating and planning with system owners in order to ensure system compliance
- Facilitating periodic progress reporting to the Year 2000 Mission-Essential Status System

c. System Owners have the overall responsibility for implementing year 2000 solutions on their systems. They are supported by a project management team consisting of users, analysts, programmers, etc. Responsibilities of system owners include:

- Formulating plans to address Y2000 issues
- Completing risk assessments and vulnerability evaluations on all mission-critical systems
- Developing necessary contingency plans
- Formulating and executing test plans
- Providing all necessary information to the Year 2000 Mission-Essential Status System.

The Department of Energy is decentralized in the sense that there are 60 sites, each responsible for doing its own renovation.

2. Status of Conversion

The Department of Energy has concluded that there are currently over 300 mission-critical systems that have been identified as of August 1997. This installed-base is currently very contractor-oriented and DOE expects to utilize these contractors in the year 2000 effort. DOE often considers its long-term contractors to be internal staff members - provided the contracts are 10-20 years in length. The Department of Energy only plans to hire other outside sources if the existing contractor needs additional expertise.

Replacement in DOE mainly refers to software. Very few systems will have to be replaced in their entirety. DOE hopes to be complete in its Y2000 conversion effort by the middle of 1999. Disruptions may be caused by overlooking systems which are mission critical.

3. Contingency Plans

The Department of Energy is considering a contingency plan. Each plan, however, would have to be site-specific. The plan would mainly entail manual processing of the work which would normally be done by the system. Reliance on processing by hand is a current trend in the federal government when it comes to triage approaches. It is often viewed as the most cost-effective and the easiest plan to implement.

4. Cost

The Y2000 conversion effort at the Department of Energy is currently being viewed as a "maintenance issue" and funding is being sought accordingly. Mainly, DOE will re-focus funding from other information technology areas. The Department's cost estimates as of August 1997 are shown in Exhibit VII-5. INPUT believes that the Department of Energy will incur costs of \$462 million by the end of 1999.

Exhibit VII-5

Energy's Y2000 Cost (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
1.8	30.6	54.5	53.2	20.4	160.5

Source: Dept. of Energy

5. Lessons Learned

The main lesson learned within the Department of Energy is that the most challenging part of solving the year 2000 problem is coordination and project management. Having the problem recognized early in the process and dedicating individuals to its solution also plays a challenging role.

6. Advice to Others

DOE recognizes that every business function must take a different approach to solving the problem. Data interchange becomes a key factor in the solution process. If a system fails during the date change, other systems must be capable of picking up the function where it was left.

E

Department of Health and Human Services

1. Organization

Within the Department of Health and Human Services, a Chief Information Officer has overall responsibility for the Y2000 issue. The CIO is also the Assistant Secretary for Management and Budget. Day-to-day responsibilities are carried out by the Deputy Assistant Secretary for Information Resources Management and the Deputy CIO. Each operational division's CIO has overall responsibility for the division.

HHS required each of its 13 operating divisions to develop their own year 2000 plan and implementation procedure. Each plan is based on the individual needs and requirements of the division.

2. Status of Conversion

HHS has completed assessment on all mission-critical systems. The Department has 434 mission-critical systems, of which 115, or 26%, are already Y2000 compliant.

3. Contingency Plans

HHS has not yet publicized any contingency plans. Plans will most likely be implemented individually by the respective operational division.

4. Cost

Estimated Y2000 cost for the Department of Health and Human Services is shown in Exhibit VII-6. INPUT estimates that HHS will spend \$280 million over the next three years on Y2000 conversion.

Exhibit VII-6

HHS' Y2000 Cost (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
9.2	25	42.9	20.1	N/A	97.2

Source: HHS

F

Department of Transportation

1. Organization

Oversight for the year 2000 problem within the Department of Transportation is maintained by the Chief Information Officer. On the CIO staff is the full-time project coordinator whose responsibilities include:

- Maintaining a systems inventory
- Tracking progress through inventory updates
- Sharing best practices of other agencies
- Serving as a facilitator and clearinghouse of information
- Chairing the Year 2000 Working Group

Responsibility for actual corrective action is assumed by each of DOT's operating divisions. Each division has in-depth knowledge of its own systems and the status of Y2000 conversion.

2. Status of Conversion

Currently, the Department of Transportation is utilizing a mix of internal staff and outside contractors to assess the scope of the year 2000 problem. There are contractors who are maintaining current systems who will play a major part in the conversion effort. DOT does not yet have plans to "buy" any additional talent to assist with solving the problem. The Department currently estimates that all conversion should be complete by late 1999.

DOT does foresee some possible disruptions to the conversion process. First, there are an incredible number of systems to assess, convert and test. The sheer magnitude of the problem may result in delayed completion. Second, there is a unique operating environment within DOT. Anyone working on conversion will need to first learn the system and its function, a process which could take valuable time. Also, many systems are so unique and aged that finding replacement systems capable of carrying the function may be difficult.

3. Contingency Plans

The Department of Transportation is working on developing a contingency plan in the event of a system failure. They have recognized the serious need for triage and are examining a three-fold approach:

- Manual operation - physically performing the work of a system by hand
- Interface shut-down - interfaces between compliant systems and failed systems will be terminated in the event of a disaster
- Windowing

4. Cost

Estimated year 2000 costs for the Department of Transportation are shown in Exhibit VII-7. INPUT estimates that this cost will reach \$761 million.

Exhibit VII-7

DOT's Y2000 Cost (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
1.8	13.8	25.6	44.1	6.6	91.8

Source: DOT

5. Lessons Learned

- Assessment was started too late
- Prioritization and contingency planning is essential
- Management must boost awareness of the problem
- Critical project management experience is key

6. Advice to Others

DOT urges other agencies to take the problem seriously. This is not a problem that will disappear but rather it is an incredible project management effort with many complexities. DOT sees the issue as more managerial than technical. Proper leadership and oversight will make the conversion process much smoother.

G**Department of the Treasury**

1. Organization

Overall responsibility for the Y2000 date conversion effort at the Department of the Treasury is held by the Assistant Secretary (Management) and the Chief Financial Officer. Program management responsibilities lie with the Deputy Assistant Secretary (Information Systems) and the Chief Information Officer.

In addition, the head of each of Treasury's bureaus is responsible for designating a year 2000 program manager responsible for making sure all implementations are performed on schedule. Treasury has stated that it believes that the potential for success in the conversion effort rests with effective plans and oversight by senior management. The decentralized nature of the Department dictates that responsibility for the problem rests with each of the 14 bureaus.

2. Status of Conversion

As of August 1997, about 75% of Treasury's systems had been assessed. During the three months between this report and the release of the May Progress Report, Treasury increased the reported number of mission critical systems from 86 to 320. This reflects the predicted trend within the government. As time passes, agencies will begin to realize that the scope of the problem is larger than originally anticipated.

3. Contingency Plans

To date, the Treasury Department has not released any information on their planned approach in the event of system failure. The scope of the Y2000 problem within the Department is far greater than many other federal agencies. Treasury is expected to consider triage strategies due to the large number of mission-critical systems that are at stake.

4. Cost

Cost estimates reported by the Department of the Treasury are shown in Exhibit VII-8. Of significant importance is that the Department increased its cost estimates from \$369.3 million in May 1997 to \$1.1 billion in August 1997. Over the three month period, the estimated expenditures on year 2000 fixes tripled. INPUT anticipates that this reevaluation of cost and increase of estimates will continue from present levels. As agencies gradually become aware of the magnitude of the conversion effort, their cost figures will be adjusted accordingly.

Exhibit VII-8

Treasury's Y2000 Cost (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
1.3	192.5	518	265	128.9	1105.7

*Source: Dept. of the Treasury***H****Department of Veterans Affairs****1. Organization**

The Chief Information Officer at the Department of Veterans Affairs is responsible for overseeing and completing the year 2000 project. Within the jurisdictions, the CIOs of the Veterans Benefits Administration (VBA) and the Veterans Health Administration (VHA), as well as senior managers at the National Cemetery System, have overall responsibility for managing their own projects.

VA has established a monthly reporting requirement which is designed to continuously monitor performance of the organizations. Also, VA has completed a Year 2000 Readiness Review by interviewing over 80 systems professionals as to the status and complexities of the conversion effort.

2. Status of Conversion

The Department of Veterans Affairs had completed the assessment phase as of August 1997. The Department has decided to contract out a large percentage of the code revision and they are estimating that the conversion effort will be complete by the fourth quarter of 1999.

VA feels that there is a possibility of deadlines being missed if providers of commercial-off-the-shelf (COTS) software miss their deadlines. Delayed software implementation is a major concern for many agencies.

3. Contingency Plans

The Department of Veterans Affairs has formulated a contingency plan to deal with system failure. Mainly, the plan consists of the use of manual processes, such as handwriting documents or performing manual calculations. Cost and time often precludes agencies from considering other triage methods. Manual backup is often the easiest to implement considering limited resources.

4. Cost

VA anticipates that a large percentage of Y2000 funding dollars will have been redirected from other IT and non-IT related projects. The anticipated

Y2000 costs for VA are shown in Exhibit VII-9. INPUT estimates that VA's cost will be \$466 million from 1997-1999.

Exhibit VII-9

VA's Y2000 Cost (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
4	53	58	47	0	162

5. Lessons Learned

- External interfaces can complement the conversion process and allow for easy portability if necessary
- Compliance of COTS products should be fully assessed before a decision to use them is made

6. Advice to Others

VA cautions other agencies to keep close contact with the vendors to ensure that the proposed solution will deliver the largest benefit to the agency. COTS products must be scrutinized for their capabilities and vendors must consistently provide status updates to the client.

I

National Aeronautics and Space Administration

1. Organization

Overall responsibility for the year 2000 issue is held by the Chief Information Officer. NASA has also designated a Y2000 project manager who has day-to-day responsibility for management of the project. Each center then has a CIO responsible for the project in his/her particular enterprise. NASA intends to verify year 2000 performance reports utilizing three echelons of management oversight:

- NASA Center CIO Representatives - collecting and verifying center level performance information
- NASA Enterprise CIO Representatives - collecting and reviewing progress reports from the centers
- CIO Office - monitor performance of overall project

The NASA CIO has assigned specific responsibilities to several centers as follows:

- Lewis Research Center - workstation hardware and software
- Marshall Space Flight Center - communications and network software & mainframe computer operating software (IBM compatible)
- Ames Research Center - supercomputer operating software

2. Status of Conversion

NASA anticipates having the conversion effort complete by late 1998. Planned tools include Computer Associates' Inventory, CA's Migrate, CA's Impact, Hourglass, Natural Parser. Possible disruptions to timely implementation will be attributed to too few resources, both in personnel and funding, or unavailability of Y2000 compliant COTS products.

NASA does have some systems which are already Y2000-compliant. These include:

- Space Station Training Facility at JSC
- Shuttle Avionics and Integration Laboratory at JSC
- Institutional Network Services at JSC
- Vehicle Master Database at JSC
- Shuttle Mission Operations Mission Control Center at JSC
- Checkout, Control & Monitor Subsystem at KSC
- Payload Checkout System at KSC
- Flight Simulation Computing System at LARC
- Major Applications on FSCS at LARC
- Numerical Propulsion Simulation System at LERC
- 173 Systems processed by the NASA Administrative Computing Center at MSFC
- NASA Supply Management System at MSFC

3. Contingency Plans

NASA has planned for possible system failure. One method involves the use of Hot Site disaster recovery, or other services and software offered by commercial providers.

4. Cost

The cost estimates reported by NASA are shown in Exhibit VII-10. INPUT estimates that NASA's cost will be substantially higher, at almost \$125 million.

Exhibit VII-10

NASA's Y2000 Cost (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
0.1	8.5	20.5	21.1	2.2	43.4

Source: NASA

5. Lessons Learned

- Agencies need to be well-organized from the top-down
- Resources are too few given recent cost cutting efforts
- Test-bed software licensing is a cost vendors are currently unwilling to negotiate

6. Advice to Others

NASA advises other agencies to do a business case in order to check planned methodologies for cost effectiveness. Cost is a major factor for the Administration. Agencies must also provide enterprise-level management for Y2000 strategies. Coordination and planning are two keys to success.

(Blank)



Defense Agency Analyses

A

Department of the Air Force

1. Organization

The Department of the Air Force is utilizing a centralized control/decentralized execution approach. The Chief Information Officer has oversight for the project and implementation of solutions will be done by the Y2000 project managers.

2. Status of Conversion

The Air Force anticipates that all implementation will be complete by 1999. Disruptions may result from Y2000 compliant COTS being delivered too late to be integrated and tested in the Air Force systems.

3. Contingency Plans

The Air Force does have a contingency plan in the works; however, the logistics involved in the plan have not yet been finalized.

4. Lessons Learned

- Aggressive and active involvement at all management levels is required
- Agencies must have early and firm commitment and support by the management staff

5. Advice to Others

The Air Force encourages other agencies to take the problem seriously. Senior managers must be committed and involved. The Y2000 challenge is much more management-oriented than technically-oriented.

B

Department of the Army**1. Organization**

The Department of the Army is also taking a centralized management/decentralized execution approach. The CIO has overall oversight for the effort and Y2000 project managers are tasked with the day-to-day implementation.

2. Status of Conversion

The Army plans to conclude Y2000 conversion by late 1999. Certain factors which may disrupt progress are as follows:

- Funding
- Testing
- Problem identification and understanding
- Interface management

3. Contingency Plans

The Department of the Army does have a contingency plan in the event of system failure. Army will focus on systems individually when formulating risk management plans

4. Advice to Others

The Army advises other agencies to begin the process as early as possible due to the limited time resources.

C

Office of the Secretary of Defense**1. Organization**

The Department of Defense Chief Information Officer, who is also the Assistant Secretary of Defense for C3I, is responsible for oversight and coordination of all DoD Y2000 functions. Implementation is delegated to the Component Heads, who are responsible for making sure all software and systems correctly process dates. DoD is using the five phase process in dealing with the problem:

- Awareness
- Assessment
- Renovation
- Validation
- Implementation

2. Status of Conversion

DoD has recognized the potential devastating extent of the Y2000 problem. The Defense Finance and Accounting Service, for example, detailed the impacts in an August 1997 GAO Report. DFAS systems may be unable to “pay millions of active and retired military and civilian personnel and annuitants accurately and on time, disburse funds to pay millions of contractor and vendor invoices or account for DoD’s worldwide operations.

