

LIFE

CYCLE

ASSET

MANAGEMENT

Good Practice Guide
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Productivity Enhancement Tools

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1.0 INTRODUCTION

This Life Cycle Asset Management Guide identifies and recommends productivity enhancement tools that could be used by technical and management product managers and organizations to improve the outcome of their performance throughout the life cycle of a fixed asset. Such tools, by definition, take advantage of the compound leveraging effort provided by technology on abilities and resource savings. The objective is to provide systems oriented tools that result in cost effective, efficient, high value ways to acquire, operate and manage fixed assets.

The approach taken to date is to identify productivity tools with appropriate points of applicability that enhance the overall performance of program management and the development of program software for technology enhancement and systems design. An informal binning approach has been taken to share experience-based knowledge, identify availability, best-of breed or significant market share products to help you make informed decisions about how useful a particular application has been in actual deployment. Many of these products are COTS (Commercial Off the Shelf Software); many of the Government-developed systems are also COTS-based, with further development. The opinions provided also reflect minimum skills and resource requirements are identified as appropriate. A broadband approach has been taken to identify most major key issues or paradigms that will be encountered, with particular focus on modeling and simulations. However, although business process reengineering discussions are included in every section, no attempt has been made to comprehensively address each and every issue or application availability.

Document Organization: Paper versus Virtual

This document is intended to be ultimately viewed from a browser; that is, published in hypertext markup language(HTML) linked to the other guides and available from the internet/intranet. This early paper version, is being published **now** to get the information out to you and to invite you to tell us if this is helpful and how we can improve our products. This affects how material is organized and presented. For this version, we are using primarily an alphabetic listing of process and products instead of organizing the material by workplace application or by user skills.

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2.0 PRINCIPLES, PRODUCTS AND PROCESSES

2.1 PROGRAM MANAGEMENT

2.1.1 Administrative Management

2.1.1.1 DESKTOP PUBLISHING

Summary.

In the past, especially in the last half century or so during which graphic design as a commercial art has flourished, people entered the field through formal training in art schools and apprenticeships with experienced designers. The almost overnight proliferation of desktop publishing technology has attracted and, through management expectations, forced many people with no training in the visual arts to take responsibility for a wide range of printed material. Increased access to publishing tools has motivated many businesses to produce in-house publishing that were previously done, in whole or part, by outside contractors. The computer is now commonly used to prepare brochures, flyers, newsletters, reports and many other printed pieces. At the same time, the promise and the inevitable hype surrounding desktop publishing has raised expectations about internal and external communications of all kinds.

While expanding the number of people involved in printed communication, desktop typesetting (*JUMPS to glossary.htm*) and electronic page assembly are also dramatically changing the day-to-day operations of an increasing number of publishers, design studios, corporate art departments, and independent freelancers. Writers and editors who cannot draw a straight line find themselves assembling pages in electronic templates. Designers used to specifying type on manuscripts are setting and manipulating it themselves. Production managers used to trafficking hard copy from one department to another are wrestling with the management of electronic files. And pasteup (*JUMPS to glossary.htm*) artists with T-squares and ruling pens are an endangered species.

Now that the first wave of desktop publishers are familiar with pagemaking programs, fonts, and electronic art, they are discovering that it takes more than dexterity with a mouse to produce a strong printed piece. The technical skills involved with desktop publishing are mechanical - they can be learned from a book, classes and friends. What is more difficult for desktop publishers to learn is what to do with the technical skills once they've got them. Remember - A desktop publishing system only does what you tell it to do. You still have to do the thinking, you still have to make the decisions.

Choosing a Desktop Publishing System

Before investing in a desktop publishing system, analyze your situation. You are after a match between your needs and the products that are currently available. Knowing what you want will enable others to be more helpful. The following questions will help sort out the relevant issues.

- What kinds of publications do you want to produce?
- How often will you produce them?
- How many pages are involved?
- What computer equipment do you currently have?
- How important is it that these pieces look?
- What are your requirements for type?
- Will you need graphics? What kind?
- Do you want to use photographs?
- Do you need color?
- Do you have the time to learn about desktop publishing?
- Do you have the enthusiasm for it, and the ability to take on new skills?

Since changes are occurring so rapidly, it is difficult to address specific hardware and software requirements. However, for desktop publishing the Macintosh is still superior to the IBM PC (and compatibles), primarily because Mac DTP software is more mature and because the minimum configuration is more robust. IBM products were originally number-oriented business machines. The Mac, on the other hand, was visually oriented from the start, and continues to evolve in that direction. Other components required in a desktop publishing system could include: scanners, to convert hard-copy photographs and illustrations into electronic (digitized) images so they can be edited by your computer; if you do a lot of desktop publishing, an advanced color monitor and graphics cards; and, a quality color capable printer which will have a lot to do about how good your printed piece looks.

Lastly, the selection of desktop publishing software will be your most important decisions, because it will drive computer and other hardware selections. During the process of software selection, the following issues should be considered:

- Price
- Document length: the maximum number of pages
- Image handling: the ease of design
- Style sheets
- Design templates
- Color
- Compatibility between DTP programs and word-processing programs
- The environment you plan to work in

- A good match between your level of sophistication and the program
- Compatibility between your DTP program and other programs you plan to use
- Fonts, letterspacing (kerning), and line spacing (leading)
- Speed: the time it takes to pour text into column, to format a page, to move from one page to another, to save a page, to print out
- Help: documentation, on-line help, and telephone technical support
- Compatibility: between computer fonts and printers; between programs and scanners

Business Process Reengineering (BPR) Impacts (JUMPS to glossary.htm)

Depending upon our business focus, the introduction of desktop publishing capabilities can have a varied response on our business process, from improving the business operation of an existing publishing organization to enhancing corporate presentations, including how the organization presents corporate capabilities and services on a Web-site.

The business investment of software and hardware enhancements, and the associated training are essential ingredients to weight the cost versus value added benefits of ~~developing~~ a desktop publishing capability. Remember, this is a system and the questions posed regarding your situation and system selection should be considered seriously prior to investment of resources. Accordingly, organizational changes will be directly related to the type of business organization and the intended use or application of the desktop publishing software.

Representative Desktop Publishing Products

The following two desktop publishing products are selected from the many products available in the commercial market based upon a subjective analysis by professional users. This information is found among the attachments to this document:

- Adobe Pagemake 6.0 (*JUMPS to File: dsktp-10.htm*)
- QuarkXPress (*JUMPS to File: dsktp-20.htm*)

2.1.1.2 DOCUMENT EXCHANGE

Summary

Communicating has always been a human priority and today, it is one our primary activities. This is typified by the current rush toward information highways and global networks. Yet it is one thing to link two computers; it is another to exchange meaningful documents across those platforms. For example, it is not possible to open on Mac Write a Word Pro document,

complete with all its formatting. Accordingly, this subject refers to software that converts a wide variety of platform-specific document files (various word processing formats, desktop publishing files, spreadsheets, electronic mail, etc.) into a common platform-independent format. Document exchange programs make it possible to share computer-generated documents across all major computing platforms.

It is not uncommon that ASCII (*JUMPS to glossary.htm*), despite its limitations, appears as the only truly interoperable standard. However, traditional problems with document-based information management include:

- Disparate File Formats. Seldom are all the pieces of information available in compatible file formats which makes information difficult to assemble.
- Disparate Formatting. The format of separate pieces of information and the final document must be changed for reproduction and distribution. Formatting and re-formatting documents requires significant time and effort.
- No Link from Document to Document. A document represents a dead-end in the flow of information because there is no link to the information that created it. This means that the information must be reassembled and re-formatted numerous times, as new and updated documents are created.

Two technologies offering *universal file formats* are discussed here:

- a. Standard Generalized Markup Language (SGML) (*JUMPS to glossary.htm*). This is an international standard for electronic document exchange. SGML is a symbolic language that provides a coherent and unambiguous syntax for describing whatever a user chooses to identify within a document. It is specifically designed to enable text interchange and is intended primarily for use in the publishing field, but has other applications. It is the basis of the highly popular HTML (*JUMPS to glossary.htm*) Internet standard (HyperText Markup Language) which, together with URLs (*JUMPS to glossary.htm*)(Uniform Resource Locators) and HTTP (*JUMPS to glossary.htm*)(HyperText Transfer Protocol), is one of the foundations of the World Wide Web initiative (also known as WWW (*JUMPS to glossary.htm*) or simply Web).

SGML solves the three problems listed above. It is based on ASCII which virtually all applications can read. Therefore, file format is no longer a problem to document creation. Pieces of information from different sources can be easily assembled because they are in the same format. Furthermore, because virtually all systems can read ASCII, SMGL is system independent. To move an SGML file from machine to machine does not require specific hardware, software, or operating system.

Its founders understood that document format would always present a problem and designed SGML to remove the format from the content and structure of a document. Because SGML preserves document structure, the layout and format can be automated. This means that pieces of information from different sources can be assembled, after which format and layout will be added automatically.

SGML has been adopted as the DOE standard for accomplishing electronic exchange. The Office of Scientific and Technical Information (OSTI) (*JUMPS to <http://www.doe.gov/html/osti>*) has the overall responsibility for managing the adopting and transition to the use of SGML for scientific and technical documents. It is working to provide a common or easily understood standard for electronic document processing and exchange under the Electronic Exchange Initiative (*JUMPS to <http://www.doe.gov/html/osti/eei/eei.html>*).

- b. Portable Document Format (PDF). This is a graphically oriented file format designed for electronic interchange; it was developed by Adobe Systems Inc. for use with its Acrobat software. In a PDF file, any page in a publication can be displayed or printed by a user in a form virtually identical to the page that appeared in the publication (including richly formatted text, graphics, and colors). The PDF format is derived from PostScript, the page description language developed by Adobe, but a PDF file is much smaller than a corresponding PostScript file, so it is more suitable for electronic delivery. PDF files can be enhanced with hyperlinks to other parts of the document, to other files, and to other applications. With the Acrobat reader, a user can view and print PDF files; in addition, a user can extract text into ASCII or Rich Text Format (a file format that preserves some of the font and formatting characteristics of a document) and performs searches on the document, because of the inherent database. There are other competing formats available that are essentially self-contained, but this is the leading one because of the name and experience of the manufacturer, and because the PDF readers are essentially free, except for configuration. (Chances are good that you are using the Acrobat Reader now to read this document, if you got it from the our home page!)

Choosing a Document Exchange System

This is a rapidly evolving field both in the sense of customer perception of need and in the technologies available. Careful analysis of existing needs relative to evolving technologies is a primary consideration for a potential client. Like DTP systems, the skill of the builder of the components remains more important than the technology. Also, it must be considered where users are on the skill curve, since it is anticipated that the paradigm shift to having your technology assemble information components as you need them instead of reading real pages is occurring very quickly.

Business Process Reengineering (BPR) Impacts

This issue represents one aspect of the cutting edge of document management. The rapidly evolving technology in this area will significantly impact business processes as standard systems are developed and accepted by the public and private sectors. Adobe Acrobat is well known and established; however, SGML has been adopted as the DOE standard for accomplishing electronic exchange. Clearly, some level of “work-together” is necessary.

Representative Document Exchange Products

The following two document exchange products are selected from the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Adobe Acrobat (*Jumps to file: docex-10.htm*)
- WordPerfect SGML Edition (*Jumps to file: docex-20.htm*)

2.1.1.3 GRAPHICS

Summary

Whether you are a novice or an expert user, graphics tools provide extraordinary capabilities to enhance presentations including: tools that automate drawing, layout, image editing, and pasteup (*JUMPS to glossary.htm*) tasks; provide extensive libraries of patterns for filling and outlining artwork; and built-in color separation capabilities.

There are two main type of computer graphics - vector images and raster (or bitmap) images. Understanding the differences between these two types of images is useful when your creating and editing digital images, or choosing among the variety of industry software products. Vector images are made up of mathematically defined lines and curves called vectors. Vector-based programs are best for type and bold graphics, such as logos, which require and will maintain crisp, clear lines no matter what size they are scaled to. Raster images consist of a grid, or raster, of small squares, known as pixels. Raster images are best used for working with continuous-tone image, such as photographs or images created in painting programs.

In general, graphics capabilities are organized according to the tasks you most commonly perform when editing and printing digitized images. These include: using tools and palettes (*JUMPS to glossary.htm*); selecting and drawing images; moving and aligning objects; modifying shapes and applying special effects; painting; creating custom colors, gradients (*JUMPS to glossary.htm*), and patterns (*JUMPS to glossary.htm*); using layers (*JUMPS to*

glossary.htm); using type and graphs; scanning and importing and exporting images in other file formats; printing documents; and, producing color separations. Evaluation of these capabilities are used to select among the wide range of graphics software offered for the graphics user.

Choosing Graphics Software

In the graphics environment, selection of top-of-the-line software products is driven by the platform. Currently, software developed for application in a Macintosh environment are among the industry leaders. Where there is comparable software made for a DOS or Windows 3.x operating system, upgrades to the software often lags behind current Macintosh applications, with no price advantages. Macintosh systems were originally designed to support engineers and graphics designers; hence, the graphics software industry focused their efforts in the development of software that was Mac supportable. However, it needs to be said that the Mac advantage is expected to continue to decline as additional applications continue to be ported over to the various Windows platforms and the supporting systems get more robust.

Certainly, selection of graphics software must consider not only the platform, but also - system characteristics, the ease of use, training and hardware requirements, and the ability of the software to be cross-platform capable, permitting a seamless transition of file formats between Macintosh and Windows operating systems.

Business Process Reengineering (BPR) Impacts

Depending upon our business focus, using graphics to enhance communications capabilities in the workplace can have a varied response on our business process, from improving the business operation of an existing publishing organization to enhancing corporate presentations, including how the organization presents corporate capabilities and services on a Web-site. Information received graphically not only adds to comprehension but is also retained longer, so that it may not always be advantageous to convey all aspects of business processes in a graphical manner.

The business investment of software and hardware enhancements, and the associated training are essential ingredients to weigh the cost versus value added benefits of developing a graphics-oriented capability. Remember, this is an integral part of a system and the questions posed regarding your situation and system selection should be considered seriously prior to investment of resources. Accordingly, organizational changes will be directly related to the type of business organization and the intended use or application of the software.

Representative Graphics Products

The following five graphics-oriented products are selected from the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Adobe Photoshop 3.0 (*Jumps to file: graph-10.htm*)
- Adobe Illustrator 4.1 (Windows version) (*Jumps to file: graph-20.htm*)
- Adobe Illustrator 6.0 (Macintosh) (*Jumps to file: graph-30.htm*)
- Macromedia Extreme 3-D (*Jumps to file: graph-40.htm*)
- Strata Studio Pro Blitz 1.75 (*Jumps to file: graph-50.htm*)

For the casual/inexperienced user, incorporating simple graphics to convey a message or enhance a presentation has been a strength of well-known client suites. Those that reside within a word processing product, such as Word or Wordperfect, or a spreadsheet, such as Excel, tend to be simplistic but appropriate for highlighting information. Applications dedicated to routine business graphics include:

- Harvard Graphics 3.0
- Power Point 4.0 and Power Point 7.0
- Corel Draw 5.0 and Corel Draw 6.0

2.1.1.4 IMAGING

(To be provided in the next version)

2.1.1.5 MULTIMEDIA & PRESENTATION

Summary

Whether you are a novice or an expert user, multimedia tools provide extraordinary capabilities to create and distribute interactive multimedia applications. Features include: 2-D and 3-D solutions for design and multimedia, graphics, animation, image editing, a database of graphics, sounds, color palettes (*JUMPS to glossary.htm*), built-in rendering across Macintosh and Windows platforms, high-resolution image editing, natural texture painting and compositing, and multi track music and sound production, with synchronized media in the score.

