

Project Management Tools Working Group – II

**Systems Management Office and the Principal Center for
Workgroup Hardware and Software - GRC**

ENTERPRISE PROJECT MANAGEMENT TOOL ANALYSIS WHITE PAPER

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PURPOSE

The purpose of this paper is to provide an overview of Project Management Tools Working Group-II's activities involving the research and evaluation of enterprise-level project management tools. This paper also outlines the comparative results of the group's evaluation.

INTRODUCTION

In FY 2000, the Agency CIO tasked the Principal Center for Workgroup Hardware and Software (PCWHS) at the NASA Glenn Research Center to recommend project management desktop tools. To that end, the PCWHS convened an Agency-wide working group, the Project Management Tools Working Group (PMTWG), to develop desktop tool requirements, evaluate best-of-breed desktop tools, and provide recommendations.

The working group defined desktop tools as tools having a core set of project management features that are designed to handle medium-to-large projects typically involving a few hundred users. The working group used market place studies, literature reviews, and third party consultants in the development of an extensive list of tools for review.

To obtain the desktop tool requirements, the PMTWG modified an existing list of desktop tool requirements originally developed by the Kennedy Space Center (KSC). The PMTWG also conducted an Agency-wide survey to validate these requirements. These requirements were then used to evaluate desktop-level project management tools. The PMTWG evaluated the tools by attending vendor demonstrations and reviewing market place literature. As a result, the working group recommended Microsoft Project 98/2000 and Primavera P3 as the desktop solutions. The deliverables consisted of a White Paper, Project Management Tool Evaluation Summaries, and a Presentation Package. The PMTWG adjourned in June 2001.

Since then, NASA has purchased and initiated the rapid deployment of the SAP Enterprise Resource Planning (ERP) System, R/3. This venture will allow NASA to finally achieve full integration of its business management and program/project management environments. The SAP R/3 system is a multi-tier, multi-module system of which the Project Systems (PS) Module is a component. Additionally, ERP Application suites are popular in businesses for offering an integrated view and reporting of information from all areas of an enterprise. These applications also reduce costs, improve business processes as well as replace legacy and custom applications. Training must be conducted as an integral part of the ERP project, and the earlier the knowledge transfer occurs in the implementation process, the higher the chances for successful ERP adoption.

The Agency Project Management Council Working Group (PMCWG) is responsible for the advocacy of project management processes, tools, and techniques. Even though the deployment of the SAP PS Module has not yet been decided, it still is the best interface to the larger ERP System (Integrated Financial Management (IFM) System), which is currently being deployed throughout the Agency. Therefore, a sub-team of the PMCWG initiated an effort to not only understand the functionality of the SAP PS Module, but also its interoperability within the current desktop environment and with other enterprise-level project management tools. Here, enterprise project management tools are defined as a powerful suite of scalable project management features that can handle very large and complex projects involving a few thousand users or more. These tools are designed to facilitate the productivity of distributed project teams. Enterprise project management tools are important for managing the day-to-day programs and projects. Both ERP systems and enterprise project management tools are

needed for controlling costs and performance. For this reason, the SAP PS module (an ERP system component) and several enterprise-level project management tools were evaluated in this study.

In May 2002, a sub-team of the PMCWG requested that the PMTWG reconvene and evaluate the SAP PS module and enterprise-level project management tools. The PMCWG sub-team chartered the working group to not only evaluate enterprise-level tools but also determine if familiar project management tools, like Microsoft Project, were interoperable with the SAP PS module and the SAP environment. The working group accepted this charter and reconvened as the Project Management Tool Working Group - II (PMTWG-II).

The PMTWG-II derived the enterprise-level requirements using a variety of sources. The majority of the enterprise-level requirements were derived by modifying and expanding the desktop tool requirements. These modifications included enterprise-level functionality common to most enterprise project management tools. The PMTWG-II also used marketplace literature and research reports to create and refine the final enterprise tool requirements.

Along with its thorough assessment of desktop project management tools, the initial PMTWG conducted a preliminary assessment of eight enterprise-level project management tools against the desktop requirements. Because the work of the PMTWG-II was constrained to a very narrow time period, the PMTWG's preliminary assessment was used as a starting point. The PMTWG-II selected four enterprise-level tools for evaluation, Microsoft Project Server 2002, Primavera P3e, Welcom OpenPlan, and SAP PS module. Microsoft Project Server 2002 and Primavera P3e were of particular interest to the group since their desktop versions were recommended initially. Welcom OpenPlan was also considered primarily because it was so closely ranked to Microsoft Project and Primavera P3e.

The PMTWG-II evaluated each tool based on requirement fulfillment, vendor demonstrations, interviews with current end-users, and marketplace literature. While a final recommendation will not be rendered, the overall findings of the PMTWG-II's efforts are the basis of this White Paper.

Project Management Tool Working Group

The working group was composed of project managers, project team members, COTRs, and government and contractor schedulers from across the Agency. The membership of the working group included the following individuals:

Anita Alexander – GRC	Donice Bell – GRC (BAH)
David Anderson – GRC	Bob Bilbrey – GRC (BAH)
Diana Centeno-Gomez– GRC	Colleen Champion – GRC (BAH)
James Yamanaka – DFC	Lita Cuen – DFC (BAH)
Richard Ryan - GSFC	Oz Findlay – GSFC (Boeing)
Yvonne Parker – KSC	Tracee Rice– LaRC (SWALES)
Debbie Cook – LaRC	Tony Beaver – MSFC (SAIC)
Ken Poole – MSFC	Greg Smith – MSFC (SVT)

The charter of the PMTWG-II is to review and evaluate Commercial-Off-The-Shelf (COTS) Enterprise Project Management Software Tools and their interoperability with the SAP Project Systems (PS) Module.

While the working group will adjourn after the completion of its charter, its members are likely to serve as resources to various teams and panels that are pursuing enterprise-level project management tool initiatives throughout the Agency.

SCOPE

The scope of this project is limited to the identification and evaluation of enterprise-level project management tools and the SAP PS module. This project is intended to identify enterprise-level tools that are compatible with the desktop tools previously recommended. Key tasks associated with this project include the following:

- Research and evaluate project management software enterprise solutions:
 - Develop enterprise-level tool requirements
 - Develop a list of enterprise-level tools for evaluation
 - Conduct an overall evaluation of each tool by:
 - Reviewing marketplace literature.
 - Interviewing end-users currently using the tools under consideration.
 - Gathering information available over the Web – including user group forums.
 - Attending vendor demonstrations.
 - Conducting an extensive literature review of current project management tools.
 - Develop a White Paper to discuss and report findings.