To address the problem, DoD has taken the following steps:

- Established a Y2000 systems inventory
- Prepared cost estimates for renovation
- Instituted a quarterly year 2000 status reporting process
- Appointed a project manager to provide year 2000 guidance and track year 2000 progress
- established a year 2000 certification program that defines the conditions that must be met for automated systems to be considered compliant.

DoD has chosen to outsource part of the Y2000 conversion effort mainly for economic reasons. They feel that actual experience is more important than perceived capabilities. Execution of the technical fixes are done at the lowest level possible where there is the most familiarity with the system. DoD is just beginning to inventory the Y2000 tools that are currently in use and a variety of vendors are currently in use for almost all tasks associated with Y2000.

3. Contingency Plans

The military departments and the defense agencies are required by the Chief Information Officer to establish contingency plans for each mission critical system. The Department of Defense has initiated contingency planning on non-compliant systems which are at risk of not being replaced or repaired

prior to the century date change. Each mission-critical system has a plan for how the core function will be achieved if the system fails.

4. Cost

The Department of Defense's costs associated with the year 2000 problem are shown in Exhibit VIII-1. INPUT believes that these estimates are understated and that DoD's conversion will cost \$4.1 billion between 1997 and 1999.

Exhibit VIII-1

DOD's Y2000 Costs (\$M)

FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	Total
10.6	389.2	659.8	281.1	7.1	1,409.4

Source: DoD Progress Letter, August 1997

5. Lessons Learned

- Top level management involvement is critical
- All systems interfaces must be fixed along with the actual system

6. Advice to Others

DoD urges other agencies to obtain top level commitment and involvement early in the process. Also, agencies must ensure that all interfaces have been accounted for and are Y2000 compliant as well as the systems themselves.

D

Department of the Navy

1. Organization

The Department of the Navy has designated four main groups for dealing with the Y2000 problem, each with a distinct set of responsibilities:

- *Chief Information Officer* - responsible for overall program management and metric tracking, policy coordination and reporting to appropriate parties
- *Resource Sponsors* - tasked with assessing the problem scope, requirements and impact
- *System Owners* - responsible for implementing Y2000 fixes
- *Infrastructure Owners* - also have the responsibility for implementing fixes but also tasked with identification of resources and disparities

2. Status of Conversion

The Department of the Navy made the following statements regarding the Department's position on Y2000 as part of their August 29, 1997 CIO Guidance and Policy Paper:

- "Fixing the year 2000 problem must be our highest priority behind life-threatening and mission failure repairs."
- "The year 2000 problem must be assessed and solutions developed, validated and implemented."
- "The replacement of legacy systems with commercial-off-the-shelf (COTS) based systems is strongly encouraged."
- "Year 2000 compliance requirements must be funded."
- "Year 2000 fixes must be deployed in CY 1998, if at all possible."

The Navy also stated that there will be no additional funding for the year 2000 problem.

The Navy intends to take a centralized management/decentralized execution approach with all reporting to be done to the Defense Integration Support Tools program.

Following are selected non-Y2000 compliant logistics systems and their planned implementation dates:

- Naval Inventory Control Point Resystemized - July 1998
- Naval Inventory Control Point Non-Resystemized - December 1998
- Navy Stock Points Inventory Control System - December 1998
- Logistics Procurement System - December 1998
- TANDEM - December 1998

The Navy does have certain vehicles in place to assist with the necessary software and services for the year 2000 project. In particular, the Information Technology Support Services (ITSS) BPA provides contract services for outsourcing business process reengineering and year 2000.

ITSS required that competing contractors met a Y2000 compliance criteria. The Navy defined "compliance" as:

“Fault free in the processing of date and date related data (including but not limited to calculating, comparing and sequencing) by all software components individually and in combination, upon installation. Fault-free performance includes the manipulation of data with dates prior to, and beyond January 1, 2000, and shall be transparent to the user.”

The following services are available on the ITSS BPA:

- Analysis of existing software systems and their interaction
- Analysis of interfaces with external systems
- Analysis of existing hardware with respect to date generation
- Design changes to parameters, job control language, tape files, disk files, database reports and screen displays
- Implementing code to handle design changes
- Modification of existing code to handle a four digit year
- Unit testing and debugging of all changes
- Integration testing of all software components
- Parallel testing before systems can become operational
- Reinsertion of corrected programs into production

Currently, seven vendors hold ITSS contracts: Booz-Allen & Hamilton, CDSI, Logicon, Lockheed Martin, SAIC, Litton/PRC and Northrop Grumman.

3. Contingency Plans

The Navy has recognized the need for contingency plans; however, there are no formal implementation guidelines yet in place.

4. Cost

Funding for 63 telephone switches in need of Y2000 fixes will be drawn from FY98-99 funding for the Base Level Information Infrastructure (BLII) Modernization project. The fix will include a combination of replacement, upgrade, regionalization and outsourcing.

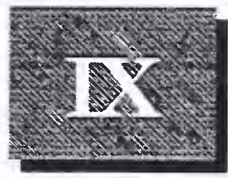
5. Lessons Learned

- The complexity involved with the Y2000 problem is in project management and not technical aspects
- Constant reporting is using valuable resources which can be better spent in other problem areas
- Agencies must adapt to working with little funding and few tools
- A single entry point in DIST is needed for all systems in order to minimize data problems
- Best practices should be shared with others
- Senior management support is essential
- Y2000 efforts will continue to consume more resources than originally anticipated
- A valuable management tool is the functional interface workshop

6. Advice to Others

The major piece of advice given by the Department of the Navy is that information sharing is essential and that the project requires sound and involved senior management. Problems may be avoided by making others aware of both successes and failures. Also, management oversight and complete project planning overshadows the technical aspects in importance.

(Blank)



Conclusions and Recommendations

The year 2000 is quickly approaching. While many people will celebrate the 2000 new year with festivities and fun, others will be worrying about whether they will still be in business when they return to work the following day. The century date change could potentially wreak havoc upon computer systems across the world. It stands to reason that one of the largest buyers of IT hardware, software and services, the federal government, will also be drastically impacted.

The following chapter provides a summary of the progress federal agencies have made in dealing with the century date change problem. Also, the costs per agency both from a financial and a personnel standpoint are addressed as well as the impact of these costs on the federal IT market. From these findings, INPUT has developed some recommendations for vendors attempting to play a part in the government's solution.

A

General Observations

In its report entitled, *Getting Federal Computers Ready for 2000*, the Office of Management and Budget reported agency estimates of \$2.3 billion to fix this problem. With the din of loud criticism in the background, the government has since publicly stated that this number is too low. OMB now asserts that this was a preliminary estimate and that more accurate estimates will become available after agencies complete the assessment phase. The August progress reports submitted by each agency to OMB increased the federal cost estimate to \$3.8 billion and the subsequent November 15 report only showed an increase in this estimate of \$100 million.

It is clear in the current political environment that the money to fix this problem will first come from agency IT budgets and then from program budgets — at the expense of which programs is yet to be determined. Only if the cost to fix this problem approaches the high end of industry estimates will

Congress consider special appropriations to supplement agency budgets. And that will only happen if mission-critical systems are faced with failure. However, as this report was finalized, the Clinton Administration announced its intention to order more than a dozen agencies to redirect funding in the hundreds of millions of dollars to perform Y2000 fixes.

The latest progress reports show that the federal government does, in fact, face system failure. Each quarter agencies find more systems which must be classified as mission-critical and that need a certain degree of conversion to become Y2000 compliant. Original estimates are now being completely dwarfed by the latest assessment. Many agencies are also being classified as "late" in the conversion process. Some agencies have not yet completed the assessment phase, which is the first step in remedying the problem.

Also, agencies have not taken a close enough look at the human resource cost associated with the Y2000 problem. The issue is not just one of money, but also the number of information technology personnel that will be diverted from their normal function to work on Y2000 conversion. INPUT estimates that this is a significant number - a number which will begin to balloon as agencies get closer to the year 2000.

INPUT forecasts that the federal government will spend \$10.9 billion on year 2000 efforts from 1997 to 1999. Of this total, \$8.1 billion will be spent externally, which is funding potentially available to vendors of Y2000 software and services. Additionally, almost 46,000 federal IT employees will need to be diverted from their normal function to deal with the Y2000 issue.

Agencies will spend 25.7% - or \$2.8 billion - of their total Y2000 costs on internal staff. This differs from the commercial world, which will spend 29% of its total cost on internal staff. This difference is attributable to the substantial government downsizing that has occurred in the last several years and the lack of specific skills to address the Y2000 problem in federal agencies, generating a major opportunity for professional services vendors.

The net impact of this problem on the professional services market is that instead of a \$9.2 billion market from 1997 to 1999, approximately \$13.2 billion may be spent in the basic professional services mode. This level of expenditure could affect other professional services modes, namely systems integration and outsourcing, but more than likely it will have an impact on other service modes within the IT budget and programs outside the IT budget.

B

Specific Conclusions

The problem is more of a management issue than a technical concern.

Many agencies reported that one of the largest lessons they learned during the assessment of Y2000 compliance is that management must play key roles. Without the buy-in of upper management and the establishment of program managers, there will be no progress in resolving the issue.

Many agencies and vendors know what it will take technically to solve the problem. The only roadblock is actually getting to the point of implementing technical fixes. This is a management concern which involves acquisition of funding, dedication of resources and oversight.

Agencies have underestimated the scope of the project.

Based on the quarterly progress reports which each agency submits to the Office of Management and Budget, it is evident that agencies' original estimates of the problem scope were grossly understated. Many agencies are revising their original estimates in recent reports. However, the original, unrealistic view of the problem resulted in incorrect cost projections and the sluggish reaction by management, problems which agencies are now fighting to overcome to get the effort back on track.

In each successive progress report, agencies are finding more systems which are not Y2000 compliant, compounding the original problem. Also, agencies remain behind schedule in general. The government would have been taking a chance of missing the deadline even if they had held to the original timetables. Now, failure to meet deadlines has pushed progress even further behind.

Each agency has distinct Y2000 requirements.

Each government agency exists for a specific purpose and, as a result, their systems are tailored to certain needs and are designed to perform distinct functions. Every agency has a different Y2000 problem. Therefore, every agency will need a different solution, which compounds the problem. Any outside vendor must learn the system, its functions and how it interacts with other systems. Because each system is distinct, the learning curve is extended. This factor will take its toll on the precious Y2000 resource of time.

Agencies are failing to take the personnel issue into consideration

In all recent government reports, agencies have shown what they estimate the Y2000 problem to cost. All attention of late has been focused on the fiscal impacts of the Y2000 problem on agencies. Agencies have failed to consider that the problem is not just one of money, but also human resources. For every agency which will need to implement some form of Y2000 fixes, a significant number of internal IT personnel will have to be diverted from their normal mission critical function to deal with the problem. This leaves fewer IT resources working on the normal technology functions of the agency. Y2000 stands to hinder IT productivity in other important areas, including procurement of non-Y2000-related information technology.

As the year 2000 approaches and agencies see the reality of being behind schedule, additional IT personnel will need to be diverted to the Y2000 cause. The potential impacts on agencies could be extreme.

“Triage” must play a part in the implementation plan.

Agencies are now concentrating on solving the problem before the date change. However, realism dictates that this will not happen. Some systems will fail. An effective contingency plan will limit the damage when these systems do fail. Agencies must factor contingency planning into the overall Y2000 implementation plan.

The purpose of a “triage” strategy is to prioritize systems in order to ensure that the most critical are repaired first. The agency assumes that there will be some systems that they will not have enough time to fix.

More importantly, systems interface with other systems. If one system is Y2000 compliant and another is not, the non-compliant system may crash, thus hindering the functions of the compliant system or crashing it entirely. Triage must not be isolated by system but must also take into account the overall function of the organization and how those systems interact to perform that function.

Vendors have a significant opportunity to gain valuable new business during the next three years.

Both the time and human resource concerns are expected to have dramatic effects on the federal government. Moving IT personnel from their normal function to deal with the Y2000 problem will leave shortages in other critical areas. Inevitably, agencies will get down to the wire. Part of planning must factor outsourcing needs. Inevitably, many agencies will need to look to vendors for both services and software not only to fix the Y2000 problem but to help in other areas impacted by skill shortages.

C**Recommendations**

Understand the scope of the problem and its impacts.

The Y2000 problem is much more than just a few bad lines of code in a system. It is a problem in which major processing systems face failure, causing problems with interfaced systems and potentially slowing or stopping an agency's core business function. Vendors can not look at the problem in a vacuum. The entire agency's environment must be understood and the relationship of systems to the core business functions must be properly assessed. The successful vendor will be one who takes the time to completely understand the agency's situation and needs.

Emphasize the total "solution."

Though cost often ranks lower than factors such as past performance in evaluating bids, it will remain a key factor in the new procurement environment. A vendor's ability to present a total solution to an agency requirement and demonstrate the savings to be achieved through implementation of that solution will be a major selling point in the next five years. In a government where personnel have been downsized, a vendor's ability and willingness to "augment" the current resources of an agency will make a difference in vendor selection.

Market capabilities to program managers.

Most agencies have assigned program managers to deal with all Y2000 efforts. These are the people that need to be made aware of all of the options available for solving the problem. Vendors must make their capabilities known to management - especially highlighting familiarity with the agency's processing environment and the problem the agency faces with its systems. Once again, vendors should concentrate on marketing an overall solution rather than just a quick fix.

Market the GSA schedule.

Vendors should look beyond the standard full and open competitive procurements for new business opportunities. Y2000 vendors will find a strong market for their products through GSA schedules, particularly with BPAs, which agencies ranked almost as favorably as full and open competition as a means of procurement. Small businesses and 8(a) vendors should also push their presence in this market, since set-asides for such firms also ranked closely to full and open competition as a preferred acquisition method.

Once on a schedule, vendors are encouraged to be proactive in publicizing their Y2000 offerings. Continue to market your year 2000 products and services. Be particularly aware of and utilize eased regulations to make products more attractive to agencies, such as spot price reductions and teaming arrangements under a schedule.