In general, multimedia capabilities are organized according to the tasks you most commonly perform when creating and distributing multimedia applications. These include:

comprehensive import and integration of texts, graphics, animation, digital video and sound from any source and integrate that media into dynamic, interactive multimedia applications; 2-D and 3-D animation of unlimited number of elements on screen; synchronize animation to voice overs and music; ability to create and edit on-screen graphics and text fast; adding interactive natural-syntax programming language; mixing sounds-like a voice-over and the soundtrack on the fly, using a multi-channel sound channels in the score; and, seamless cross-platform compatibility between Macintosh and Windows. Evaluation of these capabilities are used to select among the wide range of multimedia software offered for the user.

Choosing Multimedia Software

In the multimedia tools environment, selection of top-of-the-line software products is often driven by the platform. Currently, software developed for application in a Macintosh environment are among the industry leaders. However, there's much comparable software made for a Windows operating systems, with no price differential. Macintosh systems were originally designed to support engineers and graphics designers; hence, the software industry had focused their efforts in the development of software that was Mac supportable. Most of the most popular and heavily developed and supported features enjoyed by Mac users have now been completely ported over to Windows, in addition to those applications originally developed solely for the underlying DOS interface.

Certainly, selection of multimedia software must consider not only the platform, but also - system features and capabilities, the ease of use, training and hardware requirements, and the ability of the software to be cross-platform capable, permitting a seamless transition of file formats between Macintosh and Windows operating systems.

Business Process Reengineering (BPR) Impacts

Depending upon business focus, introduction of multimedia capabilities can have a varied impact on business processes, from improving internal and external communications, to an enhancement or replacement for publishing or corporate presentations, including how the organization presents corporate capabilities and services on a Web-site.

Probably the single most effective aspect of multimedia in current use is for user-paced training, whereby complex or easily forgotten subjects can be acquired or revisited, on demand, by the one who needs it the most at a minimum impact to scarce training human and classroom resources. The next frontier of multimedia is likely in the area of executive decision making, involving sophisticated algorithms manipulating real-time assembly of multiple data inputs, so that sensitivity impact can be generated while contemplated, and in the more mundane world of information storage and retrieval.

The business investment of software and hardware enhancements, and associated training are essential ingredients to weight the cost versus value added benefits of establishing a multimedia center. Accordingly, the impact on business processes will be directly related to the type of business organization and the intended use or application of multimedia capabilities.

Representative Multimedia Products

The following two multimedia-oriented products are selected from the many options available in the commercial market based on subjective analysis by professional users. This information is found in attachments to this document:

- Macromedia Director Multimedia Studio 1.5 (*JUMPS to File: media-10.htm*)
- Strata Virtual Studio (*JUMPS to File: media-20.htm*)

2.1.2 Communications Management

SUMMARY

Communications encompasses a broad spectrum of technologies. This section of this document address some of the new technologies in communications during the past decade that have dramatically changed both the business and private worlds of the United States. The subjects addressed below did not even exist within the memory of a large portion of the general public today.

2.1.2.1 E-MAIL

Summary

Electronic mail has been available for several years as a DOS application, and before that as terminals for mainframes. These programs were primarily suitable for simple ASCII message transfers. The user was required to learn a number of arcane commands to issue from the command line interface popular at the time. The editors available to create the message provided a challenge to the less computer literate user.

The development of mail programs with graphical user interfaces has opened the electronic mail capability to the average computer user. While making the composition of messages simpler, they also allow for more complex capabilities such as attaching a binary file such as a word processing document or a spreadsheet file to the message. The encoding of the file format at the sending end, the transmittal, and the decoding of the message at the receiving end are all handled transparently to the user.

The connection of the electronic mail system to the internet has given the user an unlimited horizon. It is now possible to send an electronic mail message to a recipient anywhere in the world, not simply to users on the same network to which you are connected. This feature is particularly useful in dealing with customers, clients, and associates who are not located within your building. Various drafts of documents are routinely circulated through electronic mail today. Real workplace power can be achieved when

Choosing E-Mail Software

The most widely used E-mail software packages offer very much the same attributes. The standard for a wide area network is a minimum of conformance to X.400 (*JUMPS file: glossary.htm*) with rapid evolution to X.500. These include:

- Addressing
- File or fax attachment and viewing/interpretation capability
- Internet provisions
- Spell checking, variable fonts, and other customization
- Synchronization with or support calendaring and/or phonebooks

Selection of a particular package will be dependent not only on the individual user's attribution of importance of these attributes, but also of the ease of system administration, since these tend quickly to get very demanding of system resources.

Business Process Reengineering (BPR) Impacts

E-mail has been widely adopted by both the private and government sectors in the United States in a relatively short time in recent years. Its impact on communications, both within and outside an organizational entity, has been dramatic. In some respects, it has challenged telephone communication in that it provides an audit trail and the convenience of responding as convenient.

Representative E-Mail Products

The following two e-mail products are selected from the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- MS Mail (*JUMPS File: mail-10.htm*)
- Lotus ccMail (*JUMPS File: mail-20.htm*)
- Eudora Internet Mail (*JUMPS File: mail-20.htm*)

2.1.2.2 INTERNET/WWW

Summary

The World Wide Web is the multi-media section of the internet that has exploded in popularity in the last two years. In the past, only text (dumb terminal) interfaces were available to access the portions of the internet. For the most part, this is still true of accessing areas such as File Transfer Protocol (FTP) sites, Telenet sites, Gopher sites, Archie sites, etc.

The development of a Windows graphical user interface front end to facilitate access has driven the Web to the forefront of internet user popularity in record time. Through the use of color, hyperlinks, etc. the Web provides an easy to use interface to all the data that is available from government agencies, commercial companies, universities and private individuals.

- a. Servers. In order for an organization to put information on the Web for public access, it must first establish a server. This is done by running server software on a computer at the information provider's location. The server waits for requests for information, locates the document requested, and sends that document to the user.
- b. Firewalls. Security is an important consideration at any server location. The fact that an organization has placed information on the internet for public access should not have the side effect of opening the organization's computer to unwanted access. Firewall software protects the server from that illegal access.

The firewall serves as the only connection between your private internal network and the entrusted outside network such as the internet. Generally, the protection is in the form of a hardware/software solution that tightly controls access to block attacks which could be launched against your network.

Ideally, an internet firewall provides transparent access to all supported services. The user's client software issues commands as if it were connected directly to the internet. Thus, no changes are required to your browser or connection.

For descriptions of books on internet firewalls and internet security, follow these links to the on line bookstores.

- Building Internet Firewalls
(JUMPS to <http://amber.ora.com/www/item/fire.html>)
- *Firewalls and Internet Security*.
(JUMPS to <http://www.clbooks.com/>)

- c. Browsers. The user who wishes to get onto the Web and gather information must run browser software on his local computer. The browser performs the necessary functions to allow the user to enter an address of the server that contains the desired information, establish a communication connection to that server, receive the file, and display the information on the user's screen with all the appropriate multi-media 'splash.'
- d. Tools and Utilities. There are software tools designed to make the task of creating Web documents easier. Mostly, these are web authoring tools such as Hyper Text Markup Language (HTML) editors. HTML is the standard language used by Web documents and understood by Web browsers. It defines a set of tags, which are codes that identify in ASCII characters what needs to be done to the document to format it. For example, to put a title into a Web document, the author uses the <TITLE> tag. To put a header into a document the author uses the <HEADER> tag. There are similar tags to center or align text, tags to bold or underline text, as well as tags to select the font for displaying the text to mention just a few of the formatting capabilities.

There are conceptually two types of editors offered. Standalone editors and editors that are part of another more common software package. The easiest solution at this time is to developments the text for your Web page in a word processor that is familiar to your staff. In this way, the learning curve of getting a completely new editor is bypassed. The two biggest selling word processors, Word Perfect and MS Word, both have lightweight HTML editors that are add-ons to these word processors that are available free from their respective websites.

Choosing Internet Software

Internet usage involves two basic levels: the receiver or "surfer" and the establishment and maintenance of a Home Page on the WWW. For the receiver, software selection involves the choice of a browser. This decision may be driven by the choice of the internet service company to provide access to the internet.

For those who maintain a Home Page on the internet, the choice of server, firewall, and tools and utilities software is open to a large market of competitive packages. A primary consideration, of course, will be compatibility among these types of software requirements.

Business Process Reengineering (BPR) Impacts

The Internet/WWW is a phenomenon of rapidly increasing impact on the business world, as well as many aspects of the individual person's environment. It provides an effective window

to the world for business and commercial entities to introduce themselves and their products and services. It also provides convenient access for assessing the competition. The rapid audience growth of this system can only be expected to continue, so that business entities should very seriously evaluate their objectives on the internet and dedicate the resources necessary to reach those objectives. On the downside, it is sometimes difficult to find what you are looking for; indeed, it may not yet be available for distribution from the 'Net. And, if truth be told, there's quite a bit of junk out there. A recent metric on typical web surfing indicates that 9.7 hours of every week is comprised of web use -- not all of that is productive.

So, some lessons-learned apply when building anything useful on the web:

- (1) Keep in mind that your potential audience just wants to find what is of substance; aimless looking or meandering is counterproductive and anger-producing. Never forward a user back to where the start was. Links back to a logical re-starting point or intermediate crossroad can be helpful.
- (2) Design is important: clearly convey the intent of the electronic page. Remember this is not paper. Also, graphics should be used sparingly, unless they are absolutely necessary - don't.
- (3) Keep learning and provide email feedback links for users. A good general site to start from to find out about good internet style is at "[Bob Allison's Tips for Web Spinners](http://gagme.wwa.com/%7Eboba/tips1.html)" (*JUMPS to: <http://gagme.wwa.com/%7Eboba/tips1.html>*)

Representative Internet/WWW Products

The following internet-related products are selected from the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

Servers

- [Spry SafetyWeb Server 1.1](#) (*JUMPS File: inet-10.htm*)
- [Netscape Commerce Server 1.12](#) (*JUMPS File: inet-20.htm*)

Firewalls

- [Gauntlet Internet Firewall](#) (*JUMPS to File: inet-30.htm*)
- [GTA Internet Firewalls](#) (*JUMPS to File: inet-40.htm*)

Browsers/Page Builders

- [Netscape Navigator](#) (*JUMPS File: inet-50.htm*)
- [MicroSoft Internet Explorer](#) (*JUMPS File: inet-60.htm*)

Tools & Utilities

- [Internet Publisher for Word Perfect \(JUMPS to File: inet-70.htm\)](#)
- [Internet Assistant for Word \(JUMPS File: inet-80.htm\)](#)

2.1.1.2.3 VIDEO-TELECONFERENCING

Summary

While fax machines, cellular phones, and modems have allowed people to stay in touch without being right there, it will never be the same as being there. Face-to-face contact and the give and take of working together in person are important human factors that are simply lacking in the long distance transfer of information today.

But as the telephone once revolutionized the world by allowing people miles apart to communicate at any given moment, affordable and accessible technology now allows two or more people to see each other, work together, and capture all of the nuances of being there in real-time. PC-based televideoconferencing (VTC) promises to revolutionize the workplace, and help motivate remote employees, increasing their ability, improving their morale, and cementing professional alliances.

What was once the material for futuristic movies, desktop and group videoconferencing have become a reality. The hardware and software have been developed to complete two-way communications tools for audio, video, and data that functions over a standard phone line and personal computer. The video component, paired with the ability to perform collaborative computing, changes the whole dynamic for two parties working at locations across town or across the globe.

The time and expense of travel are relieved when presentation to the board of directors can be done from a satellite office. And across country partners can make last minute changes on a proposal simultaneously, on screen, without the hassle of back and forth faxes. While being there may not be possible, the impact and input of being there to verify data and conceptual executions are possible through interactive video and communications.

Choosing Videoconferencing Systems

Before investing in Videoconferencing system software and hardware, analyze your situation; and match your needs with the products that are currently available. Knowing what you want will enable others to be more helpful. The big issue has been and remains bandwidth. Without the proper bandwidth coupled with speed, the video will seem like a toy, with pictures being jerky, small, grainy, and even in black-and-white. The following questions will help sort out the relevant issues. VTC and working collaboratively has been invaded by the internet as well, with most leading browser providers looking for ways to incorporate actual

face time in the user configuration. Beware of proprietary systems since the recent ITU H.320 and T.120 agreement on standards for appropriate configuration has created the situation where many high end and expensive systems have suddenly become orphans.

a. Configuration Considerations

- What computer equipment do you currently have?
- What are the interfaces to the telephone system and external databases?
- What kind of phone lines link you to your local telephone company's central office?
- What other services are available? Analog or digital? Switching and information services, such as: DID (direct inward dialing) and caller (ID)?
- Do voice-processing boards and the application generator support those services?
- Flexibility of the network: Is it compatible with TCP/IP, IPX/SPX, and NetBEUI?
- Applications: Is environment robust enough for multimedia and telephony applications development?
- Reliability: Is the environment stable enough to ensure that a mission-critical application, such as call control won't crash?
- Open Design: Is the API comparable with a wide range of PBX systems?
- Media stream: Will the environment handle multiple media devices, including fax, data, voice, and video equipment?
- Pricing: Is the API bundled with a comprehensive operating environment?
- Scalability: Does the environment support a range of form factors, platforms, and multimedia applications, as well as high-volume user traffic?

b. System Capability Requirements

(1) CONFERENCING FEATURES

- Videoconferencing
 - Capture video to movie file
 - Capture still to clipboard
 - Capture still to file
 - Freeze frame
 - Adjust color
- Whiteboarding
 - Selection of screen color tool
 - Copy/cut/paste and clear
 - Page sorter/organizer
 - Highlighter tool

- Magnification (zoom) tool
- Import graphics files
- Import text files
- Import spreadsheet files
- Import via Windows clipboard
- Export graphics files
- Applications and Data Sharing
 - Share Windows clipboard
 - Number of applications-sharing participants
 - User can request/relinquish control of shared applications
 - Share DOS applications
 - Share Windows applications
 - OLE and ODE support
- File Transfer
 - Attach file to message
 - View transfer status
 - Option to Compress/Decompress files during send/receive
- Chat
 - Number of chat participants
 - Chat window lists participants

(2) GENERAL PROGRAM FEATURES

- Communications/Networking
 - Number of attendees per document conference (LAN)
 - Number of attendees per document conference (Modem)
 - Number of video capture boards supported
 - Document conferencing via standard telephone system (STS)
 - Document conferencing via LAN
 - Document conferencing via TCP/IP
 - Simultaneously LAN and Modem connections in document conferencing
 - Videoconferencing via STS
 - Videoconferencing via ISDN
 - Videoconferencing via TCP/IP
 - Videoconferencing via LAN
 - Simultaneous LAN and modem connections in video-conferencing
 - Supports telephony API (TAPI)
- Address Book
 - Allows multiple address databases
 - Maintains LAN and modem addresses
 - Attach graphic files (photos) to address

- Attach movie files to address
- Miscellaneous
 - Number of modem setups included
 - Supports Voice over Data (VOD) modems

Lastly, the selection of modeling language or COTS specific application models will be your most important decision, because it may drive computer and other hardware selections. Remember, products manufacturers offer variants of possible system features, which require different skill levels to operate and maintain. During the process of software selection, the following issues should be considered:

- Price
- Matching business requirements with available features
- Capability best matches your experience and skills
- What platforms you want to use
- Programming skills available and required
- Runtime fees
- Number of telephone ports required
- Support ability of the software including: system upgrades and training
- Help with documentation, on-line help, and telephone technical support

Business Process Reengineering (BPR) Impacts

Depending upon our business focus, the introduction of video-conferencing capabilities can have a dramatic response on business process, by improvements to time management and cost reductions in business operations resources (e.g. travel), impromptu conferencing with colleagues, management conferencing with employees, group training, and rapid exchange of information.