BENEFITS AND RISK ASSESSMENT

There are several benefits to moving toward an integrated project management environment. The promise of ERP systems and project management tools is the accuracy and timeliness of project data. Strategic advantages are best realized through key business decisions based on real time project data.

Benefits

- Improved access to real-time project data in a timely manner that will facilitate more informed decisions.
- More timely and organized accessibility to actual and planned cost information will enable project managers to control the project within budget.
- Project status can be reported in a consistent and timely manner, which enhances communication at all levels of the organization.
- Potential project risks can be more readily identified and mitigated in a timely fashion.
- Cost savings will be realized with a decrease in resource-hours no longer expended in the procurement, licensing, and maintenance of many separate solutions.
- Training can be consolidated and standardized to align with the new tool(s), resulting in cost savings in this area.
- The capture and systematic use of historical data will make program and project planning efforts more efficient. This will also help facilitate the incorporation of lessons learned, which should lead to additional cost savings.

Risks

If the Agency chooses not to implement a standard enterprise project management tool and simply continues with the current desktop project management solution(s), there will be risks associated with that decision.

- The Agency will not be aligned with the current project management methods associated with enterprise business management. Consequently, NASA will fail to realize all of the benefits associated with being able to manage resources across projects.
- NASA may not be able to upgrade its desktop tools because some manufacturers of desktop tools are moving more towards the enterprise standard and will eventually discontinue developing desktop upgrades. Furthermore, current interface tools for the SAP modules have been developed to the enterprise standard.
- The Agency is certain to lose data integrity – programs and projects may not be able to access key financial data. While IFM will have to provide project data electronically, it may not necessarily be real-time data - which would defeat the purpose of having an integrated environment.
- Current desktop project management tools do not interface with the Core Financial System. Therefore, a desktop interface is required in order to realize the full benefits of real-time data accessibility.
- Because work elements are becoming decentralized and more distributed, the demand for collaboration and accessibility to common project data will eventually require enterprise tool solutions.

There are risks associated with implementing the SAP Project Systems (PS) Module.

- The success of the implementation will depend on the coordination of the stakeholders (i.e., PMCWG, SMO, IFM, Program Enterprises, and NASA CIOs). If each stakeholder proposes and executes separate implementation plans, NASA will fail to realize all the benefits of a proven and standard implementation process.
- Viable plans must be in place to deal with the impact of removing legacy systems which currently serve the program and project community. For legacy systems that are to be retained, there must be a suitable interface for access to the IFM system.

There are risks associated with implementing an Agency enterprise-level project management tool set other than the SAP Project Systems Module.

- The success of the future implementation will depend on the stakeholders' (i.e., PMCWG, SMO, IFM, Program Enterprises, and NASA CIO's) acceptance of the final recommendations of the Agency Process Team. Failure to comply with the Agency Process Team's recommendations will likely mean that the tool selection process will be repeated at each Center. The Agency must continue to move forward with selecting an approach to managing programs and projects in the new IFM environment.
- Integration between other third party tools and the SAP Core Financial environment may pose a host of problems. The integration of cost data will likely pose the greatest challenge. Failure to achieve full integration will result in decreased data integrity.
- There is also the risk that the recommended tool set may not be used due to inadequate training, marketing, and open communications with the project managers of the recommended tool set. Failure to use the recommended tool will mean that the overall business drivers for an integrated solution set will be unattainable.
- The third party project management tool set must interface with legacy systems. If the tool set does not, then data integration will be compromised especially if data is to be entered manually from dated reports.

- The uncertainty of the SAP Project Systems Module implementation will likely affect the decision to purchase and implement any enterprise project management tool.
- Third party project management tools cannot interface with the SAP/IFMP environment without the PS module. The PS module is needed to fully access IFMP data.

The overarching risk associated with each scenario is the lack of commitment, both programmatic and financial, to the proposed course of action. A failed implementation means wasted resources. Those involved will suffer a loss of credibility by degrading their efficiency. While at the same time, the drivers behind this effort will not be adequately addressed.

- Also, if the Agency decides to adopt the PS Module and an Agency-wide enterprise project management tool, there will be a cultural impact on the project management community. There will likely be formidable resistance to accepting and utilizing a new tool set. This community will need to be convinced of the full benefits of adopting the new tool set.

ENTERPRISE-LEVEL PROJECT MANAGEMENT TOOLS EVALUATION DOCUMENTS

Enterprise Project Management Tools Project Plan

The Project Plan organizes the planned work by phase. Each phase identifies specific activities and tasks that need to be performed. It also contains the deliverables and schedules associated with each phase.

Enterprise Project Management Tools Requirements Document

The purpose of the Project Management Tool Requirement Document is to identify and document the requirements for enterprise project management software. These requirements were used in the tool evaluation process. The Requirements Document is the key driver in the evaluation process.

Enterprise Project Management Tools Evaluation Methodology Document

The purpose of the Enterprise Project Management Tool Evaluation Methodology Document is to record the methodology used for evaluating project management solutions. The evaluation process consisted of two steps: (1) definition of requirements and (2) tool evaluation through independent evaluation and vendor demonstrations.

- The key drivers of the evaluation process were the modified requirements obtained through the Agency-wide requirements gathering survey conducted by the PMTWG in 2000, a review of the current literature on enterprise-level project management solutions, and a review of the marketplace data.
- The enterprise project management tools were evaluated against these user requirements.
- The Functional Evaluation Matrix was developed based on the requirements and was used to record the comments and scores of each of the potential project management tools.
- Product demonstrations by third party vendors were arranged to evaluate software features and functionality.

The key documents of the working group's activities are presented in the appendices of this White Paper. The weekly PMTWG-II teleconference and face-to-face meetings support the development of these key documents.