Understand the impact of the human resource factor.

The Y2000 problem will have significant impacts on the federal workforce. Agencies who divert IT personnel to the Y2000 effort may experience shortfalls in other technology areas. Vendors have a chance to augment the existing personnel base of many agencies. There must, however, be a willingness of vendors to offer an overall solution including personnel support rather than just a product. INPUT estimates that close to 46,000 full-time equivalent federal employees will be supporting Y2000 over the next three years. A vendor who can offer assistance in this key area will be much more successful than those with no support capabilities.

Highlight contingency capabilities.

Contingency planning is one of the most important and critical factors in dealing with the year 2000 problem. To date, agencies are not taking it as seriously as they should. Some systems are guaranteed to crash. There is absolutely too little time to fix all systems. Agencies must realize that there must be fallbacks in place when these systems do fail. Vendors who can both assist in the implementation of a triage strategy and who can properly correct failures stand to gain a healthy amount of business over the next three years.

One caution, however, is the warranty issue. A vendor providing any Y2000 assistance must be aware that any system is capable of failure. The question then becomes, "Who is responsible for picking up the pieces?" INPUT suggests careful consideration of the legal impacts of Y2000 crashes. All contracts with federal agencies need to address the issue of responsibility.

Consider legal ramifications.

As stated before, a vendor who has not properly factored the warranty issue into the initial contract stands to lose in many ways. There must be responsible parties for any problems which may arise as part of the Y2000 conversion effort. Vendors must be aware that improper planning may cause them to be held responsible by agencies for any system failures. This could drive some vendors quickly out of business. Take heed when contracting.

More legal ramifications of the Y2000 problem are addressed in INPUT's White Paper, provided in Appendix E.

Broaden market focus.

To capitalize on the federal Y2000 market to the maximum extent, vendors may consider broadening their services base and pursuing both civilian and defense opportunities, if they are not already doing so. Civilian agencies command the greatest share of the professional services market, a large component of the Y2000 problem, and will likely witness stronger growth. However, DoD still comprises a major portion of the current opportunities. If possible, vendors should not limit themselves to one realm over the other.

Additionally, vendors should consider teaming arrangements. Other vendors may have an existing agency presence with a place on a team for a vendor with specific capabilities. Also, the concept of a team, with each member providing specialized products and services, allows the agency to have a "one-stop shop" for their Y2000 solution.

Engage CIOs and other agency decision-makers.

CIOs will be the primary shapers of the Y2000 market of tomorrow. This force is too great to neglect by any vendor. Vendors must develop meaningful relationships with CIOs and other key decision-makers, namely Y2000 program managers, in each agency. Not only will this factor be critical for future projects, it will also be instrumental in deciding the fate of existing contracts and initiatives. Get into the mindset of the CIOs and understand their requirements from their perspective, not necessarily only from the perspective of a vendor.

Vendors who are successful in their Y2000 solution delivery basically seal their future within an agency. This is perhaps the greatest technological problem of the modern age. It is the perfect opportunity for a vendor to establish itself and secure a place in the agency's future with positive past performance ratings.

D

Closing Remarks

All of the above recommendations will help vendors maintain their competitive edge in dealing with the year 2000 problem. The federal market is in a state of change because of the federal acquisition reforms of 1996. This state of flux has created a degree of uncertainty that makes clear predictions and forecasts of the market and its future composition difficult at best. One of the few things that can be asserted with confidence is that this market will change significantly over the next two years, as agencies come closer to the deadline and realize they are not ready, creating a prime opportunity for vendors not only to solve the problem at hand but also to establish a precedent - paving the way for future business.

The bottom line is that the year 2000 is inevitable. It will take its financial toll. It will take its personnel toll. In an area in which everyone is in the dark about the final outcome, it only takes a solution that works to make a vendor shine. Critics are very skeptical about overall success. A vendor who can "save" an agency from catastrophic consequences has gained the perfect marketing edge for the future. There is no better record of past performance than contributing to the successful solution of the largest technological problem in history.

****Note:** As this report went to press, the November 15, 1997 Progress Report was released by the Office of Management and Budget. Though the cost estimates and numbers of mission critical systems did not change dramatically, the fact that many agencies will fail to meet their deadlines is reinforced. After the report was released, Congressman Horn presented his own predicted completion dates which, for many agencies was after the year 2010, considering the current implementation pace.

The OMB report may be found on the Internet at,
"<http://www.cio.fed.gov/Y2Knov97.htm/>".



Y2000 Services Schedule Holders

Advanced Management, Inc.	GS-35F-4365G
AJ, Incorporated	GS-35F-4430G
Aepco, Incorporated	G3-35F-4822G
ATS	GS-35F-3292G
BDM Federal , Inc.	GS-35F-4522G
Blackwell Consulting Services	GS-35F-4515G
Booz-Allen & Hamilton	GS-35F-4057G
CACI, Inc.	GS-35F-4483G
Cost Data Systems, Inc.	GS-35F-4415G
Computer Sciences Corp.	GS-35F-4381G
Coopers & Lybrand	GS-34F-4451G
Cost Management Systems	GS-35F-4476G
Datarac Information Service	GS-35F-4513G
DLT Solutions	GS-35F-4543G
Electronic Data Systems	GS-35F-3109G
Entek, Inc.	GS-35F-0216G
Federal Computer Corporation	GS-35F-4469G
Fu Associates, Ltd.	GS-35F-4052G
GMR	GS-35F-4507G

GTSI	GS-35F-4120D
Harvey Industries	GS-35F-4617G
HP	GS-35F-0002D
ISIS 2000	GS-35-4823G
I-Net, Inc.	GS-35F-4131D
ICF Information Technology	GS-35F-4121D
Information Builders	GS-35F-0043D
Information Spectrum, Inc.	GS-35F-4033G
Information Sys. & Network	GS-35F-4595G
Integrated Systems Control	GS-35F-4571G
Jet Form Corporation	GS-35F-4160D
KPMG Peat Marwick	GS-35F-4338G
Logicon	GS-35F-4506G
Logistics Management Institute	GS-35F-2051G
Lockheed Martin Federal Systems	GS-35F-4514G
Management Systems Designers	GS-35F-4550G
Mega-Tech, Inc.	GS-35F-4495G
Northrop Grumman Data Sys.	GS-35F-4005G
Performance Engineering Corp.	GS-35F-4366G
Pinkerton Computer Consulting	GS-35F-4454G
Platinum Technology, Inc.	GS-35F-0182D
Praxis, Inc.	GS-35F-4224D
PRC	GS-35F-4340G
Quadrtek, INC.	GS-35F--4793G
Purlar Data Systems, Inc.	GS-35F-4232G

Reston Consulting Group, Inc.	GS-35F-4405G
Seta	GS-35F-4490G
Sherikon, Inc.	GS-35F-4089D
Signal Corporation	GS-35F-4488G
STMS, Inc.	GS-35F-3266H
SRA	GS-35F-4594G
Skytel	GS-35F-4255D
Tomco Systems	GS-35F-4400G
Toshiba American Information	GS-35F-3304D
Troy Systems, Inc.	GS-35F-4525G
User Technology Associates	GS-35F-4579G
Viasoft, Inc.	GS-35F-0212G

A more comprehensive list of vendors was published by the Defense Information Systems Agency (DISA) and is accessible on the Internet at, "<http://sw-eng.falls-church.va.us/y2k-testing/tools/vendors.shtml>".

(Blank)



User Questionnaire

INPUT, a research and consulting company based in Vienna, Virginia, is conducting a study of agency readiness for Y2000. I would like 10 minutes of your time so that we might understand your agency's preparations in this area.

Your name will not be released and all your answers will be treated in confidence. We will publish an agency overview from our interviews and publicly available information. We will send a complementary copy of the executive summary of this study as a thank you for your assistance.

Are you responsible for your agency's IT preparation for the year 2000?

- Yes _____ No _____

-

If **YES** — Go to Question 1

If **NO** — Who is the person responsible for this activity?

NAME: _____

POSITION: _____

PHONE: _____

Thank you for your assistance.

End of interview

Status of preparation

1. Which of the following activities have you completed in preparation for Y2000? (Select all that apply)

Activity	Completed
Working on obtaining upper management buy-in (Awareness)	
Someone made responsible for Y2000 readiness (CIO, Y2k Program Manager)	
Developed plan of action (Assessment)	
Audited all applications (Assessment)	
Modified or changed applications (Renovation)	
Migration (Validation)	
Testing (Validation)	
Implemented revised applications (Implementation)	
Other _____	
Other _____	

- 1a. Comments on current status

Preferred Approach to Resolving the Issue

2. Please rate, on a scale of 1 to 5 how likely it is that you will use the following approaches to changing your applications.
(1 = "will not use" and 5 = "will definitely use"),

Approach	Rating
Implement upgrade to existing package	
Modify existing custom software	
Rewrite existing application	
Build new custom application	
Implement new application package	
Outsourcing your IT department	
Outsource management of application code	
Contract for a disaster recovery service	
Other _____	
Other _____	

- 2a. Comments on approach to Y2000 issue

Critical Skill Requirements

3. Please rate, on a scale of 1 to 5, how important the availability of the following skills is to the success of your Y2000 preparations (1 = "not important" and 5 = "very important"),:

Skill	Importance
Project Management Expertise	
Y2000 Audit experience	
Implementation of package software	
Previous experience with Y2000 changes	
COBOL program development	
C language development	
Other language development (please name) _____ _____	
Other Skills (describe) _____ _____	

3a. Comments on skill requirements

4. Please indicate which of the following functions will be performed using internal staff (I) or external service provider (E).

Function	Provided by:
Project Management	
Transition Methodology - the Plan	
Inventory	
Assessment	
Planning	
Migration (rehosting, rewriting, replacing, etc.)	
Testing	
Implementation	
Other Functions (describe) _____	

4a. Other Comments

5. Which of the following skills would be needed from an external service provider?

Skill	Use an ESP
Project Management	
Strategy Consulting	
Application Design and Development	
Test Planning and Design	
Network Planning and Design	
Data Migration/Database Design	
Testing	
Implementation (roll-out)	
Other Skill (describe)	

5a. Other Comments

Source of Funding for Y2000 preparation

6. Please indicate which of the following sources you intend to use to fund your Y2000 preparation?

Source	Y/N
Separately budgeted item	
Included in budgets of previously planned projects	
Reduce/cancel expenditure in other IT developments	
Increase/overrun previous budgets	
Reduce non/IT expenditure	
Other (describe) _____	
Do not know how it will be funded	

- 6a. Comments on source of Y2000 funding

Y2000 Tools

- 7a. Please list any special tools you have used, or intend to use, to help with your Y2000 preparations?
- 7b. On a scale of 1 to 5, how useful was each tool used?
(1= "not useful" and 5 = "very useful")

Tool (If name of tool not known, identify its purpose)	Usefulness (if used)

- 7b. Comments on Y2000 tools

Vendors

8. How would you rate the suitability of the following types of vendors to provide assistance with your year 2000 plans?
(1 = "not suitable" and 5 = "most suitable")

Vendor type	Suitability
Y2000 Consultants: companies that evolved or were created to address the Y2000 issue	
Y2000 Tool Vendors: companies focusing primarily on providing tools to assist others in the Y2000 inventory, assessment, migration and testing	
Outsource/Off-shore Providers: companies that focus on migrating systems with large labor pools or semi-automated "factories"	
Systems Vendors: companies that offer both hardware/software solutions and professional services	
Professional Services Vendors: Y2000 extensions to existing services and partnerships with tool vendors	
Other Type of Vendors _____ _____	 _____ _____

9. Have you used, or do you intend to use, any outside service vendors to help you with your Y2000 preparations?

Yes _____ No _____

- 9a. If "Yes", then who were the vendors and what did they do?

Vendor	Task Performed

- 9b. Comments on Y2000 service vendors

Estimate of cost

10. What is your current estimate of the cost, to your agency, of fixing the Y2000 problem?

☐ Less than \$1 million ☐ \$101 million - 200 million
☐ \$1M - \$50 million ☐ \$201 million - \$300 million
☐ \$51M - \$100 million ☐ Over \$300 million
☐ Do not know

10a. What percentage of your estimate to fix the Y2000 problem do the following elements represent?

Cost elements	%
Internal staff	
Software package upgrade	
Cost of new application package	
External consultants and developers	
New hardware	
Education and training	-
Other (describe)	-

10b. Comments on the cost of preparing for Y2000

Timescale for completion

11. When do you think you will have all IT changes complete and implemented?

_____ Already complete _____ 1998

_____ 1996 _____ 1999

_____ 1997 _____ 2000

_____ Will not finish by 2000

11a. What factors are most likely to disrupt your plans and cause you to miss your targets? (please list)

-

Disaster recovery

12 Do you have a disaster recovery plan in place in the event you are not able to meet the Y2000 deadline on all of your systems

- Yes _____ No _____

12a. If yes, please describe what the plan involves.

13. What lessons have you learned in considering the Y2000 problem?

14. What is your advice to other companies when they are considering the Y2000 issue?

Other comments

Thank you for your time and patience. We will send you a summary of the study as soon as it is available.

End of interview

(Blank)



Definitions

The definitions in this appendix include hardware, software, services and telecommunications categories to accommodate the range of information systems and services programs described in this report.

Alternate service mode terminology employed by the federal government in its procurement process is defined along with INPUT's regular terms of reference, as shown in Exhibit B-1.

A

Overall Definitions and Analytical Framework

Information Services. Include computer/telecommunications-related products and services that are oriented toward the development or use of information systems. Information services typically involve one or more of the following:

- ☐ Processing of specific applications using vendor-provided systems (called *Processing Services*)
- ☐ A combination of hardware, packaged software and associated support services that will meet a specific application processing need (called *Turnkey Systems*)
- ☐ Packaged software (called *Software Products*)
- ☐ People services that support users in developing and operating their own information systems (called *Professional Services*)
- ☐ Bundled combinations of products and services in which the vendor assumes responsibility for the development of a custom solution to an information system problem (called *Systems Integration*)
- ☐ Services that provide operation and management of all or a significant part of a user's information systems functions under a long-term contract (called *Systems Operations*)

- ❑ Services associated with the delivery of information in electronic form, typically network-oriented services such as value-added networks, electronic mail and document interchange, on-line databases, on-line news and data feeds, video text, etc. (called *Network Services*).