The business investment of software and hardware enhancements costs are essential ingredients to weigh the cost versus value added benefits of establishing a Videoconferencing capability. However, the cost of most systems today make it improbable that the return on investment would not be realized within a few months, particularly if corporate assets are distributed and scheduled conferencing (e.g. quarterly) is ongoing.

Representative Videoconferencing Products

The following four computer-telephony oriented products are selected from the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Connectix Video Phone (*JUMPS to File: video-10.htm*)

- [PictureTel Live50](#) (*JUMPS File: video-20.htm*)
- [ProShare Video System 200](#) (*JUMPS File: video-30.htm*)
- [ShareVision PC3000](#) (*JUMPS File: video-40.htm*)

2.1.1.2.4 COMPUTER-TELEPHONY INTEGRATION

Summary

What is a telephony application? At its simplest, its the automation of the handling of telephone calls; answering the phone, greeting the caller, and responding to a request - all without a human operator. As it grows more complex, it incorporates many other functions, including digit capture, storing and forwarding of voice messages, database access, automated speech recognition, text-to-speech conversation, storing and forwarding fax data, fax response, dialing out, and tracking usage statistics.

Choosing Computer-Telephony Integration Systems

Before investing in Computer-Telephony Integration system software and hardware, analyze your situation; and match your needs with the products that are currently available. Knowing what you want will enable others to be more helpful. The following questions will help sort out the relevant issues.

- a. Configuration Considerations
 - What computer equipment do you currently have?
 - What are the interfaces to the telephone system and external databases?
 - What kind of phone lines link you to your local telephone company's central office?
 - What other services are available? Analog or digital? Switching and information services, such as: DID (direct inward dialing) and caller (ID)?
 - Do voice-processing boards and the application generator support those services?
 - Flexibility of the network: Is it compatible with TCP/IP, IPX/SPX, and NetBEUI?
 - Applications: Is environment robust enough for multimedia and telephony applications development?
 - Multitasking: Does the environment allow for multiple and simultaneous functions to avoid putting calls on hold?
 - Reliability: Is the environment stable enough to ensure that a mission-critical application, such as call control won't crash?
 - Media stream: Will the environment handle multiple media devices, including fax, data, voice, and video equipment?

- Pricing: Is the API bundled with a comprehensive operating environment?
- b. System Capability Requirements
- Implement or integrate with voice mail
 - Call-Fax-back processing
 - Speech recognition
 - Text-to-speech converters
 - Telephony switching (e.g. conferencing and call forwarding)
 - Data communications capability

Lastly, the selection of modeling language or COTS specific application models will be your most important decision, because it may drive computer and other hardware selections. Remember products manufacturers offer variants of possible system features, which require different skill levels to operate and maintain. During the process of software selection, the following issues should be considered:

- Price
 - Matching business requirements with available features
 - What platforms you want to use
 - Programming skills available and required
 - Runtime fees
 - Number of telephone ports required
 - Support ability of the software including: system upgrades and training
 - Help with documentation, on-line help, and telephone technical support
- c. Helpful hints for selecting the application for your organization
- For little program experience, select product which is menu-driven
 - Whether you want a tool that uses a graphical interface or a character-based interface. GUI-based applications generators provide the ability to build an application by connecting action icons together.
 - With programming expertise, scripting language will typically provide more flexibility to the developer than menu-based products.
 - Whether you want to learn a new language, or use popular voicing tools based on Visual Basic, such as Stylus Innovation's Visual Voice or Pronexus VB Voice.
 - Processing platform:
Windows 3.1 is an inferior multitasking operating system; Windows 95 and Windows NT are true multi-tasking, multithreaded platforms. DOS-based application generators currently produce the best results for telephony system that have many ports.
 - Price leaders for building telephony applications are: Stylus Innovation (with no runtime fees) and SpeechSoft

- Higher costed programs include: Apex Voice Communications, Cascade Technologies, Expert Systems, MasterMind, Technologies, Parity Software, Technically Speaking, Telephone Response Technologies, U.S. Telcom

Business Process Reengineering (BPR) Impacts

Depending upon our business focus, the introduction of computer-telephony integration (CTI) capabilities can have a dramatic impact on business process, by improvements to personnel time management and response to business calls; and handling of fax materials, electronic version or hardcopy, including fax to multiple locations.

The business investment of software and hardware enhancements costs are essential ingredients to weigh the cost versus value added benefits of establishing a CTI voice capabilities with existing network and desktop software capabilities. However, the cost of most systems today make it improbable that the return on investment would not be realized within a few months, particularly after the first important call is missed due to manual operation overload, or the time lost trying to manually fax documents to multiple locations.

Representative Computer-Telephony Products

The following six computer-telephony oriented products are selected from the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Callware Netware Loadable Module (NLM) (*JUMPS File: cit-10.htm*)
- Callware Viewpoint (*JUMPS File: cit-20.htm*)
- CallWare EX (*JUMPS File: cit-30.htm*)
- PhoneNotes Application Kit (*JUMPS File: cit-40.htm*)
- Ease 3.0 Developer Kit (*JUMPS File: cit-50.htm*)
- Wildfire (*JUMPS File: cit-60.htm*)

2.1.3 Engineering Design

SUMMARY

The most broadly recognized impact on engineering design in the past decade has been in the development of Computer Aided Design and Drafting (CADD) tools, henceforth referred to in its abbreviated acronym as CAD. The concept of CAD is self explanatory in that it involves the production of engineering drawings on a computer in preference to the traditional drawing table method. The complexity of this process and the myriad of capabilities within the basic concept that have evolved need not be addressed here. However, a natural extension of CAD

has been the Geographic Information System (GIS) which, in simplistic terms, attaches database(s) to a CAD system and thereby offering a true analytical tool.

2.1.3.1 COMPUTER AIDED DESIGN (CAD)

Summary

CAD systems help engineering professionals to design, model, draft, map, render, and manage systems. Of the main suppliers of such software, the industry leader is Autodesk, with its AutoCAD system. Other manufacturers include Intergraph, Bentley, Cadence Design Systems, Cadkey Corporation, Cadvance, Delcam, Numera Software, Softdesk, and Synopsys. Others such as Accugraph, Hewlett-Packard, Silicon Graphics, and Sun offer CAD systems to operate on workstations.

Choosing CAD Software

As with any software category, the selection of a particular package will depend on the user's needs and resources. However, CAD is most commonly used by companies whose business is to produce engineering drawings and AutoCAD has come to nearly dominate that market. However, with all of the benefits that digitizing brings to internal efficiency, it is slowly dawning on the at-large professional workplace, that standardization is necessary to identify all of the conventions, including layering, to allow true interchangeability. Of course, this increases even more the admittedly steep learning curve that comes with these complex systems. Factors that would be considered in selecting a CAD system include:

- Scope of drawing capability and complexity
- Training requirements
- Drawing maintenance provisions

Business Process Reengineering (BPR) Impacts

CAD has marked a major milestone in engineering design and drafting and inherently entails a significant BPR impact on any entity that produces and maintains engineering drawings. Impact areas include:

- Production efficiency
- Drawing standards
- Drawing changes
- As-built maintenance

Representative CAD Products

The following three GIS oriented products are selected from the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- AutoCAD (*JUMPS to File: cad-10.htm*)
- Intergraph (*JUMPS to File: cad-20.htm*)

2.1.3.2 MAPPING AND GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Summary

Rapidly evolving technology in Geographic Information Systems (GIS) and Computer-Aided Facilities Management (CAFM) systems permits the digitized storage of graphic data on a facility or complex of facilities plus associated database(s) that together comprise powerful facilities engineering tools. Another way to describe GIS software is a system that integrates vector (x, y locations) map data, raster images such as photographs, scanned documents or satellite images, CAD drawings, sound and video data, as well as the tabular database management system (DBMS) data into a single, integrated environment. For example, a GIS for a street network could include data on underground utilities showing each utility (water, gas, electricity, sewage, storm drainage), parking, traffic volume, pavement condition, and landscaping each in a separate plane. Similar systems such as Automated Mapping/Facility Management (AM/FM) allow the digitized storage of graphic data on individual facilities such as drawings, photos, and other pictorial information. Computer Aided Design and Drafting (CADD) stores vectored arrays of 2- or 3-dimensional models of buildings, machine parts, or other assets and produces graphic drawings of them. AM/FM might be considered as a smart map; a GIS or CAFM are the only true analysis systems among this software family.

While CAD is addressed as a separate PET category in this document, these other systems are grouped under the broad umbrella of GIS. Their inherent nature and the pace of technological development entail an increasingly broad gray area to distinguish one from the other. However, while grouped under the broad GIS umbrella, the attached PET data sheets do designate among CAFM, AM/FM, and GIS.

Choosing GIS Software

As stated above, the concept of GIS encompasses a broad range of products with many gray areas in distinguishing just what is what. This is a very dynamic field that is expected to dramatically impact the operations of many entities including local governments, utility

companies, environmental engineers, and facilities managers. The needs that these systems can serve are so broad that the selection of software is totally dependent on individual cases.

Business Process Reengineering (BPR) Impacts

GIS systems in themselves involve BPR in that they greatly expand the power and control of the individual facilities manager; it's always easier to manage something complex that you can see and manipulate. Application of any one of the automated tools that are available will improve the efficiency of facilities management through such capabilities as:

- Information management
- Data analysis
- Maintenance planning
- Master planning

Each such software product will have a different level of impact on project management efficiency, but this will vary by project and the use made of the tool. Therefore, identification of specific BPR impacts for each project management tool identified below is not feasible.

Representative GIS/GIS-related Products

The following three GIS oriented products are selected from the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Geographic Resources Analysis Support System (GRASS)
(JUMPS to File: *gis-10.htm*)
- ArcInfo/Environmental Systems Research Inst. (JUMPS to File: *gis-20.htm*)
- AutoFM (JUMPS to File: *gis-30.htm*)
- (JUMPS to File: *gis-40.htm*)
- MapInfo (JUMPS to File: *gis-50.htm*)

2.1.4 Financial Management

There are many facets of financial management including budgeting, accounting, resource allocation, banking, and others. The intent here is to discuss software applications in just of those applications: accounting & payroll and electronic data interchange (EDI).

2.1.4.1 ACCOUNTING & PAYROLL

Summary

Financial management (FinMgt) requires the preparation, use and control of information for accounting, payroll, and personnel requirements. FinMgt includes posting budget estimates, accounts receivable, payments, funds available, and a host of other accounting requirements, plus it may include payroll, personnel records, and other features needed by an organization. Efficient input, storage, retrieval, manipulation, and display of this information requires an automated computer system. However, each financial management organization has different priorities and requirements, so commercial off the shelf (COTS) financial management computerized programs must be adaptable to changes under strict accounting procedure controls. Any changes to a FinMgt program that are to be used for accounting purposes must be permanent.

Many commercial software products are available for use in financial management, but not all will meet strict government audit requirements. These systems are available for the full spectrum of computer hardware, from main frame computers to networked and stand-alone microcomputer systems. The quality, competitiveness, and changing nature of commercial software make in-house software development inadvisable, but rather purchase a COTS accounting program and have a professional accountant prepare the program for use according to government accounting requirements for the specific user. A good practice is to support the adopted accounting program with a maintenance contract even though the fee could be substantial. The maintenance contract should include program upgrades, a help line, manuals to support software upgrades, and notifications of changes in accounting laws. For federal government contractors, the system used must be approved by federal auditors before it can become the official accounting vehicle of a company. Further, rapid advancement in computer hardware and software technology makes it inappropriate to recommend a specific program and version, but representative examples can be useful as provided on the following pages.

Further, the underlying idiomatic problem with all financial systems, including those of so-called "total solutions providers", is that they usually do not address the fundamental issues of data element definition and description. Thus, system validity and how well the software works is only as good as the understanding of the people working the data.

Choosing Accounting Software

Every organization has its own unique combination of requirements for an accounting system and must evaluate the capabilities of available accounting programs in making its selection. Some factors may be critical, such as the ability to run on existing hardware or interface with other existing software. If such critical factors exist, they should be evaluated first to create a "short list" from which the accounting program will be chosen. Few programs will contain

all accounting function required by federal regulations for government contractors. When a federal government contractor adopts an accounting program, the tailored package must be approved by federal auditors (DCAA), so be sure to choose one of the very few programs that will readily receive DCAA approval. The ultimate selection must be based on that system which best meets the activity's needs and its ability to interface with higher order organizational systems with minimum or no human intervention. The facility with which lower level or basic financial management software is able to interface with peer level or program management structures has given rise to a whole industry of data manipulation and interpretation handlers that are identified as "middleware" (*JUMPS to glossary.htm*)

Business Process Reengineering (BPR) Impacts

Accounting software products usually offer support services agreements with licensees, so that they can be upgraded to conform with regulation changes mandated by the Federal Acquisition Regulation (FAR) and Cost Accounting Standards (CAS). The changes are implemented only when Defense Contract Audit Agency (DCAA) auditors approve the changes for the users. Clients can be successfully audited by the DCAA.

Representative Accounting Products

The following accounting products are representative of the many options available in the commercial market for small enterprise use based on subjective analysis by professional users. This information is found among the attachments to this document:

- Deltek (*JUMPS to File: acct-10.htm*)
- Peachtree (*JUMPS to File: acct-20.htm*)
- Timberline (*JUMPS to File: acct-30.htm*)
- Intuit Quicken/Quickbooks (*JUMPS to File: acct-40.htm*)

2.1.4.2 ELECTRONIC DATA INTERCHANGE (EDI)

Summary

EDI (*JUMPS to glossary*) is the electronic transmission of routine business transactions in a standard format between two or more computers and across different computer platforms. For example, it enables trading partners to conduct routine business transactions, such as purchase orders, invoices, and shipping notices more quickly and efficiently than would be possible with conventional, paper-intensive methods. EDI implementation will not only allow for the above to occur, but will define the particular details of establishing an electronic connection between two or more organizations and address the solutions to those unique details. See also descriptions for OLTP and OLTA. (*JUMPS to: glossary.htm*)

Choosing EDI Software

Government and business entities are only recently recognizing their needs for EDI tools and rapid evolution of products in this field should be anticipated. For discrete document issues, Adobe Acrobat is well established with its PDF files; SGML has been adopted by DOE as a standard. However, most of the recent development work has been done in the area of mission critical applications, such as in financial management or in “data warehousing” by corporate entities, industry and government alike.