ENTERPRISE PROJECT MANAGEMENT TOOL GENERAL REQUIREMENTS

Enterprise Project Management Software Defined

Most enterprise-level project management software packages include six core fundamental features:

- Security – the protection against unauthorized use, password protection, and user restricted access.
- Scalability - the ability to support hundreds of users using a single system using concurrent licenses. Scalability allows the organization to grow and meet its current and future information processing needs without having to redesign the primary infrastructure.
- Extensibility – the ability to extend or expand into multiple business core process areas for the purpose of integrating data from all covered areas. Extensibility allows organizations to maintain its underlying structure as additional features and connectivity points are added to it.
- Interoperability – the ability to communicate and share services with disparate computing systems, the ability to integrate with ERP systems such as PeopleSoft, JD Edwards, SAP, or Oracle.
- Accessibility – accessibility through the Web or other remote means (i.e., WAN, dial up, VPN, etc.)
- Manageability - centralized administration and control of all system resources

Key product differentiators include:

- Architecture – Enterprise-level tools are still client/server based, however, vendors are providing Web-enabled applications to promote collaboration and commonality.
- Usability – The functionality of the tool sufficiently maps to general enterprise-level user-requirements. Usability also refers to how well the user interface is considered easy to use.
- Extensive Project Planning Capability – The ability to create breakdown structures like OBS, WBS, and RBS. The ability to create and manipulate PERT and Gantt Charts.
- Optimization – The ability to optimize program and project resources using CPM scheduling techniques.
- Resource Management – The ability to efficiently manage resources using leveling, smoothing, and loading techniques. Also refers to the ability to track resource consumption and availability.
- Event-based alerts/reporting – The ability to alert project managers when thresholds and limits are exceeded.
- Portfolio Management – The ability to sort and view project data to determine project performance, thereby making it easier to monitor and control high risk projects with low yield. Also refers to the ability to provide an executive level summary of project performance (dashboards).

- Reporting – The ability to provide various report formats such as HTML and PDF.
- Cost – The cost of the base product, maintenance or similar agreements, and add-ons required to meet functional requirements.
- Core functionality – Most EPM tools at least meet the defined requirements if available add-ons are purchased and integrated.
- Customer Service – The responsiveness to problems and questions, availability of support, and response time for that support.
- Integration – Level of effort required to integrate tools with legacy systems or other EPM tools likely to be used.

The key requirement categories used in this study include:

Database Connectivity/Architecture – Multi-user capability, multi-project capability and support, interoperability with desktop tools and newly implemented SAP modules, import and export capabilities, and ability to integrate user-defined parameters.

Workgroup Capability – Allows users to import and export project reports and documents.

User Access and Security – Allows for user- and project-level access and control.

Ease-of-Use – Consistent with other enterprise-level tools and requires limited-to-no additional training.

Project Management Functionality (i.e., Schedule, Cost, Resources, Performance, and Risk Management)

Work Breakdown Structure, Resource Breakdown Structure, and Organizational Breakdown Structure, Gantt and PERT diagrams, multi-resource and multi-calendar definition.

Full Critical Path Method (CPM) functionality.

Risk management features and functionality.

Cost tracking, cost differentiation, financial resources, commitments, and obligations and earned-value analysis.

Project and Management Reporting - Standard and customized reporting and consolidation features.

Collaboration/Web Access – HTML conversion capability, accessibility to project data by geographical by distributed teams, project portal capabilities, and e-mail notification.

The PMTWG-II used these requirements to evaluate the functionality of each tool during the performance testing with on-line or CD-based demo-version software, vendor demonstrations and marketplace literature review.

ENTERPRISE-LEVEL PROJECT MANAGEMENT TOOL INVESTIGATION RESULTS

Enterprise Project Management Tools were found to provide a wide range of functions. Among these functions are scheduling, resource allocation, cost estimating, budgeting, and collaborating. Because enterprise project management tools are usually built on centralized data repositories, their operation enables the synchronization of these functions at multiple sites. They also allow enterprise-wide views of all the projects in an organization as well as access to anyone involved in setting up, maintaining, updating or browsing to come in contact with the project information needed to make informed decisions. These tools greatly assist in disseminating and sharing project knowledge that relates to resource skills, project-related policy documents, templates, threaded discussions, and time and expense reports.

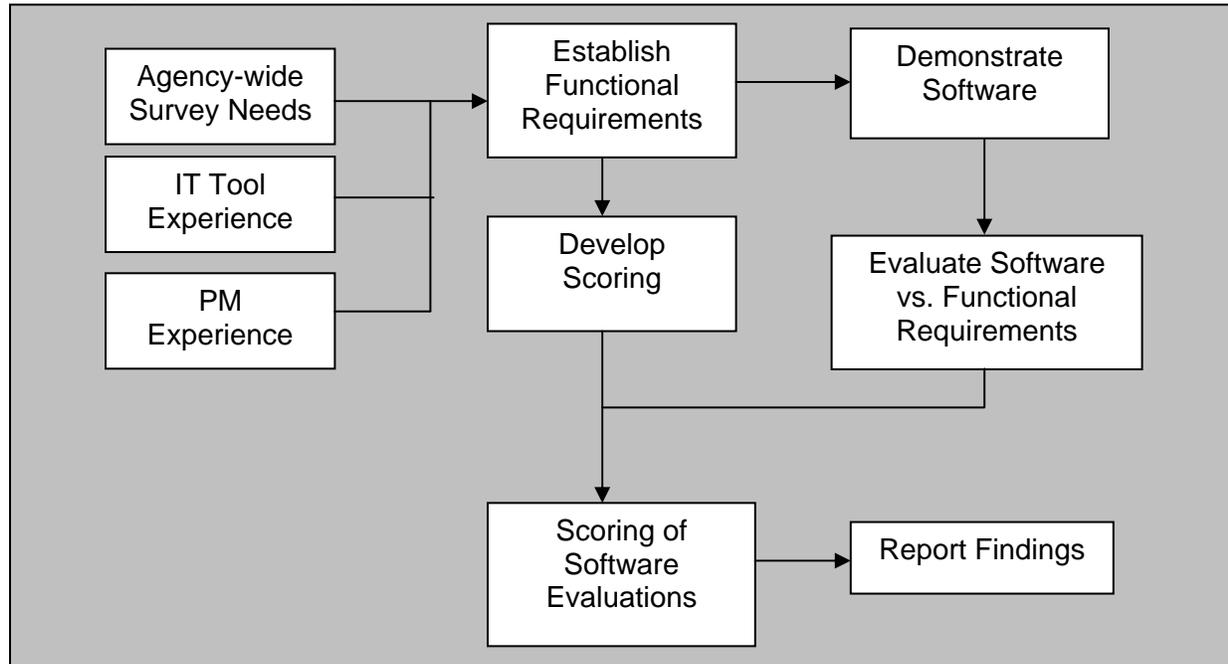
Users of enterprise project management products at NASA are characterized by their need to manage multiple projects simultaneously. Emphasis is on prioritization of projects, allocation of resources, scheduling and the tracking of resources assigned to multiple projects. These users need to create detailed project budgets, have access to actual cost data, track and distribute performance data, and create earned-value reports.