In general, the market for information services does not involve providing equipment to users. The exception is the case in which the equipment is bundled as part of an overall service offering such as a turnkey system, a systems operations contract, or a systems integration project.

The information services market also excludes pure data transport services (e.g., data or voice communications circuits). However, where information transport is associated with a network-based service (e.g., EDI or VAN services), or cannot be feasibly separated from other bundled services (e.g., some systems operations contracts), the transport costs are included as part of the services market.

The analytical framework of the *Information Services Industry* consists of the following interacting factors: overall and industry-specific business environment (trends, events and issues); technology environment; user information system requirements; size and structure of information services markets; vendors and their products, services and revenues; distribution channels; and competitive issues.

All *Information Services Market* forecasts are estimates of User Expenditures for information services. When questions arise about the proper place to count these expenditures, INPUT addresses them from the user's viewpoint: expenditures are categorized according to what users perceive they are buying.

By focusing on user expenditures, INPUT avoids two problems that are related to the distribution channels for various categories of services:

- ❑ Double counting, which can occur by estimating total vendor revenues when there is significant reselling within the industry (e.g., software sales to turnkey vendors for repackaging and resale to users)
- ❑ Missed counting, which can occur when sales to users go through indirect channels such as mail order retailers.

Product/Service Markets are defined as specific products and services that satisfy a given user need. While Market Sectors specify who the buyer is, *Product/Service Markets* specify what the user is buying.

Of the eight delivery modes defined by INPUT, five are considered primary products or services:

- ❑ Processing Services

- ☐ Network Services
- ☐ Professional Services
- ☐ Applications Software Products
- ☐ Systems Software Products.

The remaining three delivery modes represent combinations of these products and services, bundled together with equipment, management and/or other services:

- ☐ Turnkey Systems
- ☐ Systems Operations
- ☐ Systems Integration.

Section B describes the delivery modes and their structure in more detail.

Outsourcing is defined as the contracting of IS functions to outside vendors. Outsourcing should be viewed as the opposite of insourcing: anything that IS management has considered feasible to do internally (e.g., data center operations, applications development and maintenance, network management, training, etc.) is a potential candidate for outsourcing.

IS has always bought systems software, as it is infeasible for companies to develop it internally. However, all other delivery modes represent functions or products that IS management could choose to perform or develop in-house. Viewed this way, outsourcing is the result of a make-or-buy decision, and the outsourcing market covers any product or service for which the vendor must compete against the client firm's own internal resources.

B

Industry Structure and Delivery Modes

1. Service Categories

Exhibit B-1 presents the structure of the information services industry. Several of the delivery modes can be grouped into higher-level Service Categories, based on the kind of problem the user needs to solve. These categories are:

- ☐ *Business Application Solutions (BAS)*—are prepackaged or standard solutions to common business applications. These applications can be either industry-specific (e.g., mortgage loan processing for a bank), cross-industry (e.g., payroll processing) or generic (e.g., utility time sharing). In

general, BAS services involve minimal customization by the vendor and allow the user to handle a specific business application without having to develop or acquire a custom system or system resources. The following delivery modes are included under BAS:

- ⇒ Processing Services
- ⇒ Applications Software Products
- ⇒ Turnkey Systems.

- ❑ *Systems Management Services (SMS)*—are services that assist users in developing systems or operating/managing the information systems function. Two key elements of SMS are the customization of the service to each individual user and/or project and the potential for the vendor to assume significant responsibility for management of at least a portion of the user's information systems function. The following delivery modes are included under SMS:

- ⇒ Systems Operations
- ⇒ Systems Integration.

Each of the remaining three delivery modes represents a separate service category:

- ❑ Professional Services
- ❑ Network Services
- ❑ Systems Software Products.

Note: These service categories are a new concept introduced in 1990. They are purely an aggregation of lower-level delivery mode data and do not change the underlying delivery modes or industry structure.

2. Software Products

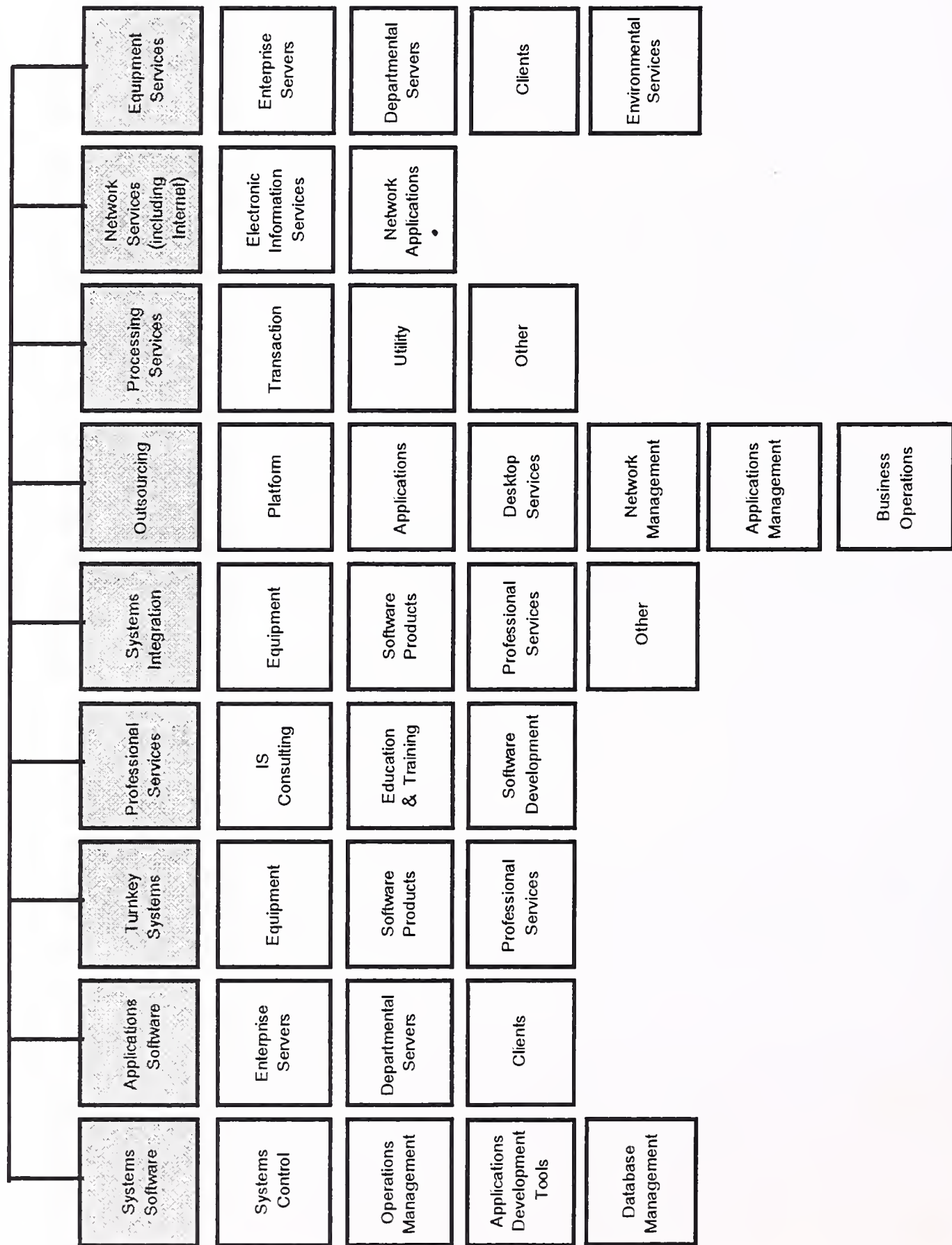
There are many similarities between the applications and systems software delivery modes. Both involve user purchases of software packages for in-house computer systems. Included are both lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's site. Vendor-provided training or support in operation and use of the package, if bundled in the software pricing, is also included here.

Expenditures for work performed by organizations other than the package vendor are counted in the category of professional services. Fees for work

related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself.

Exhibit B-1

Information Services Industry Structure



Software products have several subcategories, as indicated below.

3. Systems Software Products

Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. These products include:

- ❑ *Systems Control Products* - Include software programs that function during application program execution to manage computer system resources and control the execution of the application program. These products include operating systems, emulators, network control, library control, windowing, access control and spoolers.
- ❑ *Operations Management Tools* - Include software programs used by operations personnel to manage the computer system and/or network resources and personnel more effectively. Included are performance measurement, job accounting, computer operation scheduling, disk management utilities and capacity management.
- ❑ *Applications Development Tools* - Include software programs used to prepare applications for execution by assisting in designing, programming, testing and related functions. Included also are traditional programming languages, 4GLs, data dictionaries, database management systems, report writers, project control systems, CASE systems and other development productivity aids. Also included are system utilities (e.g., sorts) that are directly invoked by an applications program.

4. Applications Software Products

Industry-Specific Applications Software Products - Include software products that perform functions related to solving business or organizational needs unique to a specific vertical market and sold to that market only. Examples include demand deposit accounting, MRPII, medical record keeping, automobile dealer parts inventory, etc.

Cross-Industry Applications Software Products - Software products that perform a specific function that is applicable to a wide range of industry sectors. Applications include payroll and human resource systems, accounting systems, word processing and graphics systems, spreadsheets, etc.

5. Turnkey Systems

A turnkey system is an integration of equipment (CPU, peripherals, etc.), systems software, and packaged or custom application software into a single system developed to meet a specific set of user requirements. Value added by the turnkey system vendor is primarily in the software and support services provided. Most CAD/CAM systems and many small business systems are turnkey systems. Turnkey systems utilize standard computers and do not include specialized hardware such as word processors, cash registers, process control systems or embedded computer systems for military applications.

Hardware vendors that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included in the appropriate software category.

Most turnkey systems are sold through channels known as value-added resellers.

- ❑ *Value-Added Reseller (VAR)* - A VAR adds value to computer hardware and/or software and then resells it to an end user. The major value added is usually applications software for a vertical or cross-industry market, but also includes many of the other components of a turnkey systems solution, such as professional services.

Turnkey systems are divided into two categories:

Industry-Specific Systems - Include systems that serve a specific function for a given industry sector, such as automobile dealer parts inventory, medical record keeping or discrete manufacturing control systems.

Cross-Industry Systems - Include systems that provide a specific function that is applicable to a wide range of industry sectors, such as financial planning systems, payroll systems or personnel management systems.

6. Processing Services

This category includes transaction processing, utility processing and other processing services.

Transaction Processing - A client uses vendor-provided information systems including hardware, software and/or data networks at vendor site or customer site to process transactions and update client databases.

Transactions may be entered in one of four modes:

- ❑ *Interactive* - Characterized by the interaction of the users with the system for data entry, transaction processing, problem solving and report preparation: the user is on-line to the programs/files stored on the vendor's system.

- ☐ *Remote Batch* - When the user transmits batches of transaction data to the vendor's system, the vendor is allowed to schedule job execution according to overall client priorities and resource requirements.
- ☐ *Distributed Services* - Users maintain portions of an application database and enter or process some transaction data at their own site, while also being connected through communications networks to the vendor's central systems for processing other parts of the application.
- ☐ *Carry-in Batch* - Users physically deliver work to a processing services vendor.
- ☐ *Utility Processing* - Vendor provides basic software tools (language compilers, assemblers, DBMSs, graphics packages, mathematical models, scientific library routines, etc.), generic applications programs and/or databases, enabling clients to develop their own programs or process data on vendor's system.
- ☐ *Other Processing Services* - Vendor provides services, usually at vendor site, such as scanning and other data entry services, laser printing, computer output microfilm (COM), CD preparation and other data output services, backup and disaster recovery, etc.

7. Systems Operations

Systems operations involves the operation and management of all or a significant part of the user's information systems functions under a long-term contract. These services can be provided in either of two distinct submarkets:

- ☐ *Professional Services* - The vendor provides personnel to operate client-supplied equipment. Prior to 1990, this was a submode of the Professional Services product/service market.
- ☐ *Processing Services* - The vendor provides personnel, equipment and (optionally) facilities. Prior to 1990, this was a submode of the Processing Services product/service market.

Systems operations vendors now provide a wide variety of services in support of existing information systems. The vendor can plan, control, provide, operate, maintain and manage any or all components of the user's information systems (equipment, networks, systems and/or application software), either at the client's site or the vendor's site. Systems operations can also be referred to as "resource management" or "facilities management."

There are two general levels of systems operations:

- ☐ *Platform/network operations* - The vendor operates the computer system and/or network without taking responsibility for the applications.

- ☐ *Application operations* - The vendor takes responsibility for the complete system, including equipment, associated telecommunications networks and applications software.

Note: Systems Operations was introduced as a delivery mode in 1990.

8. Systems Integration (SI)

Systems integration is a business offering that provides a complete solution to an information system, networking or automation requirements through the custom selection and implementation of a variety of information system products and services. A systems integrator is responsible for the overall management of a systems integration contract and is the single point of contact and responsibility to the buyer for the delivery of the specified system function, on schedule and at the contracted price.

To be included in the information services market, systems integration projects must involve some application processing component. In addition, the majority of cost must be associated with information systems products and/or services.

The systems integrator will perform, or manage others who perform, most or all of the following functions:

- ☐ Program management, including subcontractor management
- ☐ Needs analysis
- ☐ Specification development
- ☐ Conceptual and detailed systems design and architecture
- ☐ System component selection, modification, integration and customization
- ☐ Custom hardware and software design and development
- ☐ Systems implementation, including testing, conversion and post-implementation evaluation and tuning
- ☐ Life cycle support, including:
 - ⇒ System documentation and user training
 - ⇒ Systems operations during development
 - ⇒ Systems maintenance

⇒ Financing.