Business Process Reengineering (BPR) Impacts

EDI could represent a significant BPR impact on an individual organization or a complex of entities such as represented by the Department of Energy. Its concept promotes the long-anticipated paperless, “handle it once”, environment of the future while standardizing and mechanizing routine business functions. The efficiencies that could be realized from its implementation could be very significant.

Representative EDI Products

The following EDI products are representative of the many options available in the commercial market based on subjective analysis by professional users. Each one of these may fill a niche need and may not be a complete solution by themselves. This information is found among the attachments to this document:

- Trading Partner PC (*JUMPS to edi-10.htm*)
- GENTRAN (*JUMPS to edi-20.htm*)
- Information Builders (*JUMPs to File: edi-30.htm*)
- Trinzic (*JUMPs to File: edi-40.htm*)
- Prism Solutions (*JUMPs to File: edi-50.htm*)
- Pilot Software (*JUMPs to File: edi-60.htm*)
- Other Manufacturers (*JUMPS to http://www.dbmsmag.com*)

2.1.5 Maintenance Management

Maintenance management encompasses a broad spectrum of concepts and automated tools that are rapidly evolving. For example, Computerized Maintenance Management Systems (CMMS) have become an minor industry in themselves, with literally hundreds of firms offering a wide choice of capabilities and investment costs. Only automated systems are addressed here, but an important concept that should be evaluated by facilities maintenance organizations is Reliability Center Maintenance (RCM) (*JUMPS to Glossary definition*), which incorporates a balanced approach to preventive maintenance (PM), predictive testing and inspection (PT&I), and proactive maintenance.

2.1.5.1 OPERATIONS/MAINTENANCE MANAGEMENT SYSTEMS

Summary

Facilities maintenance management requires the use and control of large amounts of information. This includes tracking incoming requests for facilities maintenance work, scheduling preventive maintenance, preparing budget estimates, projecting facilities maintenance requirements, and determining resource allocations. Efficient input, storage, retrieval, manipulation, and display of this information requires an automated computer system. However, each facilities management organization has different priorities and requirements in that regard, so that a large market of computerized maintenance management systems (CMMSs) has evolved.

Many commercial software products are available for use in facilities maintenance management. These systems are available for the full spectrum of computer hardware, from main frame computers to networked and stand-alone microcomputer systems. The quality, competitiveness, and changing nature of commercial software make in-house software development inadvisable. Further, rapid advancement in computer hardware and software technology makes it inappropriate to recommend specific systems, but representative examples can be useful as provided here.

The Department of Energy has developed two systems for data collection and to assist in informed fixed assets requirements planning for deployment complex-wide. These are known by their acronyms: CAS and FIMS. Work is underway to integrate these two reference structures to achieve one seamless source for data on all of the DOE's real property and facilities.

- [Condition Assessment Survey \(CAS\)](#) (*JUMPS to cas1.htm*)
- [Facilities Information Management System](#) (*JUMPS to fims1.htm*)

Choosing a CMMS

Every facilities management organization has its own unique combination of requirements in a CMMS and must evaluate the capabilities of available systems in making its selection. A number of factors should be considered during the evaluation and selection process and a weighing system devised for the meaning or importance of each factor. The intent in this document is to identify factors that should be considered during a comprehensive CMMS selection process. Not all factors will be applicable to all cases and the individual field site. Also, additional factors may be added to meet local needs. Weighing for each factor should be determined on an individual basis for the field site based on its needs. Some factors may be critical, such as the ability to run on existing hardware or interface with other existing software. If such critical factors exist, they should be evaluated first to create a "short list" from which the CMMS will be chosen. Few if any CMMS's will net all factors, and many will only support a few of the functions listed. However, it may be possible to combine a CMMS with a CMMS-related product to provide the needed functionality - ending up with essentially

a graphic point-and-shoot interface with an underlying database supported by scheduling and spreadsheet COTS solution. The ultimate selection must be based on that system which best meets the activity's needs.

CMMS evaluation factors can be grouped into four categories. There are numerous elements to be considered within each of these factors.

- Maintenance management functions (*JUMPS to File: cmms-10.htm*)
- Program features (*JUMPS to File: cmms-20.htm*)
- Operating environment (*JUMPS to File: cmms-30.htm*)
- Vendor/developer data (*JUMPS to File: cmms-40.htm*)

Business Process Reengineering (BPR) Impacts

CMMS systems in themselves involve BPR in that they greatly enhance the power and control of the individual facilities manager. Application of any one of the automated tools that are available will improve the efficiency of facilities management through such capabilities as listed above as Maintenance management functions. Each such software product will have a different level of impact on the efficiency of facilities management, but this will vary by maintenance organization and the use made of the automated tool. Therefore, identification of specific BPR impacts for each project management tool identified below is not feasible.

Representative CMMS Products

The following three CMMS products are representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Maximo (*JUMPS to File: cmms-50.htm*)
- Primavera Project Planner (*JUMPS to File: cmms-60.htm*)
- MP2 for Windows (*JUMPS to File: cmms-70.htm*)

The following table displays the relative capabilities of these three products through variations on the evaluation factors provided above, as evaluated by an industry magazine (*AIPE Facilities*) in its September/October 1995 issue.

FEATURES	Maximo	Primavera Project Planner	MP2 for Windows
On-line work request/approval	X		X
Work order origination	X		X
Employee competence, skills, training, etc.	X		X
Customize outputs	X	X	X

FEATURES	Maximo	Primavera Project Planner	MP2 for Windows
Customize field names, labels, screen, etc.	X	X	X
Adhoc reporting/on-line inquiries	X		X
Display report data in graphical format	X	X	X
Priority origin, management, status tracking	X	X	X
On-line standards, procedures, engineering data; operating specs	X		X
Auto. P.O. request, generation, P.O. tracking	X		X
EDI interface with suppliers			X
Inventory management analysis, control	X	X	X
Long/short interval scheduling of labor	X	X	X
Bar code reading/printing	X		X
On-line OSHA, MSDS, EPA data	X		X
Failure, root-cause management, analysis	X		X
Remote on-line support via modem	X	X	X

2.1.5.2 CONDITION ASSESSMENT SYSTEM (CAS)

Summary

The CAS system has been designed to support the creating a facility condition baseline that is based on recognized, fully-defined standards. The established baseline is used to determine the direction and cost of future assets required to define the DOE's mission against resources. The CAS framework involves assessment of the physical condition of fixed assets, a standardized inspection program, normalizes repair or replacement data, and provides decisional information to construct the essential, realistic requirements needed to establish funding profiles of mission-critical maintenance management issues. CAS stresses a standard approach to conditiona assessment, the ease/accuracy of data collection, a site specific activity controlled database, and reporting facilities that rely on current technology enhancements.

2.1.5.3 FACILITIES INFORMATION MANGAGEMENT SYSTEM (FIMS)

Summary

The Facilities Information Management System (FIMS) is the Department of Energy corporate physical assets database for real property. Real property

includes lands and all things of a permanent nature affixed, whether by nature of human hand. FIMS provides up-to-date access of real property information through adhoc queries and standard reports. This system produces a departmental annual statistical handbook, fiscal year real estate summary of real property holdings, and automates the preparation of the General Services Administration annual reports for the world-wide inventory of the Government-owned and leased real property.

FIMS is a DOE-wide system that is managed by the Associate Secretary for Field Management, Office of Project and Fixed Assets Management. During Fiscal Year 1995, FIMS became fully operational in a production environment and is the successor to the Real Property Inventory System 2, which was used to manage DOE's real property from 1983. The next release of FIMS, version 2.0, is expected by the end of Fiscal Year 1996.

2.1.6 Personal Information Managers

2.1.6.1 CALENDAR, SCHEDULING, CONTACT & TRAVEL MANAGER, AND ACTIVITY TRACKING

Summary

Managers and other personnel can be greatly aided when they use a calendar and scheduling, a contact manager, a travel manager, and an activity tracking aids. The reasons are evident since many people use pocket or book versions already. By going to a computerized version, the personal version can be extended, if desired, to colleagues inside and outside an user's organization. Fortunately, software developers have seen fit to combine all the above attributes into a software package that formerly may have been only a calendar program. Most of these software packages still go by the title of "calendar" with "plus" or other added words, but these packages contain much more than the title suggests. The titles could properly use the words "personal information manager" (PIM) in place of "calendar." We will probably see this change in the future, but the marketing people will have to work on this to get users to look for this new way of referencing PIM instead of calendar.

Choosing Personal Information Manager Software

Factors that can be considered in selecting a personal information manager include:

- Scope of services offered
- Ease of use
- Compatibility with individual's computer system
- Cost

- Portability/remote location

The choice of this type of software is more of a personal preference nature than most other categories and often is based on issues of style or personal habits.

Business Process Reengineering (BPR) Impacts

These products are intended to increase the efficiency of the individual in managing his/her time and meeting commitments. Collectively, these benefits can improve the efficiency of an organization.

Representative Calendar & Scheduling, Contact & Travel Manager, and Activity Tracking Products

The following three Calendar and Scheduling, contact and travel manager, and activity tracking products are representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Starfish Sidekick (*JUMPS to File: pim-10.htm*)
- Day-Timer Organizer 2.0 (*JUMPS to File: pim-20.htm*)
- Calendar Creator Plus (*JUMPS to File: pim-30.htm*)
- ▶ Campbell On-Time (*JUMPS to File: pim-40.htm*)

2.1.7 Primitives

This term refers to the basic automated systems of the computer age: spreadsheets and word processing. These systems in themselves become increasingly sophisticated and versatile in their capabilities and have revolutionized the office systems of today.

2.1.7.1 SPREADSHEETS

Summary

Among accountants, project managers, and anyone else responsible for tracking the costs of tasks, electronic spreadsheet software has become the productivity tool of choice. Almost anyone whose job description requires that he make numerical calculations has his favorite spreadsheet installed on his personal computer.

A spreadsheet program is used primarily to enter, manipulate, compute, graph, and store numeric data. Data is represented in the standard row and column format where the numbers in the rows can be summed horizontally and the numbers in the columns can be summed vertically. Tasks such as managing a project budget, maintaining a grade book, or generating an address list are just a few possible uses for electronic spreadsheets.

Formulas can be entered to instruct the program to perform specific operations on one or more cells (cells might be added together). Functions can be applied to cells to perform more complicated processing than simply summing the values in adjacent cells.

The spreadsheet program will print the entire table of data or selected ranges of data cells. It will produce a simple graph from the data you have entered into several cells. The introduction of “tabbed” workbooks has conferred a higher order of power to spreadsheets and allows pivot tables and other financial analysis, becoming the de facto standard.

Existing tables created in your spreadsheet program can be saved and retrieved later for revision or additional reporting and graphing. Tables created by a competing vendor’s spreadsheet can be imported into your spreadsheet or wordprocessing program - using OLE, (*JUMPS to glossary.htm*) and perhaps ActiveX, (*JUMPS to glossary.htm*) the opportunity exists to leverage the simple structure of the spreadsheet into a basis to serve corporate information purposes.

Choosing Spreadsheet Software

The three product examples provided here virtually dominant the market. Selection among these three becomes a personal preference.

Business Process Reengineering (BPR) Impacts

The impact of automated spreadsheet systems has been revolutionary in the public and private sectors, but also for personal priorities as well. The leap from essentially a manual process to automation cannot be measured in the efficiencies that have been realized.

Representative Spreadsheet Products

The following three spreadsheet products are representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Lotus 1-2-3 (*JUMPS to File: s-sht-10.htm*)
- MS Excel (*JUMPS to s-sht-20.htm*)
- Corel Quattro Pro (*JUMPS to s-sht-30.htm*)

2.1.7.2 WORD PROCESSING

Introduction

Word Processing software is probably the most common productivity tool to be found on the average user’s desk. It grew from rather humble beginnings as little more than an electronic ASCII editor to the offerings of today that are practically desktop publishing packages. These word processing packages contain so many features that they intimidate most users.

Assuming that the user cannot get to a multi-day class on the word processing software, the only workable solution is to learn just enough to do the job at hand and build upon that knowledge with each new document created.

Most word processing packages offer a full-featured document processor that combines word processing features, advanced spreadsheet functionality and multiple graphics functions. You can crunch numbers, directly import spreadsheet data, use document management functions (like copy, move, delete) or create charts, borders, tables or graphs while word processing. Most word processors incorporate spell checking and grammar checking. Many word processors now include the capability to FAX documents from within the word processor. HTML editing capabilities have been added into word processors to allow Web page authoring with your favorite word processor. Development work is under way to allow the user to connect to the internet and browse information that is located on the internet without leaving the word processor.

Choosing Word Processing Software

The two product examples provided here essentially dominant the market. Selection among these are a personal preference.

Business Process Reengineering (BPR) Impacts

The impact of word processing systems has been revolutionary in the public and private sectors, but also for personal priorities as well. The leap from essentially a manual process to automation cannot be measured in the efficiencies that have been realized. Documents created by a competing vendor's product can be imported into your spreadsheet or wordprocessing program - using OLE, (*JUMPS to glossary.htm*) and perhaps ActiveX, (*JUMPS to glossary.htm*) the opportunity exists to leverage the simple structure of the wordprocessing document into a basis to serve corporate information purposes.

Representative Word Processing Products

The following two word processing products are representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Corel's Word Perfect (*JUMPS to File: w-pro-10.htm*)
- Microsoft's Word (*JUMPS to File: w-pro-20.htm*)

2.1.8 Project Management

There are many aspects of project management including budgeting, cost estimating, scheduling, and resource control. Both the federal and private sectors have produced automated systems in support of project management that respond to the whole spectrum of

specialized needs within this important function. This section addresses nine subcategories of automated systems within the overall umbrella of project management, focusing primarily on commercial products but offering some important federally-developed systems.

2.1.8.1 BUDGET/APPROPRIATIONS

Summary

Numerous automated tools have been developed both in the federal and the private sector to assist in the federal budgeting and programming process. DOE has recently started to deploy to selected field sites a system specifically designed to prepare the Project Data Sheet required by the Congress. That system is called the Project Data System (PDS) (*JUMPS to File: pms-10.htm*). It is intended that project information entered into PDS at the field level will be transferred either electronically or by diskette to a central database where that data will be converted into the required Project Data Sheet at the appropriate point in the annual budget cycle. The design of PDS is such that it could be a valuable tool to acquisition and operations managers because its database contains a wide range of data that could be used for convenient informational and analysis purposes. Consideration is being given to further expanding the scope of the project data that can be entered into PDS for the purpose of improving its potential as a management reporting system (MRS).

Business Process Reengineering (BPR) Impacts

The Product Data Sheet is a Congressionally-imposed requirement. This system provides a convenient and efficient method for the asset manager to produce that document.