Enterprise Project Management Tools Under Consideration

Users of enterprise project management tools are in need of accessibility to actual cost data, sophisticated risk assessment as well as detailed performance tracking and earned value management and project collaboration. Now more than ever, enterprise project management tools are a suitable and necessary product in the NASA project environment since the Agency is moving more towards a standardized or unified NASA environment.

It is important to note that enterprise project management tools emphasize project performance relative to resource consumption within a given set of time constraints (i.e., progress and dates). ERP systems emphasize the overall financial state of the business and therefore focus on planning, controlling, project costs (i.e., forecasting, accounting and trending – costs). ERP systems are important for enterprise business management. Both perspectives – enterprise project management and enterprise resource planning – are needed to accurately assess the health of a business.

Scoring Methodology



Enterprise-Level Project Management Tool Evaluation Process Flowchart

The investigation process included two phases: (1) the requirement definition phase and (2) the evaluation phase.

The PMTWG-II used these expanded and modified requirements from the PMTWG findings to score the functionality of each enterprise project management tool during the performance testing with on-line and CD-based demonstration version software, vendor demonstrations, and marketplace literature review.

The evaluation phase consisted of initial scoring using demonstration versions of the software, verification and clarification of capabilities cited throughout the literature, and product demonstrations conducted by respective vendors within a group setting.

A Functional Evaluation Matrix was developed using the Requirements document. This matrix helped to facilitate the scoring of each tool under consideration. The matrix included columns for required functionality, scores to depict how well the tool fulfilled the specific requirements, and comments or notes.

The following scale was used to score each tool:

- (-) - Does Not Meet Requirements
- (0) - Meets Requirements
- (+) - Exceeds Requirements
- (?) - Unknown or Needs More Information

Initially, individual members of the PMTWG-II independently evaluated the appropriateness of the tools based on the marketplace literature and their experiences with the demonstration trial version of the tool. The scoring was then documented in the Independent Individual Evaluation Matrix as baseline scores. See Appendix A.

One-week prior to the product demonstration meeting (face-to-face), vendors were provided a completed Independent Individual Evaluation Matrix for their respective products. The vendors were instructed to focus their discussions on the specified requirements. During the demonstration meeting, vendors were given the opportunity to expound and further elaborate on those requirements that had been given a low score.

After each demonstration, the PMTWG-II performed a roundtable discussion. A re-scoring of the Independent Individual Evaluation Matrix for each tool was then completed based upon the team's perspective of the information exchanged during the demonstration. Documentation of the re-scoring was then recorded in the face-to-face Functional Evaluation Matrix.

The following scale was used to score each tool:

- (1) - Does Not Meet Requirements
- (2) - Meets Requirements
- (3) - Exceeds Requirements
- (*) - Add On Required to Meet Functionality

Each package was then given an overall score for functionality in the categories of: database connectivity and architecture, workgroup capability, network, ease of use, project scheduling, project task/field features, baselining and tracking progress, resource and calendar features, cost management, risk management, and reporting features. The final documented score was based on how many functional requirements were fulfilled or satisfied. Each package was given an average score for each category.

Summary Of The Final Evaluation Results

	Requirement Section Averages			
	Welcom Open Plan	Primavera P3e	Microsoft Project Server 2002	SAP Project Systems
1.0 Open Database Connectivity and Architecture	2.1	2.1	2.1	2.1
2.0 Workgroup Capabilities	2.0	2.0	2.3	2.0
3.0 Network	2.0	2.0	1.5	2.0
4.0 Ease of Use	2.0	2.0	2.3	1.3
5.0 Project Scheduling Methodology	2.2	2.1	1.9	1.9
6.0 Project Task/Field Features	1.9	2.0	2.0	2.0
7.0 Baselining and Tracking Progress	2.0	2.0	2.0	1.8
8.0 Resource Features	2.0	2.0	2.0	1.9
9.0 Calendar Features	2.2	2.0	2.0	1.8
10.0 Cost Management Features	2.0	2.7	2.0	2.3
11.0 Risk Management Features	2.0	1.7	1.0	1.0
12.0 Project Reports	2.1	1.8	2.0	1.8
13.0 Management Reporting	1.8	2.0	1.8	1.8
14.0 Collaboration	1.6	1.6	2.2	1.8
Average of All Sections	2.0	2.0	1.9	1.8

Core Project Management Section Averages (5, 6, 7, 8, 9, 10, 11, 12, 13)	2.0	2.0	1.9	1.8
Tool Function Section Averages (1, 2, 3, 4, 14)	1.9	1.9	2.1	1.8

Evaluation Scale 1 – does not meet 2 – meets 3 - exceeds

The tools evaluated in this study have the same relative level of functionality with the exception of one or two marginal differences. OpenPlan and Primavera are shown to have marginally-higher scores in the fulfillment of core project management requirements. Project Server 2002 is shown to have marginally-higher scores in their fulfillment of IT-related requirements.

Evaluation Assessment Summaries

Welcom OpenPlan Version (2.6)

The Welcom product suite includes:

- OpenPlan - an enterprise project scheduling and resource management tool
- COBRA - Cost and Earned Value Management Software
- WelcomHome - a Web-based tool that allows for platform independent project collaboration, project statusing, and project portal functionality

Tool Capability Summary

OpenPlan is Welcom's high-end project management tool that provides a framework for cost and schedule integration for mid-to-large sized projects. OpenPlan provides an enterprise solution for multi-user, multi-project applications. This product is scalable for any size project. Although OpenPlan does not support the Mac platform, it does support Windows, Linux, and Unix platforms.

OpenPlan is a standard Windows-based enterprise product and is consistent with other Enterprise Project Management tools in look and feel. Changes and updates can be easily made, whether to an individual task, field, or globally. Training requirements and the learning curve for this tool would be very comparable to most other cost/schedule enterprise tools.