9. Professional Services

This category includes consulting, education and training, and software development:

- ❑ *Consulting* - These services include management consulting (related to information systems), information systems consulting, feasibility analysis and cost-effectiveness studies, and project management assistance. Services may be related to any aspect of information systems, including equipment, software, networks and systems operations.
- ❑ *Education and Training* - Products and services related to information systems and services for the professional end user, including computer-aided instruction, computer-based education and vendor instruction of user personnel in operations, design, programming and documentation.
- ❑ *Software Development* - Services include user requirements definition, systems design, contract programming, documentation and implementation of software performed on a custom basis. Conversion and maintenance services are also included.

10. Network Services

Network services typically include a wide variety of network-based functions and operations. Their common thread is that most of these functions could not be performed without network involvement. Network services is divided into two major segments: Electronic Information Services, which involve selling information to the user, and Network Applications, which involve providing some form of enhanced transport service in support of a user's information processing needs.

11. Electronic Information Services

Electronic information services are databases that provide specific information via terminal- or computer-based inquiry, including items such as stock prices, legal precedents, economic indicators, periodical literature, medical diagnoses, airline schedules, automobile valuations, etc. The terminals used may be computers themselves, such as communications servers or personal computers. Users typically inquire into and extract information from the databases. Although users may load extracted data into their own computer systems, the electronic information vendor provides no data processing or manipulation capability and the users cannot update the vendor's databases.

The two kinds of electronic information services are:

- ❑ *On-line Databases* - These are structured, primarily numerical data on economic and demographic trends, financial instruments, companies, products, materials, etc.
- ❑ *News Services* - Includes unstructured, primarily textual information on people, companies, events, etc.

While electronic information services have traditionally been delivered via networks, there is a growing trend toward the use of CD ROM optical disks to support or supplant on-line services, and these optical disk-based systems are included in the definition of this delivery mode.

12. Network Applications

Value-Added Network Services (VAN Services) - VAN services are enhanced transport services that involve adding such functions as automatic error detection and correction, protocol conversion and store-and-forward message switching to the provision of basic network circuits.

Originally, VAN services were provided solely by specialized VAN carriers (Tymnet, Telenet, etc.). Today these services are also offered by traditional common carriers (AT&T, Sprint, etc.). Meanwhile, the VAN carriers have also branched into the traditional common carriers' markets and are offering unenhanced basic network circuits as well.

INPUT's market definition covers VAN services only, but includes the VAN revenues of all types of carriers.

- ❑ *Electronic Data Interchange* (EDI) - Includes application-to-application exchange of standardized business documents between trade partners or facilitators. This exchange is commonly performed using VAN services. Specialized translation software is typically employed to convert data from organizations' internal file formats to EDI interchange standards; this software may be provided as part of the VAN service or may be resident on the organization's own computers.
- ❑ *Electronic Information Exchange* (EIE) - Also known as Electronic Mail (E-Mail), EIE involves the transmission of messages across an electronic network managed by a services vendor, including facsimile transmission (FAX), voice mail, voice messaging, and access to Telex, TWX and other messaging services. This also includes bulletin board services.
- ❑ *Other Network Services* - This segment contains video text and pure network management services. Video text is actually more a delivery mode than an application. Its prime focus is on the individual as a consumer or in business. These services provide interactive access to databases and offer the inquirer the capability to send as well as receive

information for such purposes as home shopping, home banking, travel reservations, etc.

Network management services included here must involve the vendor's network and network management systems as well as people. People-only services, or services that involve the management of networks as part of the broader task of managing a user's information processing functions are included in Systems Operations.

C

Hardware/Hardware Systems

- ☐ *Hardware* - Includes all computer and telecommunications equipment that can be separately acquired with or without installation by the vendor and not acquired as part of an integrated system.
- ☐ *Peripherals* - Includes all input, output, communications and storage devices (other than main memory) that can be connected locally to the main processor, and generally cannot be included in other categories such as terminals.
- ☐ *Input Devices* - Includes keyboards, numeric pads, card readers, light pens and track balls, tape readers, position and motion sensors, and analog-to-digital converters.
- ☐ *Output Devices* - Includes printers, CRTs, projection television screens, micrographics processors, digital graphics and plotters.
- ☐ *Communication Devices* - Includes modem, encryption equipment, special interfaces and error control.
- ☐ *Storage Devices* - Includes magnetic tape (reel, cartridge and cassette), floppy and hard disks, solid state (integrated circuits), and bubble and optical memories.
- ☐ *Terminals* - Three types of terminals are described below:
 - A. *User Programmable* - Also called intelligent terminals, including the following:
 - ⇒ Single-station or standalone
 - ⇒ Multistation, shared processor
 - ⇒ Teleprinter
 - ⇒ Remote batch.
 - B. *User Nonprogrammable*

- ⇒ Single-station
- ⇒ Multistation, shared processor
- ⇒ Teleprinter.

C. *Limited Function* - Originally developed for specific needs, such as point-of-sale (POS), inventory data collection, controlled access and other applications

- ❑ *Hardware Systems* - Includes all processors from microcomputers to supercomputers. Hardware systems may require type- or model-unique operating software to be functional, but this category excludes applications software and peripheral devices, other than main memory and processors or CPUs not provided as part of an integrated (turnkey) system.
- ❑ *Microcomputer* - Combines all of the CPU, memory, and peripheral functions of an 8-, 16-, or 32-bit computer on a chip in various forms including:
 - ⇒ Integrated circuit package
 - ⇒ Plug-in boards with increased memory and peripheral circuits
 - ⇒ Console including keyboard and interfacing connectors
 - ⇒ Personal computer with at least one external storage device directly addressable by the CPU
 - ⇒ An embedded computer that may take a number of shapes or configurations.
- ❑ *Workstations* - Include high-performance, desktop, single-user computers employing (mostly) Reduced Instruction Set Computing (RISC). Workstations provide integrated, high-speed, local network-based services such as database access, file storage and back-up, remote communications and peripheral support. Typical workstation products are provided by Apollo (now a unit of Hewlett-Packard), Sun, Altos, DEC (the MicroVAX) and IBM. These products usually cost more than \$15,000. However, at this writing many companies have recently announced sizable price cuts.
- ❑ *Midsized Systems* - Describe superminicomputers and the more traditional business minicomputers. Because of steadily improving design and technology, the latter have outgrown traditional definitions (which defined small systems as providing 32-bit to 64-bit word lengths at prices ranging from \$15,000 to \$350,000). Increasingly, minicomputers and workstations meet the 32-bit definition, and may go beneath the \$15,000 lower price limit. Typical midrange systems include IBM System/3X, 43XX, AS/400 and 937X product lines, DEC PDP and VAX families

(excluding MicroVAX families), and competitive products from a wide range of vendors, including HP, Data General, Wang, AT&T, Prime Concurrent, Gould, Unisys, NCR, Bull, Harris, Tandem, Stratus and many others.

- ❑ *Large Computer* - Is presently centered on storage controllers, but likely to become bus-oriented and to consist of multiple processors or parallel processor. Intended for structured mathematical and signal processing and typically used with general-purpose, Von Neumann-type processors for system control. This term usually refers to traditional mainframes and supercomputers.
- ❑ *Supercomputer* - Includes high-powered processors with numerical processing throughput that is significantly greater than the fastest general-purpose computers, with capacities in the 100-500 million floating point operations per second (MFLOPS) range. Newer supercomputers, with burst modes over 500 MFLOPS, main storage size up to 10 million words and on-line storage in the one-to-four gigabyte class, are labeled Class V to Class VII in agency long-range plans. Supercomputers fit in one of two categories:
 - ⇒ *Real Time* - Generally used for signal processing in military applications
 - ⇒ *Non-Real Time* - For scientific use in one of three configurations:
 - ⇒ Parallel processors
 - ⇒ Pipeline processor
 - ⇒ Vector processor.
- ❑ *Supercomputer* - Is also applied to micro, mini and large mainframe computers with performance substantially higher than that attainable by Von Neumann architecture.
- ❑ *Embedded Computer* - Is a dedicated computer system designed and implemented as an integral part of a weapon, weapon system or platform; critical to a military or intelligence mission such as command and control, cryptological activities or intelligence activities. Characterized by military specifications (MIL SPEC) appearance and operation, limited but reprogrammable applications software, and permanent or semipermanent interfaces. These systems may vary in capacity from microcomputers to parallel processor computer systems.

D

General Definitions

ASCII - (American National Standard Code for Information Interchange) Eight-bit code with seven data bits and one parity bit

Asynchronous - Communications operation (such as transmission) without continuous timing signals; synchronization is accomplished by appending signal elements to the data

Bandwidth - Range of transmission frequencies that can be carried on a communications path; used as a measure of capacity

Central Processing Unit (CPU) - The arithmetic and control portion of a computer; i.e., the circuits controlling the interpretation and execution of computer instructions

Circuit Switching - Connects two or more network stations and permits exclusive circuit use until the connection is released; typical of the voice telephone network, where a circuit is established between the caller and the called party

Constant Dollars - Growth forecasts in constant dollars make no allowance for inflation or recession; dollar value is based on the year of the forecast unless otherwise indicated

Computer System - Combination of computing resources required to perform the designed functions; may include one or more CPUs, machine room peripherals, storage systems and/or applications software

CPE - (Customer Premises Equipment) DCE or DTE located at a customer site rather than at a carrier site such as the local telephone company; may include switchboards, PBX, data terminals and telephone answering devices

Current Dollars - Estimates or values expressed in current-year dollars that, for forecasts, would include an allowance for inflation

Dedicated Circuit - A permanently established network connection between two or more stations; contrast with switched circuit

Distributed Data Processing - The development of programmable intelligence in order to perform a data processing function in which it can be accomplished most effectively through computers and terminals arranged in a telecommunications network adapted to the user's needs

DTE - Data Terminal Equipment - Hardware that is a data source, link or both, such as video display terminals, that converts user information into data transmission, and reconverts data signals into user information

EFT - Electronic Funds Transfer

Encryption - Electric, code-based conversion of transmitted data to provide security and/or privacy of data between authorized access points

General-Purpose Computer System - A computer designed to handle a wide variety of problems, including machine room peripherals, systems software and small business systems

Hardware Integrator - Develops system interface electronics and controllers for the CPU, sensors, peripherals and all other ancillary hardware components; the hardware integrator also may develop control system software in addition to installing the entire system at the end-user site

Independent Suppliers - Suppliers of machine room peripherals, though usually not suppliers of general-purpose computer systems

Information Processing - Data processing as a whole, including use of business or scientific computers

Installed Base - Cumulative number or value (cost when new) of computers in use

ISDN - (Integrated Services Digital Network) Completely digital, integrated voice and nonvoice public network service; not clearly defined through any existing standards, although FCC and other federal agencies are developing CCITT recommendations

Leased Line - Permanent connection between two network stations; also known as dedicated or nonswitched line

Mainframe - The central processing unit (CPU or units in a parallel processor) of a computer that interprets and executes computer (software) instructions of 32 bits or more

Modem - A device that encodes information into electronically transmittable form (MODulator) and restores it to original analog form (DEMODulator)

Node - Connection point of three or more independent transmission points that may provide switching or data collection

Off-Line - Pertaining to equipment or devices that can function without direct control of the central processing unit

On-Line - Pertaining to equipment or devices under direct control of the central processing unit

Optical Disk - Storage device that uses laser technology to record data; optical disks provide high storage capacity, but cannot be overwritten

OSI - ISO reference model for Open Systems Interconnection Seven-layer architecture for application, presentation, session, transport, network, data link, and physical services and equipment

OSI Application Layer 7, providing end-user applications services for data processing

OSI Data Link Layer 2, providing transmission protocols, including frame management, link flow control and link initiation/release

OSI Network 3, providing call establishment and clearing control through the network nodes

OSI Physical Layer 1, providing the mechanical, electrical, functional and procedural characteristics to establish, maintain and release physical connections to the network

OSI Presentation Layer 6, providing data formats and information such as data translation, data encoding/decoding and command translation

OSI Session Layer 5, establishes, maintains, and terminates logical connections for the transfer of data between processes

OSI Transport Layer 4, providing end-to-end terminal control signals such as acknowledgments

Peripherals - Any unit of input/output equipment in a computer system, exclusive of the central processing unit

Protocols - The rules for communication system operation that must be followed if communication is to be effected. Protocols may govern portions of a network or service; in digital networks, protocols are digitally encoded as instructions to computerized equipment

Scientific Computer System - A computer system designed to process structured mathematics (such as Fast Fourier Transforms), and complex, highly redundant information (such as seismic data, sonar data and radar), with large, on-line memories and very high-capacity output

Security - Physical, electrical- and computer- (digital) coding procedures to protect the contents of computer files and data transmission from inadvertent

or unauthorized disclosure to meet the requirements of the Privacy Act and national classified information regulations

Software - Computer programs

Supplies - Includes materials associated with the use of operations of computer systems, such as printer paper, keypunch card, disk packs, and tapes

Synchronous - Communications operation with separate, continuous clocking at both sending and receiving stations

Systems Integrator - Systems house vendor that develops systems interface electronics, applications software and controllers for the CPU, peripherals and ancillary subsystems that may have been provided by a contractor or the government (GFE); this vendor may either supervise or perform the installation and testing of the completed system

Turnkey System - System composed of hardware and software integrated into a total system designed to fulfill completely the processing requirements of a single application

User (or End User) - One who is using a product or service to accomplish his or her own functions; the user may buy a system from the hardware supplier(s) and do his or her own programming, interfacing and installation; alternately, the user may buy a turnkey system from a systems house or hardware integrator, or may buy a service from an in-house department or external vendor

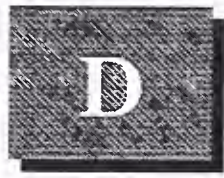
Verification and Validation - Process for examining and testing applications and special systems software to verify that it operates on the target CPU and performs all of the functions specified by the user

E

Other Considerations

When questions arise as to the proper place to count certain user expenditures, INPUT addresses the questions from the user viewpoint. Expenditures are then categorized according to the user's perception of the purchase.

(Blank)



Glossary of Federal Acronyms

The federal government's procurement language uses a combination of abbreviations, acronyms, phrases and words that is complicated by different agency definitions and interpretations. The government also uses terms of accounting, business, economics, engineering and law with new applications and technology.