2.1.8.2 BUSINESS PROCESS RE-ENGINEERING (BFR)

Summary

The concept of Business Process Reengineering is subject to wide interpretation, but it generally can be perceived as an approach used by organizations to rationalize and improve their internal processes to maximize their business objectives. Organizations that have successfully utilized BPR were able to:

- Improve customer service by ensuring business processes focus on satisfying their needs
- Decrease operation costs by reducing cycle times and eliminating those activities which do not add business value
- Create an innovative work force where new ideas are encouraged, tested and incorporated into everyday business processes
- Improve bottom line performance through cost reductions, increased sales and productivity improvements
- Maximize the value from their technology investments.

Choosing BPR Software

Many organizations find themselves in a situation that requires improving their business practices in order to cut costs, improve quality and reliability, improve delivery capability, or just generally improve their product to please their customer. It is far preferable to be the driving force for these changes, rather than to be forced into change because of negative status of your product.

Several new software packages are being sold that automate the process of business re-engineering. They provide one or several of the following tools.

- BPR program planning tool to help plan the overall strategy for implementing and executing the BPR program throughout the organization.
- Organization entity analysis tool to help revamp the organization if the process changes require an organizational change.
- Modeling analysis tool to build a model of business processes as they are and as they will be after the re-engineering.
- Activity-based costing tool to attach a cost to each process activity in terms of resources and time.
- Graphical simulation modeling tool to display the new model and allow ‘what if’ analysis.
- Business metrics tool for tracking such things as productivity, quality, delivery, market penetration, product development processes, the ability to meet demand and handle inventory or backlog and the technologies used.
- Benchmark analysis tool for measuring other organizations’ processes that fall within the same general business area as your organizations.

Business Process Reengineering (BPR) Impacts

In the current environment of worldwide competition in nearly every aspect of the business community, BPR is essential to surviving as a business entity. The impacts involve customer satisfaction and loyalty, profitability, employee satisfaction, and a myriad of other factors.

Representative BPR Products

The following six BPR products are representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- [AIØ WIN](#) (*JUMPS to File: bpr-10.htm*)
- [Design IDEF](#) (*JUMPS to File: bpr-20.htm*)
- [ProSim](#) (*JUMPS to File: bpr-30.htm*)
- [Rapid Re](#) (*JUMPS to File: bpr-40.htm*)
- [SmartER](#) (*JUMPS to File: bpr-50.htm*)
- [SIMPROCESS](#) (*JUMPS File: bpr-60.htm*)

2.1.8.3 COST ESTIMATING

Summary

There is a wide variation in methods, requirements, documentation, and quality of cost estimates from project to project within DOE. A newsletter has recently been initiated to promote an interactive flow of information on cost estimating tools used by DOE field and headquarters sites. One purpose of that newsletter is to disseminate information on cost estimating systems that are considered particularly relevant to the needs of DOE cost estimators.

Choosing Cost Estimating Software There are a wide variety of factors in choosing a cost estimating tool. These include:

- The level of cost estimate detail (often determined by the point to which a project has progressed)
- The type of cost estimate such as for construction, environmental remediation, demolition, etc.
- The degree of cost estimating, i.e., TEC, TPC, or LCC
- The experience of the user

Each of these factors will be a determinant in selecting a system from among the many that have been developed by DOE and other federal agencies and from COTS sources.

Business Process Reengineering (BPR) Impacts

Cost estimating tools serve an important requirement in project management whose success can depend entirely on the accuracy and foresight of their products. Credibility is a crucial factor in the federal sector where performance measurement and congressional oversight is a pervasive fact of life and survival.

Representative Cost Estimating Products

The following cost estimating products are representative of the many options available from both federal sources and the commercial market based on subjective analysis by professional users. The ones listed in the following are those that have been developed or successfully used by members of the DOE's Committee for Cost Methods Development (CCMD). (**JUMPS to file: *ccmd1.htm***) This information is found among the attachments to this document:

- Competitive Edge Estimating (**JUMPS to File: *cest-10.htm***)
- EBUCES (**JUMPS to File: *cest-20.htm***)
- G2 Estimator (**JUMPS to File: *cest-30.htm***)
- HCAS (**JUMPS to File: *cest-40.htm***)
- INSITE (**JUMPS to File: *cest-45.htm***)
- TRACES/MCACES Gold (**JUMPS to File: *cest-50.htm***)

- Parametric Cost Estimating Reference Manual (*JUMPS to File: cest-60.htm*)
- Precision Collection (*JUMPS to File: cest-65.htm*)
- Racer (*JUMPS to File: cest-70.htm*)
- “Should Cost” (*JUMPS to File: cest-75.htm*)
- SUCCESS (*JUMPS to File: cest-80.htm*)
- TRACES (*JUMPS to File: cest-85.htm*)
- WinEst Pro and Pro Plus, v.3.0 (*JUMPS to File: cest-90.htm*)

2.1.8.4 PROJECT MANAGEMENT & SCHEDULING

Summary

Facilities program and project management requires the use and control of large amounts of information. This includes data for functions such as:

- Work breakdown schedules (WBS)
- Resource management
- Cost management
- Procurement
- Funding and obligation
- Project performance measurement, i.e., earned value
- Environmental issues
- Contracting
- Project schedules
- Organization and personnel
- Presentations, Reports, Graphics

Efficient input, storage, retrieval, manipulation, and display of this information requires an automated computer system. However, each project management organization has different priorities and requirements in that regard, so that an impressive market of computerized project management systems has evolved.

Many commercial software products are available for project management. These systems are available for the full spectrum of computer hardware, from main frame computers to networked and stand-alone microcomputer systems. The quality, competitiveness, and changing nature of commercial software make in-house software development inadvisable. Further, rapid advancement in computer hardware and software technology makes it inappropriate to recommend specific systems, but representative examples can be useful in describing the types of capabilities available.

The Project Management Institute (*JUMPS to File: pms-10.htm*) exists to advance the state-of-the-art in project and program management and could be a valuable source (*JUMPS to <http://www.pmi.org/>*) of information for identifying (*JUMPS to File: pms-20.htm*) and

selecting the appropriate project management system for any one or multiple project effort.

Choosing Project Management Software

There is a wide range of project management software available from COTS sources; many systems also have been developed to meet specific needs in both the public and private sectors. Factors in selecting a system include:

- The degree of complexity of a project or program
- The specific element of project management to be addressed
- The project management skills of the user
- Cost of the automated system to be used

These and other factors will be the determinants in selecting the appropriate software. It should be noted that the exclusion of MS Project is due to its fundamental position as a limited desktop scheduler rather than as a robust corporate shared application. MS Project is a fine product when used appropriately and its limitations known.

Business Process Reengineering (BPR) Impacts

Automated project management systems in themselves involve BPR in that they greatly enhance the power and control of the individual project manager. Application of any one of the automated tools that are available will improve the efficiency of project management through such capabilities as:

- Information management
- Data analysis
- Trend analysis

Each such software product will have a different level of impact on project management efficiency, but this will vary by project and the use made of the tool. Therefore, identification of specific BPR impacts for each project management tool identified below is not feasible.

Representative Project Management Products

The following three project management products are representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Primavera Project Planner (P3) (*JUMPS to File: pms-30.htm*)
- SureTrak Project Manager (*JUMPS to File: pms-40.htm*)
- MIDAS (or SRMRS - Savannah River Management Reporting System) (*JUMPS to File: pms-50.htm*)

2.1.8.5 RELIABILITY/MAINTAINABILITY/AVAILABILITY (RMA)

Summary

Reliability/Maintainability/Availability (RMA) analysis is a means of assessing a component, system, or facility as to its expected performance during its life cycle. Maintainability and reliability are the two major system characteristics that combine to form the commonly used effectiveness index--availability. Reliability is defined as the probability of a component, system, or facility functioning without failure during the life cycle or even during a specific mission. Availability is defined as the probability that a component, system, or facility is operable when called upon during its life cycle. Maintainability is defined as a characteristic of design and installation. This characteristic is expressed as the probability that an item will be retained in, or restored to, a specified condition within a given period of time when prescribed procedures and resources are used. The characteristic of a probability is that it is a number that is a dimensionless number defined on the interval of [0, 1]. RMA also included such tools as event tree analysis, fault trees analysis, failure mode effects and critically analysis (FMECA), reliability centered maintenance, mean time to repair (MTTR), mean time between failures (MTBF), and costs of spares.

Choosing RMS Software

Software programs for RMA calculations require that the user understand what is being calculated and what the design of the system is, otherwise the calculations may be meaningless. It is left to the user to learn about how to tailor a RMA software package, if required, to suit the system or facility being analyzed.

RMA software, which is often referred to as reliability engineering software, can be quite sophisticated to the degree of including the generation of charts/ graphics, importation of databases in a variety of formats, linkage to CAD programs, extensive report writing, and many other features. Graphics input are accepted by most windows-based RMA programs.

RMA functions include, among others: Reliability Data, Maintainability Inputs, Availability Calculations, Failure Mode Effects and Criticality Analysis, Fault Tree, Event Tree, Cost analysis, Mean Time to Repair (MTTR), Block Diagrams, and Reliability Maintenance Costs.

There are a limited number of commercial RMA software products that are available. These programs are available for the full spectrum of computer hardware, from main frame computers to networked and stand-alone microcomputer systems. RMA software has been traditionally developed by users and held as proprietary to the company that uses it; it has thus not found as wide a market as software in other categories. Further, rapid advancement in computer hardware and software technology makes it inappropriate to recommend a specific program and version, but representative examples can be useful as provided on the following pages.

Business Process Reengineering (BPR) Impacts

Proactive management is increasingly recognized as a major factor in improving performance in many aspects of the public and private sectors. RMS tools are essentially based on the concept of proactive management and can have an important BPR impacts on most organizations.

Representative RMA Products

The following RMA products from SAS Institute, Inc. and Item Software, Inc. are representative of the many options available in the commercial based on subjective analysis by professional users. RMA software products are designed to support reliability, maintainability and availability calculations. Item Software's RMA products for Windows are stand alone software that interface other Item's products, including Item's DOS databases, and with other databases. These DOS, VAX VMS, and Sun SPARC's OS RMA products are stand alone software and interface other Item non-Windows products and with other databases. This information is found among the attachments to this document:

- MilStress for Windows (***JUMPS to File: rma-10.htm***) - creates failure rates of electronic components in Accordance with the Reliability Prediction standard MIL-HDBK-217. This program can also be used for non-electrical components/systems and other databases.
- MilStress-One-Block for Windows (***JUMPS to to File: rma-20.htm***) - calculates failure rates of electronic components in Accordance with the Reliability Prediction standard MIL-HDBK-217. This can be used for non-electrical components/systems. This software is suitable for single modules (with up to 32,000 components) only.
- FailMode for Windows (***JUMPS to File: rma-30.htm***) - performs tasks in the area of Failure Mode Effects and Criticality Analysis (FMECA) in accordance with MIL-STD-1629A.
- FaultTree+ (for Windows) (***JUMPS to File: rma-40.htm***) - Draws fault tree and event tree diagrams and carries out probability calculations and analysis.
- AvSim (for Windows) (***JUMPS to File: rma-50.htm***) - Reliability and availability simulation program for systems containing redundancy. Calculates system availability by simulating failures and repairs.
- TelStress for Windows (***JUMPS to File: rma-60.htm***) - Calculates failure rates of electronic components in accordance with the Reliability Prediction Standards Bellcore TR-NWT-000332, RDF and HRD versions 4 & 5.
- RCMCost (for Windows) (***JUMPS toFile: rma-70.htm***) - RCMCost uses reliability centered maintenance methods to optimize maintenance tasks and monitoring strategies for the lifetime of the system. The program considers the cost, risk and environmental consequences of failure simulation models which compare alternative maintenance policies.
- MilStress (for MS DOS, VAX VMS, and Sun Sparc's OS) (***JUMPS to File: rma-***

80.htm) - creates failure rates of electronic components in accordance with the reliability prediction standard MIL-HDBK-217. This can also be used for non-electrical components/systems and other databases. MilStress Utilities (for MS DOS, VAX VMS, Sun Sparc's OS) provides utilities for DOS, VAX VMS, Sun Sparc's OS Item software and other user software and includes MilLib, MilPrint, Nonlec+, NonOp, and PartsCount.

- SAS Institute, Inc. RMA software (**JUMPS to File: rma-90.htm**) - SAS RMA software are known in the industry.

2.1.8.6 RISK ANALYSIS

Summary

Risk analysis as it applies to DOE project management is addressed in the Risk Analysis and Management Guide. (**JUMPS to Guide in Existing Home Page**) Automated systems are available to assist in this process and often are contained within an automated project management system.

Choosing Risk Analysis Software

The selection of risk analysis software is largely a factor of the size or scope of the project to it will be applied. Also, some of this software, as in the case with Primavera, is an add-on to the project management system being used at the site. Cost can vary considerably. For example, among the products evaluated the price ranged from under \$400 to over \$2,000.

Business Process Reengineering (BPR) Impacts

Risk analysis or assessment in itself involves BPR in that it attempts to anticipate problems in advance and formulate management and/or mitigation plans. Application of any one of the automated risk analysis tools that are available will improve the efficiency of project management through timely adjustments based on projected cost, schedules, or other problems. Each such software product will have a different level of impact on project management efficiency, but this will vary by project and the use made of the tool. Therefore, identification of specific BPR impacts for each individual risk analysis tool identified below is not feasible.

Representative Risk Analysis Products

The following three risk analysis products are representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- Monte Carlo (**JUMPS to File: risk-10.htm**)
- @RISK (**JUMPS to File: risk-20.htm**)
- Opera (**JUMPS to File: risk-30.htm**)

2.1.8.7. STATISTICS AND TREND ANALYSIS

Summary

Statistical and trend analysis software products are designed to support calculations for numerous types of situations, including program management, financial analysis, decision support, report writing, market research, engineering analysis, data visualization, network and systems management, laboratory analysis, clinical trials analysis, quality improvement, etc.

Statistical analysis software packages are designed primarily for users with some understanding of statistics to better analyze trends in data that has been collected and organized. These packages are used with standard spreadsheet packages, such as Lotus 1-2-3, QuatroPro, and Excel on the PC and spreadsheets on other platforms, to analyze the data contained in a spreadsheet.

Choosing Statistical and Trend Analysis Software

Selection among available software package will depend primarily on the capabilities offered. These can include statistical applications to:

- Project management
- Financial analysis
- Decision support
- Report writing
- Market research
- Engineering analysis

Another important factor is cost because available systems vary from a few hundred dollar to tens of thousands.

Business Process Reengineering (BPR) Impacts

Statistical and trend analysis is important to successfully managing nearly all types of organizations in the public and private sectors. It applies heavily to market research which often determines the success of the company and to a myriad of other important managerial factors such as personnel considerations, operational efficiency, and financial versatility.

Representative Statistical and Trend Analysis Products

The industry leaders in statistical and trend analysis are SAS and SPSS. The following statistical and trend analysis products are representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- SAS/STAT (*JUMPS to File: stats-10.htm*)

- SPSS (Base 6.1 for Windows) (*JUMPs to File: stats-20.htm*)

2.1.9 Simulations & Operations Analysis/Training

2.1.9.1 SIMULATION & OPERATIONS ANALYSIS MODELING

Summary

Simulation is an effective way of pretesting proposed systems, plans or policies before developing expensive prototypes, field tests or actual implementations. In simulation analysis, the computer traces out in detail the implications and consequences of a proposed system or course of action. Consequently, simulation is more realistic, more easily understood, and more conclusive than other forms of analysis. Because the results are easier to understand, the conclusions are more widely accepted. Simulation languages have been successfully used to develop thousands of models in fields such as communications, transportation, manufacturing, computer architecture and network analysis, military planning, health care, business operations, and logistics planning.