OpenPlan's open, object-oriented architecture allows users to share information with legacy project systems while also providing capabilities for easy customization. OpenPlan uses standard Open Database Connectivity (ODBC) to read and write to external databases. OpenPlan also uses standard Dynamic Data Exchange (DDE) and Object Linking and Embedding (OLE) to link to other applications. While OpenPlan is not a platform-independent tool, non-PC-based users may use Citrix or the WelcomHome add-on package to access and status project data. Security access in OpenPlan has been enhanced so that only a particular function can have access to project data.

OpenPlan's functionality for Critical Path Method (CPM) scheduling and slack calculation is proven. Schedules can be shown as either in Gantt chart format or as a PERT chart with time-phasing capabilities. The tool provides for maximum flexibility in task duration scaling allowing for month, week, day, and minute durations or any combination within the same project file. Its network logic capability also provides for four different types of task interdependency relationships along with the lag and lead values that can be used to more accurately model the project's real sequence of work. Its CPM functionality enables total, free, and negative slack calculations for all tasks. This provides for all of the standard types of tasks and milestones, including hammock tasks, as well as, the standard task constraint options for determined and controlled only by the user and not by the software. Task status can be reported by both percent complete to be entered for earned value calculations.

OpenPlan also allows for exceptional flexibility at the task level. While users may store, manipulate, and manage an unlimited number of tasks, users may also assign variable time scales to each individual task within a project. Users may specify up to 90 codes with unlimited attributes per task. OpenPlan, however, is not able to restrict user access to specified fields.

Moreover, OpenPlan offers full project planning functionality. OpenPlan provides exceptional capability in generating Organizational Breakdown Structures (OBS), Work Breakdown

Structures (WBS), and Resource Breakdown Structures (RBS). Users have access to standard templates to generate these structures. These templates may also be modified to meet the individual user's needs. Once created, these structures may be shared out to other projects. OpenPlan contains features that allow these structures to be drawn in a box diagram format, which eliminates the need for a separate tool to develop and maintain this information.

Baseline data can be stored and used for comparison with current project status data. The user can save, delete, or edit numerous baselines, but only one set of baseline data can be compared to current data at a time. Users can show both current schedule bars and baseline bars on the same Gantt chart to more easily identify variances. Custom views can be generated to allow the user to choose whatever specified calendar period is desired for checking the status of the project.

OpenPlan provides excellent flexibility in resource loading and leveling. An unlimited number of resources can be established and defined as individuals or skills, which have associated unit rates, or as lump sum quantities, such as hours or dollars. Multiple resource assignments can be made to a single task, which prevents the need for task duplication. Once resources are established and stored, they can then be shared among multiple projects. Resource constraints and escalation rates can be identified in the software to provide for better-cost control and estimating. Users may then utilize these constraints to identify over-allocated situations and level the resources as necessary. OpenPlan has the capability to quickly load and spread resources and costs by using the preset distribution curves or the users own curves for loading resources. This feature could significantly cut the amount of time required for crucial resource loading which is a must for establishing an accurate resource plan, project estimating, and earned-value calculations. Resource completion status can be either a manually reported value, independent of the task duration, or a percent-complete value automatically calculated from the remaining task duration.

The calendar features provided by OpenPlan include the following:

- the ability to establish an unlimited number of task and resource calendar options within a single file that define shift patterns, work weeks, daily hours, and holidays,
- the ability to assign multiple calendars within the same project,
- and the provision for using fiscal years or calendar years as well as the ability to set the starting day of the week.

OpenPlan also features capabilities for simplified Earned-Value (EV) cost management . Earned value as identified in this tool is based on the reported resource (physical) percent-complete status, with values being calculated for Budgeted Cost of Work Scheduled (BCWS), Budgeted Cost of Work Performed (BCWP), Actual Cost of Work Performed (ACWP), Schedule Variance (SV), Cost Variance (CV), Budget at Completion (BAC), Estimate to Complete (ETC), Estimate at Completion (EAC), Cost Performance Index (CPI), and Schedule Performance Index (SPI). A customizable earned value report is provided for management reporting of project EV data. Cost account numbers can be assigned, if desired, in the same manner as any other coding identifier and can be used for the sorting, selecting, and summarizing of project data.

OpenPlan has a risk management function within the tool that allows the user to quantify the uncertainties associated with project durations (schedule). The tool allows the user to enter a probable duration range for some or all of the tasks in the project, and then utilize a fast Monte Carlo-simulation to perform a schedule risk analysis to determine the effects and impacts on each task and the project as a whole. Views and graphs can be produced reflecting the

schedule risk information for critical management analysis. Optimistic, pessimistic, and most likely durations (three point estimates) for all activities are reported. It is important to note that OpenPlan performs risk analysis only on schedules. The software does not specifically enable users to assign cost uncertainties or determining cost risk impacts and estimates.

An unlimited number of project reports and graphs can be created within OpenPlan and shared by various projects. This tool provides for standard schedule Gantt and PERT charts, resource and cost histograms, S-curves, spreadsheets, as well as breakdown structures for WBS, organization, and resources. PERT networks can be zoned and time-scaled for better presentation and reports and graphs can be distributed on the Web or via the Intranet. All project data reflected in these reports can be filtered, summarized, and arranged based upon the associated coding structures developed by the user.

OpenPlan also offers event-based email notification and Web publishing so that project data can be distributed electronically in real time. Project users with access to the project Web site can update projects via the Web.

OpenPlan allows users to share project data via email and its Web Publisher. Information in HTML and PDF formats can be shared with team members in real time. Updates to multiple projects can also be simultaneously done in batch mode for the most current project information for your staff. Full collaboration capability is best realized using the companion software, WelcomHome.

SAP Integration Discussion

The current version of OpenPlan (Version 2.6) does not allow for SAP integration. However, SAP integration will be available in the next version planned for release in 2003.

Microsoft Project Server 2002

Microsoft Project 2002 has three components: (1) Microsoft Project Standard, (2) Microsoft Project Server, and (3) Microsoft Project Professional. The traditional stand-alone desktop only Microsoft Project is called "Microsoft Project Standard". The enterprise configuration requires both "Microsoft Project Server" and "Microsoft Project Professional".

Project Professional 2002 - Resides on the desktop and provides full project management functionality plus a built-in connection to Microsoft Project Server.