Abbreviations and contract terms that INPUT encountered most often in program documentation and interviews for this report are included here, but this glossary should not be considered all-inclusive. Federal procurement regulations (DAR, FPR, FAR, FIRMR, FPMR) and contract terms listed in RFIs, RFPs, and RFQs provide applicable terms and definitions.

Federal agency abbreviations have been included to the extent they are employed in this report.

A

Federal Agency Acronyms

8(a) Set-Aside	Agency awards direct to Small Business Administration for direct placement with a small, socially/economically disadvantaged company
AAS	Automatic Addressing System
AATMS	Advanced Air Traffic Management System
ACS	Advanced Communications Satellite (formerly NASA 30/20 GHz Satellite Program)
ACT-1	Advanced Computer Techniques (Air Force)
ACWP	Actual Cost of Work Performed
Ada	DoD high-order language

ADA	Airborne Data Acquisition
ADL	Authorized Data List
ADNET	Anti-Drug Network
ADS	Automatic Digital Switches (DCS)
AFA	Air Force Association
AFCEA	Armed Forces Communications Electronics Association
AGE	Aerospace Ground Equipment
AIP	Array Information Processing
AIPC	Automated Information Processing Center
AIS	Automated Information System
AMD	Acquisition Management Directorate
AMPE	Automated Message Processing Equipment
AMPS	Automated Message Processing System
AMSDL	Acquisition Management Systems Data List
AP(P)	Advance Procurement Plan
Appropriation	Congressionally approved funding for authorized programs and activities of the Executive Branch
APR	Agency Procurement Request
ARB	Acquisition Review Board
ARPA	Advanced Research Projects Agency
ARPANET	ARPA network of scientific computers
ASP	Aggregated Switch Procurement
ASR	Acquisition Strategy Report
ATLAS	Abbreviated Test Language for All Systems (for ATE Automated Test Equipment)

Authorization	In the legislative process programs, staffing and other routine activities must be approved by Oversight Committees before the Appropriations Committee will approve the money from the budget
AUSA	Association of the U.S. Army
BA	Basic Agreement or Budget Authority
BAFO	Best And Final Offer
Base level	Procurement, purchasing, and contracting at the military installation level
BCA	Board of Contract Appeals
BCE	Baseline Cost Estimate
Benchmark	Method of evaluating ability of a candidate computer system to meet user requirements
Bid protest	Objection (in writing, before or after contract award) to some aspect of a solicitation by a valid bidder
BML	Bidders Mailing List of qualified vendor information filed annually with federal agencies to automatically receive RFPs and RFQs in areas of claimed competence
BOA	Basic Ordering Agreement
B&P	Bid and Proposal vendor activities in response to government solicitation/specific overhead allowance
BPA	Blanket Purchase Agreement
Budget	Federal Budget, proposed by the President and subject to Congressional review
BY	Budget Year or Base Year
C2	Command and Control
C3	Command, Control and Communications
C4	Command, Control, Communications and Computers
C3I	Command, Control, Communications and Intelligence
CAB	Contract Adjustment Board or Contract Appeals Board

CADE	Computer-Aided Design and Engineering
CADS	Computer-Assisted Display Systems
CAIS	Computer-Assisted Instruction System
CALS	Continuous Acquisition and Life-cycle Support (formerly Computer-Aided Acquisition and Logistics Support)
CAPS	Command Automation Procurement Systems
CAS	Contract Administration Services or Cost Accounting Standards
CASB	Cost Accounting Standards Board
CASP	Computer-Assisted Search Planning
CBD	(Commerce Business Daily) U.S. Department of Commerce publication listing government contract opportunities and awards
CBO	Congressional Budget Office
CCEP	Commercial Comsec Endorsement Program
CCDR	Contractor Cost Data Reporting
CCN	Contract Change Notice or Configuration Change Notice
CCPDS	Command Center Processing and Display Systems
CCPO	Central Civilian Personnel Office
CDA	Central Design Activity
CDR	Critical Design Review
CDRL	Contractor Data Requirement List
CFE	Contractor-Furnished Equipment
CFM	Contractor Furnished Material
CFR	Code of Federal Regulations
CIA	Central Intelligence Agency
CICA	Competition in Contracting Act (1984)

CIG	Computerized Interactive Graphics
CIM	Corporate Information Management or Center for Information Management
CINCs	Commanders-in-Chief
CIR	Cost Information Reports
CM	Configuration Management
CMI	Computer-Managed Instruction
CNI	Communications, Navigation and Identification
CO	Contracting Office, Contract Offices, Contracting Officer or Change Order
COC	Certificate of Competency (administered by the Small Business Administration) or Certificate of Compliance
COCO	Contractor-Owned, Contractor-Operated
CODSIA	Council of Defense and Space Industry Associations
COMSAT	Communications Satellite Corporation
CONUS	Continental United States
COP	Capability Objective Package
COSMIC	Computer Software Management Information Center (NASA)
COTR	Contracting Officer's Technical Representative
COTS	Commercial Off-The-Shelf (Commodities)
CPAF	Cost-Plus-Award-Fee Contract
CPFF	Cost-Plus-Fixed-Fee Contract
CPIF	Cost-Plus-Incentive-Fee Contract
CPR	Cost Performance Reports
CPSR	Contractor Procurement System Review
CR	Cost Reimbursement (Cost-Plus Contract)

CSIF	Communications Services Industrial Fund
C/SCSC	Cost/Schedule Control System Criteria (also called "C-Spec")
CWAS	Contractor Weighted Average Share in Cost Risk
CWBS	Contract Work Breakdown Structure
DAB	Defense Acquisition Board
DABBS	Defense Acquisition Bulletin Board System
DAC	Defense Acquisition Circular
DAL	Data Accession List
DAR	Defense Acquisition Regulations
DARC	Defense Acquisition Regulatory Council
DAS	Data Acquisition System
DBHS	Data Base Handling System
DBOF	Defense Business Operating Fund
DCAA	Defense Contract Audit Agency
DCAS	Defense Contract Administration Services
DCASR	DCAS Region
DCC	Digital Control Computer
DCS	Defense Communications System
DDA	Dynamic Demand Assessment (Delta Modulation)
DDC	Defense Documentation Center
DDL	Digital Data Link - A segment of a communications network used for data transmission in digital form
DDS	Defense Distribution System
DECCO	Defense Commercial Communications Office
DECEO	Defense Communications Engineering Office

D&F	Determination and Findings - required documentation for approval of a negotiated procurement
DFARS	DoD FAR Supplement
DFAS	Defense Finance and Accounting Service
DIA	Defense Intelligence Agency
DISA	Defense Information Systems Agency (Formerly DCA)
DHHS	Department of Health and Human Services
DIDS	Defense Integrated Data Systems
DISC	Defense Industrial Supply Center
DITSO	Defense Information Technology Systems Office
DLA	Defense Logistics Agency
DMA	Defense Mapping Agency
DMR	Defense Management Review
DMRD	Defense Management Review Decision
DNA	Defense Nuclear Agency
DO	Delivery Order
DOC	Department of Commerce
DoD	Department of Defense
DoDD	Department of Defense Directive
DOE	Department of Energy
DOI	Department of Interior
DOJ	Department of Justice
DOS	Department of State
DOT	Department of Transportation
DNA	Defense Nuclear Agency

DPA	Delegation of Procurement Authority (granted by GSA under FPRs)
DPC	Defense Procurement Circular
DPF	Defense Processing Facility
DQ	Definite Quantity Contract
DQ/PL	Definite Quantity/Price List Contract
DR	Deficiency Report
DRFP	Draft Request For Proposal
DSCS	Defense Satellite Communication System
DSN	Defense Switched Network
DSP	Defense Support Program (WWMCCS)
DSS	Defense Supply Service
DTC	Design-To-Cost
DTIC	Defense Technical Information Center
DTN	Defense Transmission Network
DVA	Department of Veterans Affairs
ECP	Engineering Change Proposal
ED	Department of Education
EEO	Equal Employment Opportunity
EMC	Electro-Magnetic Compatibility
EMCS	Energy Monitoring and Control System
EO	Executive Order issued by the President
EOQ	Economic Ordering Quantity
EPA	Economic Price Adjustment or Environmental Protection Agency
EPMR	Estimated Peak Monthly Requirement

EPS	Emergency Procurement Service (GSA) or Emergency Power System
ETR	Estimated Time to Repair
ESTSC	Energy Science and Technology Software Center (DOE)
FA	Formal Advertising
FAC	Federal Acquisition Circular
FAR	Federal Acquisition Regulations
FCA	Functional Configuration Audit
FCC	Federal Communications Commission
FCDC	Federal Contract Data Center
FCPC	Federal Computer Products Center
FCRC	Federal Contract Research Center
FDR	Formal Design Review
FEDSIM	Federal (Computer) Simulation Center (GSA)
FEMA	Federal Emergency Management Agency
FFP	Firm Fixed-Price Contract (also Lump Sum Contract)
FFRDC	Federally Funded Research & Development Center
FIPR	Federal Information Processing Resource
FIPS	Federal Information Processing Standard
FIPS PUBS	FIPS Publications
FIRMR	Federal Information Resource Management Regulations
FMS	Foreign Military Sales
FOC	Full Operating Capability
FOIA	Freedom of Information Act
FP	Fixed-Price Contract

FPAF	Fixed-Price Award Fee
FPIF	Fixed-Price Incentive Fee
FP-L/H	Fixed-Price Labor/Hour Contract
FP-LOE	Fixed-Price Level-Of-Effort Contract
FDPC	Federal Data Processing Center
FPMR	Federal Property Management Regulations
FPR	Federal Procurement Regulations
FSC	Federal Supply Classification
FSG	Federal Supply Group
FSN	Federal Stock Number
FSS	Federal Supply Schedule or Federal Supply Service (GSA)
FSTS	Federal Secure Telecommunications System
FT Fund	A revolving fund, designated as the Federal Telecommunications Fund, used by GSA to pay for GSA-provided common-user services, specifically including the current FTS and proposed FTS2000 services
FTSP	Federal Telecommunications Standards Program administered by NCS; Standards are published by GSA
FTS	Federal Telecommunications System, especially FTS2000
FY	Fiscal Year
FYDP	Five-Year Defense Plan
G&A	General and Administrative (Expense)
GAO	General Accounting Office
GFE	Government-Furnished Equipment
GFM	Government-Furnished Material
GFY	Government Fiscal Year (October to September)
GIDEP	Government-Industry Data Exchange Program

GOCO	Government Owned, Contractor Operated
GOGO	Government Owned, Government Operated
GOSIP	Government Open Systems Interconnection Profile
GPO	Government Printing Office
GPS	Global Positioning System
GRH	Gramm-Rudman-Hollings Act (1985), also called Gramm-Rudman Deficit Control
GSA	General Services Administration
GSBCA	General Services Administration Board of Contract Appeals
HAC	House Appropriations Committee
HASC	House Armed Services Committee
HCFA	Health Care Financing Administration
HHS	(Department of) Health and Human Services
HOL	Higher Order Language
HSDP	High-Speed Data Processors
HUD	(Department of) Housing and Urban Development
I-CASE	Integrated Computer-Aided Software Engineering
ICA	Independent Cost Analysis
ICAM	Integrated Computer-Aided Manufacturing
ICE	Independent Cost Estimate
ICP	Inventory Control Point
ICST	Institute for Computer Sciences and Technology, National Institute of Standards and Technology, Department of Commerce
IDA	Institute for Defense Analysis
IDAMS	Image Display And Manipulation System
IDEP	Interservice Data Exchange Program

IDIQ	Indefinite Delivery, Indefinite Quantity
IDN	Integrated Data Network
IFB	Invitation For Bids
IOC	Initial Operating Capability
IOI	Internal Operating Instructions
IPS	Integrated Procurement System
IQ	Indefinite Quantity Contract
IR&D	Independent Research & Development
IRM	Information Resources Management
IXS	Information Exchange System
IV&V	Independent Verification & Validation
JCS	Joint Chiefs of Staff
JCALS	Joint Computer-Aided Acquisition and Logistics Support
JFMIP	Joint Financial Management Improvement Program
JPO	Joint Program Office
JSIPS	Joint Systems Integration Planning Staff
JSOP	Joint Strategic Objectives Plan
JSOR	Joint Service Operational Requirement
JUMPS	Joint Uniform Military Pay System
JWAM	Joint WWMCCS ADP Modernization (Program)
LC	Letter Contract
LCC	Life Cycle Cost
LCMP	Life Cycle Management Procedures (DD7920.1)
LCMS	Life Cycle Management System
L-H	Labor-Hour Contract

LOI	Letter of Intent; Letter of Instruction
LRPE	Long-Range Procurement Estimate
LRIRP	Long-Range Information Resource Plan
LTD	Live Test Demonstration
LSI	Large-Scale Integration
MAISRC	Major Automated Information Systems Review Council (DoD)
MANTECH	Manufacturing Technology
MAPS	Multiple Address Processing System
MAP/TOP	Manufacturing Automation Protocol/Technical and Office Protocol
MASC	Multiple Award Schedule Contract
MDA	Multiplexed Data Accumulator
MENS	Mission Element Need Statement or Mission Essential Need Statement (see DD-5000.1 Major Systems Acquisition)
MILSCAP	Military Standard Contract Administration Procedures
MIL SPEC	Military Specification
MIL STD	Military Standard
MIPR	Military Interdepartmental Purchase Request
MLS	Multilevel Security
MNF	Multi-National Force
MOD	Modification
MOL	Maximum Ordering Limit (Federal Supply Service)
MPC	Military Procurement Code
MTBF	Mean-Time-Between-Failures
MTTR	Mean-Time-To-Repair
MYP	Multi-Year Procurement

NARDIC	Navy Research and Development Information Center
NASA	National Aeronautics and Space Administration
NCA	National Command Authorities
NCMA	National Contract Management Association
NCS	National Communications System (evolving to DISN)
NDI	Non-Development Item
NICRAD	Navy-Industry Cooperative Research and Development
NIP	Notice of Intent to Purchase
NIST	National Institute of Science and Technology (was NBS)
NMCS	National Military Command System
NSA	National Security Agency
NSEP	National Security and Emergency Preparedness
NSF	National Science Foundation
NSIA	National Security Industrial Association
NTIA	National Telecommunications and Information Administration, Department of Commerce
NTIS	National Technical Information Service
Obligation funds	“Earmarking” of specific funding for a contract from committed agency funds
OA	Obligational Authority
OCS	Office of Contract Settlement
OFCC	Office of Federal Contract Compliance
Off-Site	Services to be provided near but not in government facilities
FMP	Office of Federal Management Policy (GSA)
OFPP	Office of Federal Procurement Policy
OIRM	Office of Information Resources Management