Simulation languages provide a basic model structure that can be used for quick prototyping and tailor able to specific applications areas. Commercial-off-the-shelf (COTS) models are available, that provide immediate simulation capability with graphical representations, alternative system developments, and animated graphics. However, these models are specific to the application area and are not suited for application in other, non-programmed application areas.

Choosing Simulation & Operations Analysis Models

Before investing in a simulation language or COTS model, analyze your situation; and match your needs with the products that are currently available. Knowing what you want will enable others to be more helpful. The following questions will help sort out the relevant issues.

- What kinds of simulation models do you want to produce?
- How often will you produce them?
- How large is the system your modeling?
- What is the anticipated rate of return on investment?
- What computer equipment do you currently have?
- How important is it that the presentations look?
- Do you have the time to learn about a simulation language?
- Do you have the enthusiasm for it, and the ability to take on new skills?

Lastly, the selection of modeling language or COTS specific application models will be your most important decision, because it may drive computer and other hardware selections. During the process of software selection, the following issues should be considered:

- Price
- A readable language - similar to the system under study
- Amount of code requirements
- Process or object oriented simulation language
- Graphics and animation capability for easy understanding of the results
- Rapid prototyping of models, user interfaces, and screen appearance
- Computer independence from centralized computer systems
- Portability of the system
- Support ability of the software including: system upgrades and training
- Help with documentation, on-line help, and telephone technical support

Business Process Reengineering (BPR) Impacts

Complex systems and operations often require careful study and analysis because mistakes can be costly and time consuming to correct. In cases such as military operations, strategic mistakes can cost lives. In such cases such as the design of complex telecommunication or computer systems, reengineering can be extremely expensive, time-consuming and difficult. With the availability of more powerful and inexpensive computers, simulation models are more heavily relied upon than ever before when choosing between alternative systems, architectures or strategies.

With respect to return on investment, assuming the user is properly trained, the business organization can reap a harvest of benefits. Payback on the cost of investment, including software and training, is difficult to measure. Unlike other tools, simulation modeling is both a cost avoidance as well as a cost savings tool. In the circumstance where a system is already in place, and the simulation language or model is used as a process reengineering tool, the cost benefit is easy to measure. As a system development tool, the simulation program language or COTS models are used as cost avoidance tools, optimizing system integration and performance.

Representative Simulation & Operations Analysis Products

The following three simulation and operations analysis products are representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- SIMSCRIPT II.5 (*JUMPS File: simul-10.htm*)
- Network II.5 (*JUMPS File: simul-20.htm*)
- COMNET III (*JUMPS File: simul-30.htm*)

2.1.9.2 COMPUTER BASED TRAINING

Summary

Computer Based Training (CBT) is training that uses computers and multimedia technology to promote student interest and motivation. By using the computer's multimedia capability to show graphics, run simulations, and play sound, video, and animation the software program is able to greatly enhance the student's learning experience.

CBT makes an ideal resource for on-the-job training. Training can be delivered to remote sites, provided to large staff groups economically, offered to multiple offices, and used to train a variety of students at various levels of familiarity to the subject of the training.

Various software packages are available to assist the developer to author multimedia training materials. These packages generally fall into authoring applications, graphic tools, sound tools, and file compression tools.

Choosing Computer-Based Training Software

In the Authoring Environment for Interactive Information, selection of top-of-the-line software products is often driven by the platform. Currently, software developed for application in a Macintosh environment are among the industry leaders. However, there is comparable software made for a Windows operating systems, with no price advantages. Macintosh systems were originally designed to support engineers and graphics designers; hence, the software industry focused their efforts in the development of software that was Mac supportable.

Before investing in a Computer-based Training program, analyze your situation; and match your needs with the products that are currently available. Knowing what you want will enable others to be more helpful. The following questions will help sort out the relevant issues.

- What kinds of CBT models do you want to produce?
- How often will you produce them?
- How many and how large is the course of study to be developed ?
- What is the anticipated rate of return on investment?
- What computer equipment do you currently have?
- How important is it that the course materials look?
- Do you have the time to learn about a CBT software?
- Do you have the enthusiasm for it, and the ability to take on new skills?

Lastly, the selection of CBT software will be your most important decision, because it may drive computer and other hardware selections. During the process of software selection, the following issues should be considered:

- Price
- Hardware requirement and enhancements

- Ease of use (graphics/text interface)
- Graphics and animation capability
- Object Linking and Embedding (OLE) capability
- Ability to create interactive help systems, on-line documentation, and interactive reference files
- Full text functionality
- Ability of the software to be cross-platform capable, permitting a seamless transition of file formats between Macintosh and Windows operating systems.
- Portability of the system
- Supportableness of the software including: system upgrades and training
- Help with documentation, on-line help, and telephone technical support Certainly, selection of Authoring and Multimedia software must consider not only the platform, but also - system features and capabilities:

Business Process Reengineering (BPR) Impacts

Depending upon our business focus, the introduction of Computer-Based Training (CBT) capabilities can have a dramatic response on the business process. Performance support's cost/benefit model makes the argument for management to get into multimedia immediately. Instead of shipping employee to the training centers, you ship the knowledge to the employees, where they access:

- The information they need and want;
- When they need and want it; and,
- How they need and want it.

Workers learn and retain the training much more efficiently. They aren't distracted by being away from home. They learn at their own pace. The system can even test and certify them for advancement, step by step, as they go along. This will go a long way toward knowing whether employees fully understand the materials presented.

The business investment of establishing a Multimedia-Training Development Team, software and hardware requirements or enhancements are essential ingredients to weight the cost versus value added benefits of "bringing training to the employees". The cost savings assessment will be driven by the diverse locations of training centers, cost of travel, time lost from the work day, time lost in transit, turnover rate of employees, and the intangible benefits of improved morale.

In addition to the benefits of computer-based training, the same software programs can be used for corporate graphics and presentation development, on-line documentation, digital publications, simulations, and kiosks.

At a very practical business-day level, emplacing a workflow cognizant context-sensitive help facility that can be set by the user in terms of assistance offer intervention can be significant in increasing the efficiency of the typical worker. This is the next level up in the food chain that combines just-in-time training with agents linked to specifically constructed help files. The worker no longer has to remember lengthy reference structures, complex processes, immediate position in workflow, or even where something is kept or filed. Depending on the level of “help” intrusiveness built into the the “help angel” facility and manipulated by the user, the technology is able to offer a complete menu of choices that provides process training to fetching mission-critical information.

Representative Computer-Based Training Products

The following computer-based training product is representative of the many options available in the commercial market based on subjective analysis by professional users. This information is found among the attachments to this document:

- [Computer-Based Training \(CBT\) \(JUMPS File: c-tng-10.htm\)](#)
- [Robohelp \(JUMPS File: cbt-a-10.htm\)](#)
- [Doc-To-Help \(JUMPS File: cbt-a-20.htm\)](#)

2.2 PROGRAM SOFTWARE & COMPUTER SYSTEM DESIGN

2.2.1 Software Development

2.2.1.1 COMPUTER ASSISTED SOFTWARE ENGINEERING (CASE)

Summary

CASE tools can substantially reduce development costs and schedules but require extensive knowledge, training and experience to use effectively. The first time use in a development organization is usually a break even or much worse experience. Avoid, at all costs, thinking of COTS as a silver bullet that will turn around a troubled development.

Methodologies and CASE.

A methodology is a cohesive set of procedures that explains what to do, when to do it and how. Methodologies: greatly improve quality; enforce rigor on the development process; improve the capability to measure development progress; improve the capability to accurately predict schedule and cost. Enforcing rigor on the development process moves the development from "seat of the pants code and test, non-disciplined" to an engineering-like discipline.

Without SW methodologies, there is no basis for instituting software project controls and product quality controls. Applying methodologies to system development means that: the development is guided by systematic, step-by-step procedures; the results to be produced by each procedure can be rigorously defined; and an evaluation step is typically included to determine whether a procedure has been executed correctly and whether the result produced is correct. Most methodologies are focused on specific: types of projects (e.g. real time embedded systems or large database applications); types of development (e.g. Object Oriented Programming) or Lifecycle phase (requirements, design, code and test). Typically several methodologies are selected for a project over the development cycle. Selection is constrained by:

- The ability of two methodologies to complement each other. For example, Data Flow Diagrams (DFD) and Entity Relationship Diagrams represent two different views of the same system and, if both are correct, should reconcile. These are often used as parallel methodologies and the results compared during analysis to identify analysis mistakes.
- *The appropriateness of the methodology to the overall development paradigm. For example, using Object Oriented Analysis methods and attempting an implementation in COBOL or using Structured Design and attempting to implement in C++ usually results in what the industry is now calling the "Mid-Life Crisis" where the project never leaves the code and unit test phase.*
- The availability of a companion tool set.
- The availability of personnel trained in the methodology (and, where appropriate, the companion tool set).
- The availability of CASE tools to interoperate.

CASE tools implement existing methodologies by automating the kinds of tasks that people find boring and difficult to accurately accomplish, such as checking hundreds of data structures for normalization errors or tracking thousands of requirements from beginning to end of a development.

Studies have shown that approximately 50% of CASE analysis and design tools sit on the shelf unused. Analysis of failed CASE usage have identified two principle causes:

- A lack of understanding of the underlying methodology. Training entire development staffs in the use of a tool is difficult enough, attempting to teach the methodology on top of tool is very difficult.
- The silver bullet syndrome. Many managers, when faced with a project in trouble, turned to CASE to turn the project around. Typically the lack of disciplined methodologies was the reason the projects were in trouble, adding CASE, with its high learning curve to an organization with no knowledge or practice in the

appropriate methodologies guaranteed project failure.

It is often recommended that users practice the methodology by hand before attempting to implement on a CASE tool.

Software Configuration Management (SCM) Tools.

Good SCM practices are critical for good system development. Major SCM activities include: version identification and version control, change control and status tracking. Organizations lacking CM control will typically suffer from:

- High development costs. Problems become exponentially more expensive to fix as the systems move through the development lifecycle. Lack of sound CM practices will guarantee known problems (status tracking) will fall through the cracks.
- Late schedules. A lack of change control often results in developer “churning”, where individuals, some time recursively, change code a module, with little understanding of the effects of the change on the entire system that in turn causes multiple additional problems.

SCM CASE is a very good investment since:

- The underlying processes are easily understood and therefore significant training is unnecessary.
- The underlying processes tend to center on tracking and sorting large amounts of data, tasks that computers accomplish with ease and accuracy but people do not.
- SCM tools can be used to *enforce* some aspects of SCM (e.g. source code control).

Requirements Tracking Tools.

The systematic tracking of requirements is essential for all system development and critical for medium and large systems. Individual requirements should be tracked from the requirements documentation, through design, code and testing. But, lack of systematic, disciplined requirements tracking usually results in missing, incompletely executed or incorrectly executed requirements. Like CM, this is a task for which humans are ill equipped but computers can do well. A problem with either manual or automated requirements tracking is verifying a requirement that needs to be executed in multiple places. For example, an “all” requirements such as “f1 will call the help system from every screen” needs to be verified in every screen. This type of requirement still tends to be manually intensive.

Software Analysis and Design Tools.

This is the tool that leads discussion of CASE in the technical press and most readily comes to mind when software engineers discuss CASE. SA/SD tools implement SA/SD methodologies, but, some methodologies are proprietary. For all the usual reasons, tools that implement propriety methodologies should be avoided. SA/SD tools enjoyed a high level of

product maturity until the object revelation. Most of these tools automated the same common methodologies centered on: Entity Relationship Diagrams (ERT), Data Flow Diagrams (DFD) and State Transition Diagrams (STD).

Object Oriented started with Object Oriented Languages and attempts to develop appropriate, companion analysis and design methodologies have not meet with great success. Many OO methodologies exist but none have the intuitive flow form requirements to completed design that for example DFD have for non-OO development. The result is that the SA/SD CASE tool market is in great flux with a large number of offerings but no centering around accepted methodologies. While a great many implementations exist, a significant number are incomplete in enforcing the supported methodology rule base. Most OO CASE tools are limited to automating diagramming techniques for classes.

4th GL Tools.

Fourth generation tools typically combine and leverage third generation tools such as automated screen generators and SQL. A user of this type of tool can design screens using point and click graphical techniques to: design screens and menus; specify the screen and menu behavior; construct SQL searches and data updates using Query By Example.

Advantages include:

- Dramatically reduced development **time**.
- Dramatically reduced development **costs**.
- Interoperability, some tools will produce executables for different operating systems (e.g. Windows and Mac) from a single design.
- Reduced implementation errors, the tool makes fewer errors than programmers.

Disadvantages include:

- High costs of the tools.
- High cost of software engineering experts that can operate the tool.
- Change difficulty. Ideally, the tool operator specifies the desired behavior, presses a button and executables for the complete system are automatically generated. Frequently, implementations on some tools will have some required capability that the tool does not support. In this case, programmers have to add the capability by hand, but if code added to the completed tool output will be overwritten if the design is changed and the tool is rerun.

I-CASE

I-CASE or Integrated CASE is where most experts think the largest improvements in productivity and accuracy in medium to large development efforts. Most of the existing CASE tools have limited to no interpretability with other tools. Those that do generally offer interpretability only between products of the same company. CASE tools store metadata in

what is called a data repository. Multiple integration standards, designed to allow interoperability of the repository exist or are in work including: Information Resource Dictionary, ANSI (X.I38-1988); Common Ada Interface Standard and Electronic Design Interchange. Developers should attempt to find products that follow one of these standards.

2.2.1.2. GROUPWARE AND COLLABORATIVE

SUMMARY

Groupware is a type of workflow software that is used enable people to access and work on products in a controlled fashion.

A groupware package will include: e-mail, word-processing and database support. A recent development in bringing all of these basic structures together is the overlay of a graphical process diagram to allow symbols for activities, resources, and direction to be represented together as workflow. Lotus invented the first groupware product in 1989 and competitors are only now emerging. Products available or scheduled for release are: Lotus Notes (now); Netscape Navigator/Collabra (now); Microsoft Exchange Server (April 96); Novell Groupwise XTD (2nd Q CY 96) and Hewlett Packard OpenMail/Web Server (July). Most of these are expansions of existing e-mail products. The capabilities of these products are expanding at a rapid rate as vendors add new capabilities as fast as they can code and test them. All of the above products are or will be internet capable. A small group of vendors has seized on the capabilities inherent in working only from a network point of view. The focus of this work can be roughly captured in two descriptive classes:

- Object Linking & Embedding and Object Orientation
- Middleware and Agents

2.2.1.3 OBJECT LINKING & EMBEDDING AND OBJECT ORIENTATION.

SUMMARY

At the heart of any object, whether it is used in flat structures like a worprocessing file or a complex wide area network three tier-structure database, is the premise that an Object maintains the practice of using:

- Data encapsulation, separating data from processing, limiting data visibility and reducing errors.
- Polymorphism, allows the same interface to function with different types of data or objects.
- Inheritance, allows program segments called classes to easily added to the behavior modified with out changing the original segment, results in reduced development time

and code reuse.