Project Server – Is based on IIS (Internet Information Services) and SQL Server technology that enables concurrent Web-based and Project Professional sessions while maintaining consistent project security. Project Web Access (PWA) is the user interface for Project Server. PWA provides a customizable Web interface for various project stakeholders – from team members through executives. PWA also supports customizable cross-project views. It also provides the interface for configuring analysis views that utilize Microsoft SQL Analysis Services to provide built-in OLAP capabilities.

Risk + - An add on software package that provides risk management functionality.

Tool Capability Summary

Microsoft Project Professional and Project Server 2002 satisfactorily provide support for cost and schedule integration in small- to medium- and large-sized projects. Microsoft Project 2002

has moved, from a primarily desktop application with some server-based collaborative features provided in previous versions, to a full enterprise-ready environment. It leverages features of Microsoft Windows 2000 and XP, Internet Information Services (IIS), SQL Server 2000, and Visual Basic for Applications (VBA) to become a scalable solution for larger organizations and large projects.

Project Professional is licensed per Windows PC and is used in conjunction with Project Server 2002 to provide the enterprise functionality. Microsoft Project Professional 2002 is not available for MAC computers.

Microsoft Project Server 2002 is built using SQL Server 2000 and ODBC that support several mechanisms for importing data from and exporting data to other platforms. Project Professional provides for the use of Dynamic Data Exchange (DDE) and Object Linking and Embedding (OLE) that allows users to insert data, graphs, tables, and figures from other applications, as well as, include Project objects in other applications.

While ease of use is subjective and dependent upon the skills and qualifications of each user, Project Professional 2002 is a very straightforward, pull-down menu Windows-driven tool. It provides preset wizards and context-sensitive help to guide the user through all of its processes and operations. Project Professional 2002's graphical-user-interface (GUI) provides many features that are very useful and easy to use. On-line tutorial and user guide documents reduce the need for extensive training.

Project Professional 2002 has a feature that enables users to vary the time increment on a portion of the overall 3-tier timescale by zooming in or out. This feature allows users to see more bars on the screen. There is also a "Go to selected task" function to quickly make the bars of interest visible on the screen. Project Professional 2002 Gantt charts provide for rolling activities up to a single summary bar. The style of these and other bars can be customized in order to highlight, add free text, and adjust units and ranges of time within the Gantt chart view.

Project Plans can also be transferred to any other stand-alone user with Project 98 and higher as needed. Project templates can be created, shared and controlled for future project development, as well as, assisting project managers in adopting the most current organizational process requirements.

Project Web Access and Professional 2002 both provide the capability for grouping multiple projects or subprojects together into a single, program-level master schedule. Several projects can also be viewed as program-level project groups. Project Professional and Server 2002 can virtually accommodate an unlimited number of tasks per project. Each schedule task, assignment, and resource has a set of user customizable fields for sorting, selecting, and summarizing project data. There is an additional set of these user customizable fields in Project Server to implement enterprise-wide codes applied across multiple projects. Attached to each activity is a comment or note field to record free-form text notes about the project, task or assignment. This is a feature that enhances reporting.

The default method for organizing a project is via a pre-defined Work Breakdown Structure (WBS) element identifier. This identifier can be generated by Microsoft Project or controlled totally by the user and the rest of the project team. Each level of the WBS hierarchy can be customized, plus an over-all project prefix can be defined to distinguish from various projects that have been combined into a master schedule. For clear, effective management reporting, both schedule and assignment data can be filtered and rolled-up utilizing the WBS.

There are many canned report templates that can be used to generate views from the extensive collection of Project data. Schedule Activity Reports, Cost Reports, Predecessor/Successor Reports, Resource Allocation and Usage Reports are among the most widely used. In most cases, Target vs. Current or Actual comparison reports can also be generated. Microsoft Project Web Access (PWA) provides almost real-time analysis generated using OLAP (SQL Analysis Services). Custom Web views and analysis graphs can be created through PWA for built-in and custom-defined data fields.

A good variety of preset management reports and histograms are provided in Project Professional 2002. These reports and graphs can be customized and new custom reports and graphs may be created. The graphics capabilities and quality of this software package are extremely well done. In some cases, they are better than those provided in some of the comparable products. Histograms and stacked bar charts reflecting planned versus actual; over/under resource allocations, cumulative totals, and associated tables are possible, as well as, the ability to insert graphs into the Gantt schedule layout. Similar capabilities are provided through customizable analysis views in PWA.

Project Professional and Server 2002 provide excellent flexibility in allowing unlimited resource types (including dollars) that can be scheduled by assigning unit rates or lump sum amounts to be automatically spread across individual tasks. Multiple resource assignments can be made to a single task, preventing unneeded duplication. Resources are spread linearly across assigned tasks by default. For scheduling purposes, several "work contour" resource loading schemes are provided. Several "Accrue At" options are provided to define when costs for a resource should be accrued. A provision is made for resource completion status as either a manually reported value, leaving the task duration constant, or a percent complete value automatically calculated from the remaining task duration.

When using Project Professional in conjunction with Project Server (enterprise mode) a common global pool of resources for the organization can be created and controlled. This allows cross project visibility into resource utilization. By default, Project Professional 2002 schedules activities as though resources are unlimited. Users may then take advantage of cross project availability information in order to level resources as necessary. Project Professional 2002 has an extensive leveling feature that includes a dialogue box permitting users to assign leveling constraints and priority criteria.

Moreover, Project Server 2002 allows the use of a single calendar. The same calendar is applied to the availability and assignment of resources across multiple project plans. This global calendar is the basis for all other calendars. It controls the normal workdays, holidays, and work time. The global calendar may be customized to show different work and non-work periods as well as exceptions. Each resource calendar inherits the work times and holidays from the selected global calendar. All calendars can be customized and edited at any time. Project Professional 2002 can recalculate activity dates and float values based on any calendar revision.

Like earlier versions of Project, Microsoft Project 2002 in enterprise mode (i.e., Project Professional plus Project Server), is able to perform global updates across multiple projects and sub-projects. Microsoft Project Professional and Project Server 2002 support simultaneous multi-user access to project information and database updates without the performance constraints encountered with previous versions. With Microsoft Project 2002, Microsoft has added necessary features to make shared access to enterprise common data usable in a real

organization. For example, Microsoft Project Server 2002 includes a role-based, multi-level security model. The concepts implemented in this security model are similar to those used in the Windows operating system, making the model easier to learn and customize. The security features are transparent to the average user plus custom security groups can be defined. The security settings are also used to simplify and customize the Web interface provided to the user through PWA.