O&M	Operations & Maintenance
OMB	Office of Management and Budget
O,M&R	Operations, Maintenance and Readiness
On-Site	Services to be performed on a government installation or in a specified building
OPM	Office of Procurement Management (GSA) or Office of Personnel Management
Options	Sole-source additions to the base contract for services or goods to be exercised at the government's discretion
OSADBU	Office of Small and Disadvantaged Businesses
OSHA	Occupational Safety and Health Act
OSI	Open System Interconnect
OSP	Offshore Procurement
OTA	Office of Technology Assessment (Congress)
Outyear	Proposed funding for fiscal years beyond the budget year (next fiscal year)
P-1	FY Defense Production Budget
P3I	Pre-Planned Product Improvement (program in DoD)
PAR	Procurement Authorization Request or Procurement Action Report
PAS	Pre-Award Survey
PASS	Procurement Automated Source System
PCO	Procurement Contracting Officer
PDA	Principal Development Agency
PDM	Program Decision Memorandum
PDR	Preliminary Design Review
PIR	Procurement Information Reporting
PME	Performance Monitoring Equipment

PMP	Purchase Management Plan
PO	Purchase Order or Program Office
POE	Panel Of Experts
POM	Program Objective Memorandum
POSIX	Portable Open System Interconnection Exchange
POTS	Purchase of Telephone Systems
PPBS	Planning, Programming, Budgeting System
PR	Purchase Request or Procurement Requisition
PRA	Paperwork Reduction Act
PS	Performance Specification alternative to a Statement of Work, when work to be performed can be clearly specified
QA	Quality Assurance
QAO	Quality Assurance Office
QBL	Qualified Bidders List
QMCS	Quality Monitoring and Control System (DoD software)
QMR	Qualitative Material Requirement (Army)
QPL	Qualified Products List
QRC	Quick Reaction Capability
QRI	Quick Reaction Inquiry
R-1	FY Defense RDT&E Budget
RAM	Reliability, Availability and Maintainability or Random Access Memory
RC	Requirements Contract
R&D	Research and Development
RDA	Research, Development and Acquisition
RDD	Required Delivery Date

RD&E	Research, Development and Engineering
RDF	Rapid Deployment Force
RDT&E	Research, Development, Test and Engineering
RFB	Request For Bid
RFI	Request For Information
RFP	Request For Proposal
RFQ	Request For Quotation
RFTP	Request For Technical Proposals (Two-Step)
ROC	Required Operational Capability
ROI	Return On Investment
RSI	Rationalization, Standardization and Interoperability
RTAS	Real-Time Analysis System
RTDS	Real-Time Display System
SA	Supplemental Agreement
SAC	Senate Appropriations Committee
SADBU	Small and Disadvantaged Business Utilization
SAR	Selected Acquisition Report
SASC	Senate Armed Services Committee
SBA	Small Business Administration
SB Set-Aside	Small Business Set-Aside contract opportunities with bidders limited to certified small businesses
SCA	Service Contract Act (1964 as amended)
SCN	Specification Change Notice
SDB	Small/Disadvantaged Business
SDI	Strategic Defense Initiative

SDIO	Strategic Defense Initiative Office
SDN	Secure Data Network
SDR	System Design Review
SEC	Securities and Exchange Commission
SE&I	Systems Engineering and Integration
SETA	Systems Engineering/Technical Assistance
SETS	Systems Engineering/Technical Support
SIBAC	Simplified Intragovernmental Billing and Collection System
SIC	Standard Industrial Classification
SIMP	Systems Integration Master Plan
SIOP	Single Integrated Operations Plan
Sole Source	Contract award without competition
Solicitation	Invitation to submit a bid
SOR	Specific Operational Requirement
SOW	Statement of Work
SSA	Source Selection Authority (DoD) or Social Security Administration
SSAC	Source Selection Advisory Council
SSEB	Source Selection Evaluation Board
SSO	Source Selection Official (NASA)
STINFO	Scientific and Technical Information Program Air Force/NASA
STU	Secure Telephone Unit
SWO	Stop-Work Order
Synopsis	Brief description of contract opportunity in CBD after D&F and before release of solicitation
TA/AS	Technical Assistance/Analysis Services

TCP/IP	Transmission Control Protocol/Internet Protocol
TEMPEST	Studies, inspections and tests of unintentional electromagnetic radiation from computer, communication, command and control equipment that may cause unauthorized disclosure of information; usually applied to DoD and security agency testing programs
TILO	Technical and Industrial Liason Office, Qualified Requirement Information Program, Army
TM	Time and Materials contract
TOA	Total Obligational Authority (Defense)
TOD	Technical Objective Document
TQM	Total Quality Management
TR	Temporary Regulation (added to FPR, FAR)
TRACE	Total Risk Assessing Cost Estimate
TRCO	Technical Representative of the Contracting Offices
TREAS	Department of Treasury
TRM	Technical Reference Model
TRP	Technical Resources Plan
TVA	Tennessee Valley Authority
UCAS	Uniform Cost Accounting System
UPS	Uniform Procurement System
USA	U.S. Army
USAF	U.S. Air Force
USC	United States Code
USCG	U.S. Coast Guard
USMC	U.S. Marine Corps
USN	U.S. Navy
USPS	United States Postal Service

USRRB	United States Railroad Retirement Board
VA	Veterans Affairs Department
VE	Value Engineering
VHSIC	Very High-Speed Integrated Circuits
VIABLE	Vertical Installation Automation Baseline (Army)
VICI	Voice Input Code Identifier
VTC	Video Teleconferencing
WAM	WWMCCS ADP Modernization Program
WBS	Work Breakdown Structure
WGM	Weighted Guidelines Method
WIN	WWMCCS Intercomputer Network
WITS	Washington Interagency Telecommunications System
WIS	WWMCCS Information Systems
WPI	Wholesale Price Index
WS	Work Statement Offerer's description of the work to be done (proposal or contract)
WWMCCS	WorldWide Military Command and Control System
Y2000	Year 2000

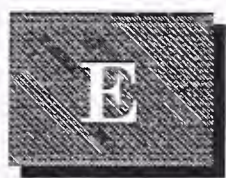
B**General and Industry Acronyms**

ADP	Automatic Data Processing
ADPE	Automatic Data Processing Equipment
ANSI	American National Standards Institute
BOC	Bell Operating Company
CAD	Computer-Aided Design
CAM	Computer-Aided Manufacturing

CASE	Computer-Aided Software Engineering
CBEMA	Computer and Business Equipment Manufacturers Association
CCIA	Computers and Communications Industry Association
CCITT	Comite Consultatif Internationale de Télégraphique et Téléphonique; Committee of the International Telecommunication Union
COBOL	Common Business-Oriented Language
COS	Corporation for Open Systems
CPU	Central Processor Unit
DMBS	Data Base Management System
DRAM	Dynamic Random Access Memory
EIA	Electronic Industries Association
EPROM	Erasible Programmable Read-Only Memory
IEEE	Institute of Electrical and Electronics Engineers
ISDN	Integrated Services Digital Networks
ISO	International Organization for Standardization; voluntary international standards organization and member of CCITT
ITAA	Information Technology Association of America (Formerly ADAPSO)
ITU	International Telecommunication Unio
LSI	Large-Scale Integration
MFJ	Modified Final Judgment
RBOC	Regional Bell Operating Company
UNIX	Proprietary Operating System developed by AT&T; and now owned by UNIX Systems Laboratory, Novell, Inc.
UPS	Uninterruptable Power Source
VAR	Value-Added Reseller
VLSI	Very Large-Scale Integration

WORM

Write-Once-Read-Many times



The IT Industry and the Year 2000: A White Paper

A

Introduction - "The Problem of the Century"

You've looked at your calendars and most of you are now at least dimly aware that the year 2000 is less than 3 years away. Likewise, the fact that the passing of this landmark could spell significant trouble for organizations whose current systems rely on traditional two-digit date fields is nothing new. The looming danger may be summarized in a general sentence; programs utilizing conventional date formatting may perform calculation errors or cease functioning altogether. This can have dire consequences for businesses and may precipitate the failure of an enterprise altogether.

Having been roused by the cacophony of "Y2000" solutions providers springing from the woodwork, most businesses have at least awakened to face these potentially devastating consequences and begun shuffling towards developing and administering viable solutions. Or have they? INPUT research has shown that a substantial percentage are still just beginning to acquaint themselves with the issue, and those that have begun the transition have vastly underestimated the associated time/cost commitment.

Attending the recent ITAA conference that addressed the Y2000 issue specifically, one couldn't help but be overwhelmed by the dizzying array of service vendors offering their own unique solution. But are they truly unique? A close look at the literature reveals that many of the differences are indiscernible, or that simply the user community isn't familiar enough with the issues to readily differentiate between vendor offerings. Virtually all vendors of Y2000 services offer full-service contracts - from initial diagnosis of present systems to the implementation and testing of formal solutions.

The result? The rush to tap into the estimated \$300B Y2000 compliance market has overwhelmed corporations with choices. In selecting a service vendor, a company must first perform several checks including;

- Ensure that the company is reputable - that they have an established lifespan and track record on similar projects
- Make sure that the company will not vaporize at midnight, December 31, 1999 and is taking proper measures to ensure the viability of their own enterprise beyond the Year 2000
- Ascertain which competencies must be scrutinized to determine that the firm is technically able to perform the conversion
- Obtain assurance that the vendor truly understands the scope of the Y2000 problem
- Ensure that the service provider can deliver a satisfactory solution on time and within budget
- Determine whether the vendor's technical solution evolved from a management solution, or vice-versa
- Evaluate how much of the conversion should be conducted internally and how much should be outsourced
- Assess the impact of enlisting offshore resources
- Determine whether software tools are enough or whether a comprehensive solution is required (software + external resources)?

These are but a few of the issues confronting an organization as it addresses a Year 2000 software conversion program. Each vendor or "Y2000" conversion expert has their own opinion regarding the steps a firm should take to ensure that they are year 2000 compliant, but generally they incorporate the same elements of any systems-related project:

- Planning - how to address the issue
- Analysis/Diagnostics - delineating the problem
- Assessment - sizing up the problem
- Solution Design
- Resource Allocation - time/money/expertise (internal/external) required
- Development

- Testing
- Implementation
- Maintenance

This is certainly not a hard and fast recipe for project management and there are undoubtedly innumerable subsets of each category, but most of the Y2K solution vendors provide services which fall into at least one or combine several (all?) of these general elements.

B

Addressing the Problem

There are several types of Y2000 solution vendor, each capable of providing one or more of the following products/services:

- Consulting
- Tool(s) - one or a few
- Clock simulation - date library or clock simulation support
- Full conversion service - possibly with other options, i.e. tools, but not primarily
- Integrated toolset - many possibly integrated tools covering stages of the project cycle in various combinations.

INPUT's experience has shown that vendors of Y2000 conversion products and services are reluctant to restrict themselves to one particular slice of the proverbial pie. For example, one may find that the vendor of a particular software diagnostic tool does not want to just sell the software tool, but has partnered with a consulting firm and now wants to bundle the tool with a comprehensive solution package. This pervasive development makes it difficult to obtain Y2000 conversion elements *a la carte*. While this may make decisions simpler since any one vendor can provide everything, how do you know what you're truly getting and just how a particular vendor's competencies stack up?

As the dawn draws nigh, organizations are realizing that the number of conversion options available to them is quickly dwindling. Considerations of proactively reengineering application systems, replacing systems with third-party application packages, or converting systems to client/server platforms are being abandoned in favor of more immediate, programmatic changes. These changes can generally be classified into two categories:

- Date field expansion - expanding the existing two-digit year fields to accommodate four-digit year fields.
- Date field interpretation - incorporate work-around logic into programs to convert two-digit year date fields into four-digit year date fields.

C

Synopsis of Conversion Strategies

There are six general conversion strategies that incorporate these two approaches:

- Date Field Expansion Strategy
- Smart Century Digit Date Field Strategy
- Century Window Strategy
- Datastore Duplexing Strategy
- Standard Date Routine Strategy
- Bridging Strategy

Date Field Expansion Strategy

The date field expansion strategy involves expanding an existing date field that does not contain a century indicator (e.g., *mmddyy*) to one that supports multi-century date values (e.g., *mmddccyy*). From a programming perspective, expanding the date fields is the most straightforward approach as well as the easiest to test. However, it is also the hardest to implement. This is due to the fact that all application components related to a specific date field must be modified at the same time the file is expanded to accommodate the expanded definition.

The massive synchronization of changes to the programs and files required to implement the date field expansion strategy is extremely difficult. It introduces project management problems such as requiring all source code to be frozen for long periods of time to prevent any further maintenance activities until these changes are complete. It also introduces difficulties associated with managing parallel development functions.

Smart Century Digit Date Field Strategy

The smart century digit approach, also known as “date value encoding”, uses an encoding scheme to represent the century value, usually as a one byte indicator. Although any unique character can be assigned to represent a specific century value, the most common scheme is shown below:

Code	Century	Value
0	19th century	18
1	20th century	19
2	21st century	20

Organizations should select the code value that ensures proper sort sequencing (i.e., 1 is less than 2). This date field conversion technique is most appropriate when the existing date format has an unused byte that can be used to indicate the century code (e.g., 1="1900", 2="2000"). This situation occurs when a six-digit date field is stored in packed storage format. The smart century digit approach requires that the physical data and all logic based components that access the date fields be converted in a single effort (e.g., this approach requires both data and program changes).

The introduction of processing logic to interpret the century codes adds to the program maintenance burden. If subsequently the date fields in the file are expanded, then all of this processing logic must be removed and the program retested. This strategy is best implemented as a temporary or short-term solution due to the increased overhead in processing and date access.