In primitives (*JUMPS: glossary.htm*) applications, this is referred to as object linking and embedding (OLE). Within the corporate wide area network structure, a question of scale arises, and much work is being devoted to establishing standards to enable objects to function across multiple platforms. The terminology used in this arena include ActiveX and CORBA.

2.2.1.4 MIDDLEWARE AND AGENTS (not yet completed)

Obviously server computer and server software (e.g. Oracle) and client computers and software (e.g. Access) are required along with a network. But additional software, called by the generic (and overused) term “middleware”, is usually required. Middleware requirements (from the client standpoint) include software to:

- Match the client software with the server software. Microsoft’s Open Database Connectivity is the most frequently supported by vendors of client software.
- Local Area Network connectivity. If the server is directly attached to the LAN, software will be required to allow the client workstation to attach to the server. This is usually included in the server package.
- Other communications protocols. Most Local Area Networks operate using Ethernet or Token Ring at the lowest levels. Wide area communications and many LAN to LAN communications require a higher level protocols such as TCP/IP.

2.2.2 Systems Architecture

2.2.2.1 CLIENT SERVER APPLICATIONS

SUMMARY

Client Server is the practice of splitting the computing work among several computers (a server and one or more clients). This typically results in dramatically lower HW and SW costs.

Mainframe systems conduct all the computing on the mainframe, the terminals are limited to displaying data and transmitting key strokes. Personal Computers (PC) took the opposite approach, all the computing was done on the PC. PC networks offer limited workload distribution but are essentially limited to common file and print services. A typical PC network, for example would be a common “phone book”. A PC application looking for the number of a person named “John Smith” would read the phone book data base from the server, piece by piece, attempting to find a match. In this example the network server does almost no real computing, but it is limited to transferring pieces of the “Phone Book” file over the network as requested by the PC.

A client server application would send, over the network, a request to a database server to return John Smith's telephone number. The database server would determine, on its own, the correct procedure to identify the proper number, execute the procedure, and transmit the number back to the requesting PC (client).

Advantages of a client server paradigm over mainframe or PC- network, include:

- Much lower network traffic, the only data transversing the network is the request for a specific data set and the matching data set.
- Lower complexity for the client applications, the application sends the request, how to fulfill the request is the servers responsibility.
- More efficient operations. The server can be operated with hardware and software that is appropriate for its size and complexity. Large complex databases can operate on appropriately sized systems, something that can not be done with a PC, PC network, or mainframe paradigm. Server computers can range from PCs to mainframes. The clients can also be sized appropriately and typically range from small capability PCs with DOS to well equipped workstations with UNIX.
- Interoperability. Different types of computers and operating systems can be integrated and use the same data. Since all that travels over the network is the data request and response, there is no requirement for the client and server to be the same type of machine. It is the client software's problem to put the request in a proper form.
- Capability to upgrade legacy systems. By splitting the processing, mainframe like speed can be obtained with mini's or high end work stations. The high volume of hardware and software sales combined with the non priority nature of this paradigm has resulted in costs that are a small fraction of continued mainframe maintenance or mainframe replacement.
- Users conducting data analysis can often use well known and inexpensive client software such as Access or dBase to query servers.
- Multiple servers can be accessed simultaneously to answer a single query.

Disadvantages include:

- Overselling. The capabilities of the client server paradigm have been significantly oversold by software venders. In particular, the difficulty in converting legacy systems was greatly underestimated. Legacy systems typically have embedded hundreds of complex business rules that have been: fine tuned over decades; generally work; but are undocumented and occasionally unknown.. The existence of many of these rules is often gained at cutover. A manager suffering with legacy system cost and limitations should consider conversion to a client server application but should be aware that while development costs, especially if coupled with 4GL CASE will be minimized, they will still be substantial.
- Low speed. Client servers, based on the network, can be significantly slower then the

stand alone applications.

- What to do with the current development staff. Client server implementations require skills that take years of education and experience and are seldom in existence in organizations upgrading legacy systems or implementing client server for the first time. Reeducating existing staffs can be done but even with education, the experience level of the existing staff is usually insufficient to rely on for critical tasks during the transition.
- Vendor claims for server interoperability are often exaggerated. The capability to simultaneously access multiple servers is vendor dependent and caution is urged if this is a critical requirement.

A Third Tier

The client server pair are normally called a two tier architecture. One driver of the three tier architecture is the complexity and size of client software that results from attempts to implement a substantial portion of the complete rule base for every use of the system. The three tier architecture moves the rule implementation to a separate applications server, where only the rules applicable to a particular implementation are executed. This and other difficulties associated with large enterprise implementations have resulted in the addition of a third tier broken out as:

- Presentation logic maintained on client.
- Data maintained on a data server.
- The functional logic maintained on a separate server.

Advantages include reducing:

- The load on a the data server.
- The complexity of the client software since complete rule implementation is done by the application server.
- Applications and database management by isolating these functions.
- Expense of business rule creation and maintenance by isolating them from the data.
- Reducing database licensing costs by reducing the number of applications accessing the database server.

Disadvantages include:

- Cost, more hardware, few fully supported 4th GL tools (now).
- A data warehouse may be a better way to go. Limiting the applications programs to OLTP in the client server and OLTA to the Data warehouse may solve the two tier architecture problems and provide much more robust OLTA capability.

2.2.2.2 DATABASES (HIERARCHY, NETWORK, AND RDBMS)

SUMMARY

Selection of a database type is a fundamental decision for data systems. Two broad database types: RDBMS and Hierarchical, are discussed:

Hierarchical

IBM's Dr. Codd defined a set of rules that a database system should have in order to be a RDBMS. Hierarchical databases such as Access and xBase products such as Fox and dBase are partial implementations of these rules, but are, never the less, are very capable databases that are appropriate for small to mid size applications.

RDBMS

A critical COTS decision for IS systems is the selection of the database. Most medium to large systems are now implemented using a Relational Database Management System (RDBMS) that use a Structured Query Language.

FIPS 127 requires all data systems developed after August 3, 1988, to use National Institute of Science and Technology (JUMPS: <http://www.nist.gov>) approved SQL products.

Advantages of using SQL include:

- A Relational Database Management System, can perform many tasks that require thousands of line of COBOL with one line of Structured Query Language (SQL). This results in lower development and maintenance costs and schedules.
- Capability to upgrade legacy systems. These systems were often built, at great expense, with techniques and computer languages that are inefficient compared to today's in terms of development labor, long term cost to support and end user capabilities. In addition, many were built with proprietary tools, operating systems and/or hardware that resulted in low capability to upgrade and high cost.

Disadvantages include:

- High costs for small simple systems.
- Low speed. Client servers, especially database servers, are usually significantly slower than the applications developed totally in code. Industry performance numbers are usually centered around the measurement of transactions per second. This metric is extensively used to compare one client server product against another. However, comparisons against non client servers is seldom reported. In addition, the metric is often taken by people new to the industry as actually meaning the number of updates or queries that can actually be done in a second. Real world performance expectations can usually be obtained by substituting "minute" for "second" in vendor claims.
- There is no procedural programming language associated with SQL, and as a result, practical SQL systems development is constrained to using one of three methods:

- 1) Front end products, such as Oracle's SQL Forms. A developer creates the database and then uses proprietary screen and report generators with embedded SQL commands to construct the system.
 - 2) ANSI-NIST approved embedded SQL compilers, such as Oracle SQL*C. A developer writes "C" code with embedded SQL commands. This source code is then run through a precompiler (SQL*C) that substitutes regular "C" code for the SQL statements. The output of the precompiler is then compiled and linked in the normal manner.
 - 3) Non-ANSI-NIST approved compilers/interpreters such as Microsoft Access and xBase products such as Fox.
- The practical capabilities to execute complex searches of large databases is greatly exaggerated. The limitation, in large part, is fueling the data warehouse industry.
 - Finally, but maybe the most important aspect: real people to understand SQL - it's not only foreign, it's alien.

2.2.2.3 EMULATIONS AND TERMINALS *(not yet written)*

2.2.3 System Processes

2.2.3.1 On-line Transaction Analysis (OLTA) and On-line Transfer Process (OLTP)

Summary

Corporate data bases tend to be categorized by the warehouse community as or On Line Transaction Analysis (OLTA) Systems (data warehouses) [also popularly called On-line Analytical Process (OLAP) just to differentiate the acronyms in conversations] or either On Line Transaction Processing (OLTP) Systems (everything else).

On Line Transaction Processing (OLTP) systems are usually operational systems (e.g. "Point of Sale", "Accounting", or "Payroll") that:

- Are designed to optimize: transaction speed; reliability and security.
- usually have: predictable queries; limited to zero "one of a kind" query capability; very limited flexibility (e.g. the clerk is not allowed to book passengers on a non existent flight).
- High numbers of small transactions.
- Can easily perform frequent small updates and single record retrieval.

On-line Transaction Analysis (OLTA) Systems (also called Informational Systems or data warehouses) are primarily used as Executive Information Systems and Decision Support Systems because of the large investment of resources to construct, populate and optimize such a system given the frequency of usage. OLTA Systems:

- Are designed to optimize: flexibility; large numbers of data views; and usability by non programmers;
- Usually: have infrequent, large, read only updates; small numbers of long transactions; and can manage very large amounts of data.
- Can easily perform: ad hoc queries; multiple record aggregates and summaries and multi-variable, complex queries.

Why Would an organization Need or Want an On-line Analytical Process facility (or Data Warehouse)? Because businesses typically have massive historical databases with no practical access methods since:

- Data is in different systems that do not talk to each other. Interoperability among systems is relatively new, in the past, manufacturers of HW and SW would attempt to limit interoperability to force clients to stay with their products.
- Data is in different formats that cannot be easily integrated (COBOL, dBase).
- The existing system is “old” technology that requires a moderate to large programming effort to ask any question.
- The existing system runs critical applications that can not stop for several hours because a query requires the program to individually match a million records against the query criteria.

2.2.3.2 DATA WAREHOUSING

Summary

Data Warehousing is a general term used to describe solutions to problems associated with obtaining concise, detailed data in organizations with multiple systems that do not communicate well. New methodologies and companion technologies exist, generally described by the generic term: “data warehousing” that are devoted to providing integrated, searchable information from large, dissimilar legacy systems. A data warehouse has been defined “as a facility to provide easy access to quality data by both non-professional and professional end-users.” (Ken Orr ‘95’). It should also be understood that while good methodologies are emerging, the term “data warehouse” is a concept that describes efforts to turn data into information rather than a specific methodology or technology to do so.

Data Warehousing has been defined as:

- “A facility to provide easy access to quality data by both non-professional and professional end-users.” (Ken Orr ‘95’).
- An approach to integrating existing data systems into a form that lends itself to both canned reports and one of a kind searches at very detailed levels.

Lets look at some of the key terms:

- “Existing data”, a data warehouses always uses existing data, if you are keying in

- data, it is not a data warehouse.
- “Canned reports”, a warehouse will have frequent reports or queries set up and easily available.
- “One of a kind searches”, the analysis of the results of a query often leads to additional queries. This is a key point of warehouse technology: the data has to be searchable by people with moderate desk top computing skills, not programmers.
- “Very detailed levels”, a warehouse has to be able to get at large volumes of very low level data, since we do not know the questions, we can not depend on or store aggregate or summarized data.

Lets look at a practical example, a bank trying to sell second mortgages by advertising using direct mail. The bank has separate systems for its savings, mortgage and consumer loan departments developed over 20 years and has multiple checking account systems acquired through merging with other banks. Without a data warehouse, the bank sends direct mail advertisements to everyone in a zip code, but it is mailing to: apartment dwellers who cannot use a second mortgage, low income people who cannot afford one, people who recently purchased their homes and do not have sufficient equity, and people with poor payment histories. With a data warehouse the bank mails to its existing 1st mortgage customers whose loans are over five old and have good payment histories. With a data warehouse, bank employee talking to a customer can see the entire range of business the consumer does with the bank.

Data Warehouse Types. Data warehouses can be classified as: enterprise, virtual prototypes or data marts:

Enterprise Warehouses are:

- Complex wide;
- Very tremendously difficult to stand up;
- Often fail when schedule and cost expectations are severely overrun.

Virtual Warehouses are:

- The opposite extreme;
- Data is processed using mostly classical tools (e.g. Oracle) and techniques.
- Uses warehouse technology only for data importation from the legacy system.
- Uses a very small data set and powerful hardware to overcome the classical tools and technology.
- Most often virtual Warehouses are first established as a **Prototypes** or Pilot Warehouse and is typically used to:
 - 1) Gain experience with warehouse technology;
 - 2) Identify data problems;
 - 3) Identify data mapping required to convert data from multiple data formats into

- a common warehouse standard;
- 4) Gain domain knowledge of the Enterprise warehouse requirements to optimize the selection of advanced warehouse tools.

Data Marts are:

- A specialized data warehouse designed to handle a specific enterprise data.
- Multiple data marts are integrated into an enterprise warehouse
- Each data mart should be designed to be compatible with integration across the complex.

Data Warehousing Implementation Technologies. In general there are four steps in a data warehouse process:

1. Data Replication
2. Data Sanitization and restructuring
3. Data Storage
4. Data Extraction

Data Replication is:

- Obtaining the data from the legacy system
- Performed on a predetermined schedule;
- Conducted in an automated, electronic fashion;
- Supported by new software tools that know how to:
 - 1) Capture data from many different types of systems;
 - 2) Capture data when updates take place; or
 - 3) Search tables and capture only changes since the last update.
 - 4) Separate tools and integration efforts are required for each legacy system.

Data Sanitization and Restructuring is converting the data from different systems that used different data structures into one common format and is:

- Supported by new software tools that:
 - 1) Can recover some or most of the underlying legacy system data structure in an automated fashion.
 - 2) Once programmed will, for each legacy system update, automatically:
 - Convert legacy system tables update into the warehouse data structure and convert the legacy system field names to the warehouse equivalents;
 - Format the legacy system data into the warehouse standard;
 - Change abbreviations to the warehouse standard.
 - 3) Identifies obvious data errors.
- Capable of performing separate integration required for each legacy system.

Data Storage, is storing the data and:

- Uses different techniques and data engines are typically used;
- Requires between 10 and 100 times more disk space than used on the legacy systems to store the same data.
- Uses new special software that is optimized for quick search capability

Data Extraction is processing the data at a user request and can be characterized by:

- Multiple, common end user tools are typically supported by a data warehouse and include Access, Excel and Lotus 123.
- Need for middleware to both connect and sometimes perform some aggregation.
- New specialized tools available to speed especially sophisticated and complex queries.

Practical Data Warehouse Products? Unfortunately, there is no fits your size, off the shelf data warehouse, warehouses can not be bought, they have to be intelligently designed and then built, stocked and maintained - just like the physical ones.

2.2.4 Intelligent Program Systems

2.2.4.1 EXPERT AND EXPERT BASED SYSTEMS

Summary

Expert Systems (ES) are a branch of applied artificial intelligence (AI). An ES is a decision-making and/or problem-solving package of computer hardware and software that can reach a level of performance comparable to or even exceeding that of a human expert (if data is provided by more than one expert) in some specialized and usually narrow problem area. Its success is based on the quality of the data and rules obtained from the human expert. In practice, expert systems perform both below and above that of a human. An expert system derives its answers by running the knowledge base through an inference engine, which is software that interacts with the user and processes the results from the rules and data in the knowledge base.