Microsoft Project 2002's architecture is organized so that users can create the project plan in Project Professional, assign resources, publish the plan to the Web, and accept updates to the plan via the Web (PWA). This feature allows team members to view and approve their task assignments, relay pertinent task information, and provide updates without using Project Professional 2002. Resources can delegate tasks and submit new tasks from Project Web Access. The project manager must review and accept updates from team members before they are added to the project plan. A project manager can define a set of rules to help automate this task. Even though PWA does not allow users to directly update project plans via the Web, viewing of the detailed project plan is available depending on the user's security permissions. The project manager has the ability to launch Project Professional with their project plan already loaded from PWA. These and the other work-group features can be customized to be automatic, semi-automatic, or not available. Direct collaborative access to key schedule status and resource allocation and usage information is available through the Web and secured using the built-in role-based security model.

Optional e-mail reminders are provided for many events including task updates and status reports. Project's e-mail features are compliant with Vendor Independent Messaging (VIM), as well as, Microsoft Mail and Messaging Application Programming Interface (MAPI).

Baseline data can be stored and used for comparison with current project status. Users can show current status bars and baseline bars on the Gantt chart to more easily identify variances. The baseline can be changed any number of times and up to 11 sets of baseline data can be stored for each project. Although not displayed by default, comparisons of current status to a specific baseline are possible.

Earned-value cost management is featured in Project Professional 2002. One of two methods can be used for calculating values. The "% Complete" method, which is the default and was available in prior versions, uses the resource's Percent Complete status. MS Project Professional 2002 adds a second method called "Physical % Complete" which is not tied to the resource's status. Any of the 11 sets of baseline data can be selected for the EVM calculations. All the main EVM values are calculated by Project Professional, including: Budgeted Cost of Work Scheduled (BCWS), Budgeted Cost of Work Performed (BCWP), Actual Cost of Work Performed (ACWP), Schedule Variance (SV), Cost Variance (CV), Budget at Completion (BAC), Cost Performance Index (CPI), Schedule Performance Index (SPI), Variance at Completion (VAC), and Estimate at Completion (EAC).

The well-designed PERT view allows the user to focus on an activity's predecessors and successors, one at a time, while also displaying the entire network via split screen. This feature allows users to visually see the downstream-effect project delays have on the entire project and its critical path. The PERT view can be shown not only as a pure logic flowchart, but also in a time-phased manner for added schedule perspective.

Project Professional 2002 utilizes acceptable Critical Path Method (CPM) functionality. It calculates using the forward pass, the slack between all types of tasks and relationships. It

uses the conventional red-highlighted bar or box to draw attention to the activity on the longest path through the project. This application also allows for the assignment of variable units for task duration. A task's duration can be specified in week, day, hour, or any fraction of these. Its network logic capability allows for four different types of task interdependency relationships along with lag and lead values that can be used to more accurately model the project's real sequence of work. Its CPM functionality also provides for total, free, and negative slack calculations, as well as, the capability of assigning multiple calendars within the same project. Project Professional 2002 provides for three different calculation types for tasks: Fixed Duration, Fixed Units, and Fixed Work. In addition, tasks may be marked as Effort Driven. There are eight types of constraints that can be applied to individual tasks in a project. This enables the proper modeling and correct sequencing of work in a project. Project Professional 2002 allows the tracking and recording of progress and recording of the status of each task by applying Work, Remaining Work, Work %, or % Complete. Even though it is not the default behavior, Project Professional 2002 can reschedule incomplete task duration beyond the status as-of date.

Project Professional 2002 provides limited risk assessment and management capabilities. No "Monte-Carlo" style calculations and analyses based on a co-efficient of deviations from specified task duration are available. There is a Microsoft Project add-on called Risk + from CS Solutions that provides this additional functionality.

SAP Integration Discussion For Microsoft Tool

OpenPS, developed and supported by SAP, is a BAPI based object-oriented interface that allows for synchronous connectivity between MS Project 2000 and the SAP PS module. OpenPS allows for the bi-directional data exchange between the two systems. Users can (upload) create or update project data in SAP PS based on data in MS Project 2000. Users can (download) also create a project in Project 2000 based on data in PS.

OpenPS is a viable interface for Project 2000. However a new release (2.0) will be able to interface with Project 2002 Standard and Professional. The release date has not been announced. There are currently no plans to integrate SAP PS with MS Project Server.

Current users of MS Project Professional and Server 2002 can still utilize SAP OpenPS by importing project data from an SAP module into Project Professional and then publishing that data to Project Server. Once the project data is published – executives and team members are able to receive task assignments and view Project information inside of Project Web Access.

Primavera Project Planner Enterprise (P3e) Version 3.0

The Primavera P3e suite of tools includes:

- Primavision – Provides Web-enabled project management for team members and executives.
- Portfolio Analyst – Provides program-level analysis of project data.
- Progress Reporter – Provides reporting capabilities.

Tool Capability Summary

Primavera Project Planner Enterprise (P3e) is Primavera's high-end project management tool that provides an excellent framework for cost and schedule integration for medium- to large-sized projects with extensive collaboration and enterprise requirements. P3e serves as the core of the Primavera Enterprise suite of management tools and is built on either Oracle or Microsoft SQL Server relational databases for enterprise-wide scalability. It can serve as a stand-alone, single-user management tool or a multi-user, multi-project tool for high performance scheduling and resource control. Although P3e does not support the MAC platform, it does support Windows and Unix platforms.

P3e's open architecture allows users to share information with other project systems including legacy systems while also providing capabilities for easy customization when required. When P3e is placed on a fileserver, it provides full read-write access to multiple users, not licensed by name, simultaneously. The tool also has a check-in/check-out feature that allows the project file owner to control project changes temporarily with read-only access. This software provides the capability of making global changes within a single project or a grouping of projects from a single command screen at one time. Additionally, this software provides for an unlimited number of customizable view layouts for each project that can also be transferred to any other project file as needed. Project templates can also be created and stored for future project development. P3e provides the capability for grouping multiple projects or subprojects together into a single program-level master database containing both schedule and resource information while still allowing each separate project to be updated and maintained by different personnel. This software provides for the use of Dynamic Data Exchange (DDE) and Object Linking and Embedding (OLE) allowing users to insert data, graphs, tables, and figures from other applications.