Century Window Strategy

The century window strategy establishes a base "bridge" between the two centuries. Date years that are greater than or equal to the base year are considered to be within the current century. Date years that are less than the base year are considered to be in the next century. For example, if the base year is 1930, then a two-digit date year value of 31 would be interpreted as the year '1931' while a two-digit date year of 29 would be considered to represent '2029'.

A two-digit value of 30 would be interpreted as the year '1930' given that the rule is "greater than or equal to" the base year. In other words, the strategy involves nothing more than a floating century window which allows years from two consecutive centuries to be represented by their last two digits and be protected against replication. Note, the interpretation rules must be consistent in all programs for a specific date field within the organization, as well as externally if the data is shared with other organizations.

Typically, an organization can use the century windowing technique to avoid or postpone physical field expansion by supporting multi-century date processing past December 31, 1999. Organizations whose applications use date fields that contain year values spanning more than one hundred years cannot use the century window technique. For example, birth dates and insurance policy start/end dates may span three centuries.

Datastore Duplexing Strategy

The datastore duplexing strategy involves the creation of a “duplicate” file/database so that one datastore contains unexpanded records (two-digit year date fields) and the second contains expanded records (four-digit year date fields). This technique uses an external process to copy an existing file and creates a year 2000 compliant format of the same data. Both year 2000 compliant and non-compliant programs can then process the data without any code modifications. The duplicated datastore can be deleted following the completion of the last processing job provided that it is recreated in each processing cycle.

Datastore duplexing is most applicable to batch processing - this technique is not easily deployed for files/databases that are maintained by on-line transaction processing. Depending on the type, size, and usage of the data store, this option may provide a more controlled conversion. The data duplication (date expand/contract) utility step can be migrated down the batch processing stream as each subsequent program is converted to read the new expanded date file. Typically this is a temporary solution and is usually coupled with field expansion and century window strategies. Very large files/databases are not good candidates for data duplexing as their duplication may require too much disk and CPU resource. The creation of large duplicate files may also adversely impact batch processing timeframes/windows.

Standard Date Routine Strategy

In conjunction with the other year 2000 conversion strategies, one or more standard date routines may be used as well. The standard (common) date routines can be developed in-house or commercially purchased. If an existing in-house date routine is not year 2000 compliant, the conversion effort involves the modification or replacement of the current program logic (i.e., call logic) to call a new date routine at the appropriate points within the program logic flow. The degree of code change depends on the structure of the program logic and date routine call parameters.

Bridging Strategy

The bridging strategy is a combination of date field expansion and century window techniques that enables date field definitions within programs to be expanded without requiring the simultaneous expansion of their related files/databases.

This strategy involves the same modifications of the program logic to accommodate expanded year 2000 compliant date fields as in the date field expansion strategy. Additionally however, interpretive logic is incorporated within the program to check whether or not the program requires the bridging technique. The bridging routine determines if input or output records contain compliant (four-digit year) or non-compliant (two-digit year) date fields immediately after a datastore read or before a datastore write.

The "I/O bridge" logic then expands or contracts the date fields appropriately based on the current status of each specific datastore being accessed.

The key advantages of this dynamic bridging strategy is that individual programs can be upgraded to support expanded date fields, validated, and then put back into the production environment "ready" for the future conversion of the physical datastores.

This approach is best suited for critical on-line transaction processing environments as it enables large numbers of programs to be upgraded over a period of time in preparation for the conversion of the master file/database over a weekend window.

D

Careful Planning the Key to Y2000 Conversion Cost Savings

An approach to saving on the expense of a Y2000 conversion is to perform the project in three phases. Each phase should have specific deliverables that build on each other to ensure a tightly controlled, well planned and implemented Y2000 solution. These phases are:

- **Analysis** - how many programs are impacted, how to fix and test them;
- **Pilot project** - proof of concept and process/procedure streamlining
- **Implementation** - repair, test, and implement each application group

Requests for proposals (RFPs) and bid requests should be issued against each specific phase and not all phases at once. This will make the bid/RFP creation and vendor selection much more cost effective.

Analysis

The analysis phase is where all of the questions at the beginning of this section are addressed. While simply getting the answer to how many objects are date impacted in many instances is all an IS professional is after, it is far from the complete picture. An RFP or bid request should address the following areas:

Tools

- Does the vendor solution incorporate tools that analyze all or many of the enterprise's application languages and files on multiple computer platforms? (the authoring RFP company should specify the languages, platforms, and data file access methods or database types such as Assembler, PL/1, Focus, and Easytrieve)

- Do these tools build a data repository that feeds automated change tools during the actual implementation phase?
- What is the annual or one-time charge for these tools?
- What type of repository is built? (SQL, Flat File, other)
- Can standard query and report writer tools already in the client inventory be used against the repository? (vendors must be informed what tools the client already possesses)

Methods

- describe the methodology used to perform the year 2000 project
- Provide graphical depiction and narrative of the tool flow and process

Deliverables

- Does the proposed solution provide a detailed plan for repairing and testing applications?
- Does the solution provide a general estimate of the total project manpower and application repair schedule?
- Does the solution provide the formal testing standards and strategy to be effectively utilized?
- Does the solution assist in awareness training to users and/or executives?
- Is there a tool repository for use in automated repair actions to be done?
- Does the solution provide a general impact analysis of affected application objects?

Vendor Information

- What is the financial status of the vendor? Will they be around in the year 2000 to honor any warranty?
- What volume of repair or conversion work has the vendor performed in the past? Can they provide references?
- For the proposed project lead personnel, what type of skills and experience do they have?

Project estimates/tracking

- How long will the analysis take? - a function of the estimated number of lines of code by language and platform

- How many personnel will be assigned at what are their duties?
- Will the work be done on-site, off-site, or in some combination of both?
- What is the vendor's suggested process for project tracking and reporting?

For any Y2000 conversion project, these questions are considered to be of major importance; any vendor who avoids these issues should be viewed as suspect. Accordingly, vendors of Y2000 applications should be as straightforward as possible when confronted with these questions.

Another critical point to remember is that most if not all vendors rely on a mix of analysis tools depending on the language and computer platforms involved. This mix may consist of in-house creations or licensed tools from other parties. A tool set that utilizes the same repository for all languages and platforms is rare. The key is to ensure that each tool provides a repository for future automation of repairs.

Performing a Pilot Project

A pilot project will allow the vendor who created the project plan with the client to work out any rough edges. As with any project, some processes and procedures will need tuning. Some adjustments to the tool set may be required to achieve a higher level of automation. For a Y2000 solution enlisting company, specific RFP/bid questions should include:

Tools

- Does the vendor offer, or is it willing to use another vendor's automated change tools that can utilize the existing analysis repository?
- Does the solution properly incorporate the existing change and problem management processes and procedures?
- Does the solution offer automated change tools for all involved languages? (if the answer is 'no', this may be where offshore resources will be useful)

Project Plan

- How will the vendor execute the pilot project plan? (staffing, schedule, deviations)
- Can the vendor operate in the defined testing environment and strategy?
- Does the vendor require on-site, off-site or offshore facilities?

Vendor information and tracking

- Does the vendor agree to operate under the defined project tracking process defined during the analysis phase?

- What experiences and skills make this vendor a candidate for inclusion in the project?
- Financial data and stability: will they be around? How long have they been in business? What is the size of their operation? What is the volume of their prior conversion or repair experience?
- Does the vendor have any affiliations with or capabilities to work with offshore companies where needed?

The Implementation Phase

Once the pilot phase has proved the concept of the repair actions, testing, and implementation, the bulk of the grunt work is performed. For the sake of speed and project timeliness, the recommended approach is to have broken up the applications into groups that can be provided to the year 2000 vendor in consumable portions. By assigning these work packets to a small repair/test team, the team will own it from client delivery to until client acceptance.

The learning curve of each team on the work packet application, testing, and exceptions tends to elongate the project versus having just one team intimately familiar with the application from beginning to end. This small team approach permits easier project management and multiple concurrent work packets to be in various stages of repair, test, or acceptance.

E

Legal Issues Surrounding the Year 2000

First and foremost, the Y2000 issue is a technical one; a company should first work to fix its own internal problems. However, companies should also be careful not to ignore the legal ramifications involved and should endeavor to improve awareness regarding law and Y2000 conversions. There are many important legal issues and risks that require the attention of high-level executives. These aspects should not be overlooked during the management of a technical solution. The following sections delineate parties with legal interests in how a firm performs a Y2000 conversion and provide insights on avoiding liability.

Shareholders

When making an investment decision, investors in a company, partners, and long-term debt holders are entitled to know all the material facts regarding the subject firm. The Securities and Exchange Commission requires that companies that are subject to federal reporting duties must disclose all material future anticipated liabilities. Generally accepted accounting principles may also require full disclosure. All companies, public or private, are subject to investor fraud claims for material nondisclosures. Accordingly,

a company should carefully evaluate its impact analysis and enlist legal assistance to determine what disclosures must be made.

Furthermore, corporate management has a legal duty to shareholders to act in a responsible manner regarding the conduct of the business and protect the shareholder's investment. All companies - those employing a Y2000 conversion strategy or those who inexplicably are not - should act immediately to meet applicable legal standards of due diligence, prudence, and sound business judgment in addressing the issue. Corporate management should consider coverage under Directors and Officers (D&O) insurance and, with the assistance of legal counsel, create a record of diligence that can withstand the scrutiny of a nontechnical judge and jury.

Customers

If a company's operations are adversely affected by a failure to properly address the Y2000 issue, its relationship with its customers may be at risk. Though the law in this area is complex, companies should work to develop force majeure (out-of-control developments), warranty disclaimer, and liability cap provisions with its most critical contracts. A company should demonstrate its diligence in addressing the issue by notifying customers in writing of potential problems work in conjunction with them to create back-up and parallel systems. Correspondingly, if a company has good reason to believe that its subcontractors and upstream suppliers may not become Y2000 compliant, it should work with them to identify and solve problem areas and take the necessary legal action to ensure that they do.

Third Parties

Employees, subcontractors, or any other entities that rely on the integrity of your systems or data should also be considered. Asking the question "What if our applications fail?", a company should use its impact analysis to identify all areas involving legal risks of collateral third-party damage that may result from affected data. As appropriate, back-up alternatives should be suggested and blind reliance on vulnerable applications should be discouraged.

Insurers

One way a company can protect itself from Y2000 exposure is through the effective use of general liability, errors and omissions, or first-party business insurance coverage. A careful review of a company's insurance assets may reveal coverage for accounts receivable or other important computerized data affected by Y2000 failures. If a firm discovers that it doesn't have the right coverage, it should ensure that it acquires it. The law in this area is just beginning to evolve so it is important that a company keep apprised of developments.

Software Vendors

Whether or not a company's existing software vendors are legally responsible for making their products Y2000 compliant depends upon the nature of the contracts written with them. Typically, vendor-written contracts contain warranty disclaimers and liability caps. However, under many circumstances, such caveats are not robust and require careful legal analysis to properly interpret. In many instances, the law may require vendors to honor pre-sale representations about their products in letters, marketing pieces, demonstrations, and even oral statements. Such elements are taken into consideration when assessing the user's reasonable expectations, without liability caps, regardless of the content of the written contract.

If any software products owned or licensed by a company may fail, the firm should (a) conduct a legal analysis of all software-related contracts and licenses; (b) inventory all representations made by the vendor outside the contract for express or implied statements that the product was Y2000 compliant; and (c) give vendors appropriate legal notice of the company's intentions.

Looking ahead, a company should ensure that any newly acquired or licensed software package is compliant and that future contracts with vendors contain proper restrictions to avoid escape loopholes.

Software Maintenance Providers

Another question surrounding the Y2000 issue involves determining if outside parties who maintain a company's software applications are legally responsible for fixing Y2000 non-compliance problems. These parties are typically, but not always, the original vendors. Once again, this matter depends on the service contract associated with the software's purchase. There is often a difference between modifications to fix bugs for which the vendor pays, and customer-requested enhancements for which the end-user pays. The responsibility for major modification projects such as a Y2000 conversion is likely to fall outside the original scope of the agreement. Thus, the result of these negotiations will depend almost entirely on the strength of a company's legal position.

Non-Software Suppliers

If the companies on which another relies for the supply of ordinary goods and services experience Y2000 problems, their problems can become problems for downstream organizations. This issue is amplified if software application interact - which is almost assured in any large organization. These suppliers should be contacted regarding their compliance plans and run tests to identify mutual and precipatory Y2000 problem areas. A downstream organization should review its contracts, particularly the force majeure and liability limitation clauses, to ascertain how the non-performance of

companies on which it relies might be legally excused. If appropriate, a relying company should inform these organizations that a failure to fix Y2000 related problems will not excuse nonperformance. If a company is bound to a supplier through a long-term exclusivity agreement, their inability to demonstrate compliance may provide legal justification to pursue another supplier.

F

Conclusion

The coming of the year 2000 is not just a hardware or software issue, but a social problem with the potential to reach crisis levels in this information-hungry society. To avoid potentially expensive and crippling Y2000 problems, companies must ensure that not only is their own shop in order, but that every company on which it relies solves its own Y2000 problem as well. Along with the previous legal issues presented, steps on an organization's Y2000 conversion checklist should be:

- Gain executive management understanding and support
- Decide the proper mix of "make vs. buy" of the technical resources needed for the impact assessment, conversion, and testing processes
- Select the appropriate tools for all affected computer platforms and applications
- Create a plans to set conversion priorities base on the degree of importance attached to candidate systems
- Adopt an overall conversion methodology, including an adequate test plan allowing the necessary time to "get it right"
- Screen the introduction of new system resources to assure that the millennium problem is not reintroduced

The time to begin preparations for the year 2000 is now. The problems associated with the impending date change will only become greater as the year 2000 approaches. Organizations that wait for a proverbial silver bullet solution are assuming a tremendous risk. Even inherent bureaucratic delays can be costly. IT firms qualified to perform Y2000 conversions have commitments spanning the next year or so. A delay in starting a conversion may spell difficulty in acquiring the services of a qualified Y2000 solution provider. These are all compelling arguments to begin preparation for year 2000 compliancy today.