Applications are found in:

medical diagnosis	mineral exploration	computer configuration
vehicle routing	corporate planning	tax advice
contract bidding	internal control evaluations	fault analysis
equipment repair	investment analysis	production control
training	equipment repair	
	financial, estate and insurance planning	

They are used especially in areas where human expertise is in short supply.

Many of the early expert systems, and many current small ones, are rule-based. That is, the expert's information is encoded as a set of "if....., then" rules. Many people think of expert systems as being synonymous with rule-based systems, although in actuality, there are other techniques available (such as blackboards).

Some **advantages** of expert systems include:

- Experts are expensive and relatively scarce. Therefore, an ES can be less expensive, and always available. The ES won't find a better job or retire or go on vacation or go home at night after an 8 hour day.
- ESs can operate in areas where it could be hazardous for people (nuclear reactor rooms, for example).
- Like object oriented systems, they separate the knowledge base rules from both the data and from the mechanics of retrieving the data, so updating and changing may be easier.
- The systems can answer simple questions about how they reach their conclusions and why they ask questions (i.e., they can provide a "trace" of their logic). This helps them be useful as training aids.

Disadvantages of expert systems include:

- It's hard to incorporate all of an expert's knowledge, even in a narrow problem area. The experts don't like to share/give away their information, they often don't know exactly how they do what they do, and frequently, their rules are contradictory and inconsistent.
- The complexity of the domain expands geometrically with its size. This combined with time and schedule realities can so restrict the implemented that it is not that useful.
- They can be slow if the rule base is large and the entire rule base has to be sequentially searched.
- The area of expertise has to be specific - such as "allergies" rather than "all of medicine." The problem with building very large rule base systems has been that the rule base gets too complicated. The experts either do not know all of the rules they use, or they actually use contradictory rules at times.
- Basic rule based systems lack many of the characteristics of human experts. At best, they can be idiot savants. Among the qualities they lack are:
 - 1) Basic rule-based systems do not learn. In AI, learn means to automatically change behavior based on feedback. A neural network compares output against prediction and adjusts its behavior, An Ess, until reprogrammed, will continuously make the same error.
 - 2) They do not reason on multiple levels.
 - 3) They do not use constraint-exposing models
 - 4) They do not look at problems from different perspectives.

- 5) They do not know how and when to break their own rules.
- 6) They do not have access to the reasoning behind their rules.

Rule based systems are either backward-chaining systems, or forward-chaining systems, or a combination of the two types.

Forward chaining systems move from condition-specified if parts to the action specifying then parts. That is, they work forward from the current situation toward a conclusion. To forward chain using if-then rules, the following procedure is used:

1. Until a problem is solved or no rule's if parts are satisfied by the current situation:
 - 1.1 connect rules whose if parts are satisfied. If more than one rule's if parts are satisfied, use a conflict-resolution strategy to eliminate all but one.
 - 1.2 Do what the rule's then parts say to do.

When all of the conditions in a rule are satisfied by the current situation, the rule is said to be triggered. When the actions are performed, the rule is said to be fired. Triggering does not always mean firing, because the conditions of several rules may be satisfied simultaneously, triggering them all, making it necessary for a conflict-resolution procedure to decide which rule actually fires. An example of a synthesis-oriented forward chaining rule based system would be a system for bagging groceries. Another would be for laying out computer systems.

Backward-chaining systems work toward the known facts from an hypothesis, or work toward a verifiable set of condition clauses from a action clauses of a rule. For example, if you want to fly from DC to Los Angeles, you can start with all the flights that arrive at Los Angeles and find the city where each flight originated. Then look up all the flights arriving at those cities and find where they originated. Continue the process until you find DC.

Expert systems that add certainty factors to the rules are said to use *fuzzy logic*. A certainty factor is a percentage supplied by an expert system to indicate the probability that the conclusion (the final "then" in a series of "if...then's") reached by the system is correct. A certainty factor can also indicate the expert's level of belief that a certain conclusion ("then") will occur if certain premise ("if") is true.

2.2.4.2 NEURAL NETWORKS, HEURISTICS, and ARTIFICIAL INTELLIGENCE

Summary

A neural network is a modeling technique based on the observed behavior of biological neurons and used to mimic the performance of a brain. It is not a physical model of the brain, but only mimics its ability to sort out patterns, learn from trial and error, and discern and extract relationships that underlie the data with which it is presented. There are many potential computer applications for neural networks. They have frequently been used for solving problems of complex data translation, or in cases in which a “best guess” must be made as output even when presented with noisy input data. Neural networks are used in applications such as robotics, diagnosing, forecasting, image processing and pattern recognition, foreign language translation, process control, and medical data interpretation.

For example, databases exist that allow a business engaging in direct mail advertising to specify an income range, sex, degree of education, occupation, etc. to optimize responses to direct mail. A neural network system would start with equations and coefficients, developed by humans, to specify the attributes for selection of people to receive a mailing. The results of the mailing would be entered into the neural network which would change the weight of each node in an attempt to improve the response.

Advantages of neural networks include:

- The parallel nature of neural networks reduce the time required by a sequential processor to perform the mapping.
- System development time can be reduced because the network can learn the proper algorithm without having someone deduce that algorithm in advance.
- Once trained, the system can make best guesses concerning new data that it has not seen before.
- Even noisy data can be included in the training data.

- Back propagating neural networks are good at generalization. Given several different input vectors, all belonging to the same class, a Back propagating neural network will learn to key off of significant similarities in the input vectors. Irrelevant data will be ignored.

Disadvantages of using neural networks include:

- Sufficient and relevant training data must be available to adequately train the network. This can be expensive and time consuming.
- The system will make occasional mistakes.
- A Back propagating neural network does not extrapolate well. If the network is inadequately or insufficiently trained on a particular class of input vectors, subsequent identification of members of that class may be unreliable.

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3. MEASURING RESULTS

Performance standards (by phase) for all project and fixed asset management activities are being developed by Department of Energy's Associate Deputy Secretary for Field Management Office of Project and Fixed Asset Management organization as well as by various process improvement teams. Draft performance standards have been prepared and are being circulated among Headquarters, Field, and contractor points-of-contact for review/comment. Performance objectives (LCAM requirements), criteria, measures, and expectations are intended to be consistent with performance criteria currently used by some Field Elements, and with Joint Program Office Direction on Project Management and DOE O 430.1, LIFE CYCLE ASSET MANAGEMENT.

4.0 SUGGESTED READING

Suggested reading for context and applicability of these tools include Field Management's library of Good Practice Guides. Further informational material may be obtained through direct contact with manufacturers of the products and services or may be found at their internet site. Sponsoring corporate or government entities identified herein may also be located in a similar manner.

5.0 ASSISTANCE, QUESTIONS OR COMMENTS

We welcome all **questions or comments** about the PM Guide for Productivity Tool Enhancements (PETs). We are especially interested in your reaction to the information we have assembled and posted on FM-20 homepage and appreciate your comments regarding its usefulness, as well as your suggestions to improve it in some areas (e.g., content, currency, ease of use, or layout).

You may send us your comments or tell us about something related to productivity tools or request assistance by replying via the e-mail form on the Office of Project and Fixed Asset Management Home Page, or sending a message to **fminfo@hq.doe.gov**

6.0 GLOSSARY OF TERMS

A/E/C Systems. This term traditionally addresses the information management needs of the design and construction industry. Its focus covers the entire building team drawn from the private, institutional, and government sectors, from project manager and front-line professional to the CEO and government user.

American Standard Code for Information Interchange (ASCII). The predominant character set encoding of present-day computers. The modern version uses 7 bits for each character, whereas most earlier codes (including an early version of ASCII) used fewer. This change allowed the inclusion of lowercase letters -- a major win - but it did not provide for accented letters or any other letterforms not used in English (such as the German sharp-S or the ae-ligature which is a letter I, for example, Norwegian).

Business Process Reengineering (BPR). BPR is a concept for assessing the processes within an organization from the standpoint of the entity(ies) benefiting from the products of those processes and redesigning, if appropriate, to improve them from that same point of view.

Computer-Aided Facilities Management (CAFM) System. A CAFM system is a computerized program providing database management and analysis tools. Using a variety of databases containing facility information, the CAFM assists in decision making regarding facilities management functions. These functions typically include:

- Space planning and analysis
- Furniture and equipment management
- Lease and real property management
- Telecommunications and cable management
- Building operations and maintenance (including the normal CMMS functions)
- Preventive maintenance
- Construction budgeting
- Computer-Aided Design (CAD) drawing integration

Computerized Maintenance Management System (CMMS). A CMMS is a set of computer software modules and equipment databases containing facility data with the capability to process the data for facilities maintenance management functions. A CMMS has a narrower range of functions than a CAFM. These maintenance-related functions typically include:

- Facility/equipment inventory

- Facility/equipment history
- Work input control
- Job estimating
- Work scheduling and tracking
- Preventive and predictive maintenance
- Facility inspection and assessment
- Material management
- Utilities management

Collage. This is an artistic composition composed of various types of materials.

Condition Assessment. Condition assessment is the inspection and documentation of the material condition of facilities and equipment, as measured against the applicable maintenance standard. It provides the basis for long-range maintenance planning as well as annual work plans and budgets.

Electronic Commerce\Electronic Data Interchange (EC/EDI). Electronic commerce has been defined as the conduct of business transactions, supporting functions such as administration, finance, logistics, procurement, and transportation, between the Government and private industry, using an integrated automated information environment. EDI is simply defined as the computer-to-computer electronic transfer of business transaction information, in a public, standard format.

Electronic images (digitized). Images created on the cathode-ray tube.

Facilities Management. The planning, prioritizing, organizing, controlling, reporting, evaluating, and adjusting of facility use to support field sites based upon customers' facility needs and field site mission requirements.

Facility. A term used to encompass land, buildings, other structures, and other real property improvements, including utilities and collateral equipment. The term does not include operating materials, supplies, special tooling, special test equipment, and noncapitalized equipment. The term *facility* is used in connection with land, buildings (facilities having the basic function to enclose usable space), structures (facilities having the basic function of a research or operational activity), and other real property improvement.

Gradient. In the graphics and printing industries, this refers to color blending from light to dark.

Layers. In graphics or CAD operations, layers are an options in drawing programs which allow the designer to create multiple levels to permit easier editing of documents.

Life-cycle Costs (LCC). A form of economic analysis that considers the total cost of owning, operating, and maintaining a facility over its useful life. Life-cycle costs are the sum of the present value of:

- a. Investment costs, less salvage values, at the end of the study period;
- b. Nonfuel operation and maintenance costs;
- c. Replacement costs, less salvage costs, of replaced building systems; and
- d. Energy costs.

Montages. This refers to the production of a rapid succession of images in a motion picture to illustrate an association of ideas.

Page Composition. The structural arrangement of a page within a document.

Palette. This is a movable window that is always displayed in front of open documents. Palettes pertain to color and are a subset of all the possible colors that a computer can display. Palettes are used to control the colors of the artwork on the screen.

Patterns. Patterns are used to create special effects in drawing and image enhancement programs.

Paste Up. This is a term used in the graphics field also known as a mechanical. In the master document from which a printing plate is made, a mechanical includes all the design elements such as text, photographs, line art, etc. in position and ready for the final form.

Predictive Testing & Inspection (PT&I). (1) PT&I is the use of advanced technology to assess machinery condition. It replaces maintenance scheduled at arbitrary time or usage intervals with maintenance that is scheduled only when the condition of the equipment requires it. The PT&I data obtained allows for planning and scheduling corrective maintenance or repairs in advance of failure. (2) Those testing and inspection activities for facility items that generally require more sophisticated means to identify maintenance requirements than those of preventive maintenance.

Prepress Experts. Professionals in the fields of design and printing who are knowledgeable in the prepress process, which is a collective term for the steps necessary to transfer original artwork to the film from which printing plates are made.

Preventive Maintenance (PM). PM is the planned, scheduled periodic inspection, adjustment, cleaning, lubrication, parts replacement, and minor repair of equipment and systems for which a specific operator is not assigned. PM consists of many checkpoint activities on items that, if disabled, would interfere with an essential field site operation, endanger life or property, or involve high cost or long lead time for replacement. In a shift away from reactive maintenance, PM schedules periodic inspection and maintenance at predefined time or usage intervals in an attempt to reduce equipment failures. Depending on the intervals set, PM can result in a significant increase in inspection and routine maintenance; however, a weak or nonexistent PM program can result in much more emergency work and costly repairs.

Proactive Maintenance. Also referred to as “root-cause analysis,” proactive maintenance is the further application of predictive maintenance technologies toward extending machinery life. It seeks to reduce the need for maintenance through better design, better installation, precision balance and alignment, and root-cause failure analysis.

Project Data System (PDS). PDS is a computerized system provide a database of all Department projects from which individual Project Data Sheets can be prepared. This document is required by the Congress for its decision-making processes. However, PDS has been structured to include a wide range of project data beyond the requirements of the Project Data Sheet for the purpose of supporting the Departmental project management system.

Reliability Centered Maintenance (RCM). RCM is a maintenance strategy that logically incorporates into a maintenance program the proper mix of reactive, preventive, predictive, and proactive maintenance practices. Rather than being independent, the four maintenance categories draw upon their respective strengths to maximize facility and equipment operability and efficiency while minimizing required maintenance time, materials, and consequently, costs. For example, a small pump might be run to failure, a gasoline engine might be placed on a 1,000 PM program, and a critical turbine might be monitored with on-line diagnostic sensors. This strategy often includes performing a statistical analysis of historical data related to failures to determine the optimal investment of maintenance resources and risk assessment methods, called Failure Mode and Effects Analysis (FMEA), to identify those processes or systems that statistically exhibit the greatest chance of catastrophic failure. The equipment is then maintained, modified, or replace accordingly. Thus, the result is a shift in maintenance resources to areas of greatest mission consequence.

TIFF or TIF. Acronym for Tag Image File Format. TIFF/TIF images and graphics can be line art, (black and white) gray scale or color. They are created on either a Macintosh or

DOS- and Windows- based computer.

Typograghy. Within the graphics or publishing industry, this refers to the style, arrangement, or appearance of text.

Typesetting. This involves two types of information: the characters seen on a computer screen and

7.0 RELATED TRAINING

Available training associated with the above productivity and program support tools is identified in the product tool data sheets, indicating product service numbers for training requirements. Data sheets are catalogued by functional category (e.g. project management) and product type (e.g. Project Management System).

Additional training on topics covered by this Guide is being jointly developed by the DOE Training Curriculum Process Improvement Team (with members from FM/HR/EM) for the Professional Skills Training Program. Questions concerning this program and course availability may be referred to the Office of Professional and Technical Training in Washington, D.C. on (202) 426-1329.

8.0 EXAMPLES

Best-of-Breed examples, success stories, and other updated information will be available on the Office of Project and Fixed Asset Management Home Page or its FTP Site. You are invited to share your examples and stories by contacting us via e-mail through the home page or by sending a message to **fminfo@hq.doe.gov**