P3e has been enhanced for greater collaborative usability and publishing capability. Project data can be communicated quickly and directly to team members through P3e's Project Web site or normal E-mail distribution. Publishing on the P3e Project Web site allows the user to decide how much and which kind of information to show, as well as which report graphs to include. This allows team members to view and keep abreast of the latest project information. P3e does not allow users to automatically update project plans via the Internet. Users are required to use an add-on package, namely Primavera Progress Reporter that enables Web-based team communication and automated timekeeping. P3e's e-mail features are compliant with Vendor Independent Messaging (VIM) as well as Microsoft Mail and Messaging Application Programming Interface (MAPI). P3e allows users to import and export blocks of data from other Windows applications as well as MPX file conversions from other scheduling software applications.

While rating a tool's ease-of-use may be very subjective and normally dependent upon the user's experience level and qualifications, it should be noted that Primavera's P3e is a standard Windows-based product. It is consistent with many other desktop tools with robust Help

screens and an on-line tutorial. Training requirements and quickness to learn this tool would be very comparable to most other cost/schedule management tools on the market.

P3e utilizes excellent Critical Path Methodology (CPM) by performing accurate slack calculations for all types of task relationships, which provides the capability to identify multiple project critical paths. The software also provides for variable scaling of task durations to some degree, but not to extent of OpenPlan or Microsoft Project. Its network logic capability allows for four different types of task interdependency-relationships along with lag and lead values that can be used to more accurately model the project's real sequence of work. Its CPM functionality also provides for total, free, and negative slack calculations as well as the capability of assigning multiple calendars within the same project.

P3e provides for four different types of tasks that include the following: task dependent, resource dependent, LOE, and milestone. It should be noted that hammock activities are not available in this version of P3e. Duration types include the following: fixed units/time, fixed-duration, and fixed-units. It also includes nine types of constraints, all of which enable users to more accurately model the correct project sequence of work. Task status can be reported by both remaining duration or percent complete, and most importantly P3e enforces the proper scheduling discipline to always reflect incomplete task durations in the future beyond the status as-of date. When desired, P3e allows the user to specify the percent complete type as a physical percent which in effect de-links it from the remaining duration to prevent inaccurate earned-value status calculations from occurring.

P3e has no practical limit for the number of tasks and resources that can be assigned per project. Each task can be assigned an unlimited number of unique user-defined activity codes for sorting, selecting, and summarizing project data. Additionally, each task is assigned a unique ID that is determined and controlled only by the user and not the software. The unique task ID can be made up of alphanumeric characters, which enables user intelligence to be built into each task ID for additional sort and select capability. P3e provides the capability for generating a Work Breakdown Structure (WBS) and an Organizational Breakdown Structure (OBS), and a very special feature of being able to draw these structures in a box diagram format, eliminating the need for a separate tool and effort to develop and maintain this information. P3e also provides for the viewing of network logic tables to show task relationships, schedule drivers, float values, early and late dates. Cost account and resource breakdown structures are also capabilities provided for in this management tool. Both schedule and resource data can be filtered and rolled-up as summaries using activity codes, WBS, or by cost accounts for clear, effective management reporting. This tool allows users to control read-write access to numerous functions and data elements within their projects.

Baseline data can be stored in P3e and used for comparison with current project status data. The user can change or delete baselines at any time and store as many as (50) baselines per project, but only one may be compared to the current schedule at a single time. Users can show both current and baseline bars on the same Gantt chart to more easily identify variances. When desired, baseline data can be restored as a working project file with all resource information and logic relationships to allow for "what-if" studies of baseline information.

P3e provides excellent flexibility in allowing unlimited resource types (including dollars) which can be scheduled by assigning unit rates or as lump sum amounts to be spread across task durations. Resource structures can be shared among all projects and subprojects within the enterprise. Multiple resource assignments can be made to a single task, preventing unneeded task duplication. Resource completion status can be either a manually-reported value,

independent of the task duration, or a percent-complete value automatically calculated from the remaining task duration. P3e schedules activities as though resources are unlimited, however, users may specify different limits for each resource assignment. Users may then utilize these constraints to level resources as necessary to reduce or eliminate over-allocation. P3e has fairly sophisticated resource scheduling and leveling options, which lets the user set up calendars and shifts that reflect each employees work pattern. The software also allows users to prioritize, split, stretch, and crunch activities based on resource availability. Resources can be used as filtering and sorting criteria so that project data can be organized and ordered by resource type if desired.

P3e tracks revenue and costs associated with resources, and supports the development of an unlimited number of cost accounts so that data can be tracked and managed by individual cost accounts if desired. Cost and revenue data can be organized and summarized by the cost account coding structure if needed. This also enables the user to establish budgets, forecast estimates-to-complete, and determine variances for each cost account.

The calendar features provided by P3e are very robust. It supports three kinds of calendars: global, project, and resource. The capability exists to establish an unlimited number of task and resource calendar options within a single project that define shift patterns, work weeks, daily hours, and holidays. P3e has the capability to assign multiple calendars within the same project, and the provision for using fiscal years or calendar years as well as the ability to set the starting day of the week.

The capability for simplified Earned Value (EV) cost management is provided for in P3e. Options for calculating EV include percent-complete of original duration, user-defined physical percent complete, 0/100 percent complete, and 50/50 percent-complete. Values being calculated are Budgeted Cost of Work Scheduled (BCWS), Budgeted Cost of Work Performed (BCWP), Actual Cost of Work Performed (ACWP), Schedule Variance (SV), Cost Variance (CV), Budget at Completion (BAC), Estimate to Complete (ETC), and Estimate at Completion (EAC). Formulas can be entered to also provide the Cost Performance Index (CPI) and Schedule Performance Index (SPI) for additional analysis. A customizable Earned Value Report is provided for management analysis or data can be transferred to Excel for additional EV reports and graphs.

P3e contains an integrated risk management feature that enables the user to identify, log, categorize, and prioritize potential risks associated with specific WBS elements and resources. While P3e does not offer a Monte Carlo-risk simulation, it does offer a very simplistic approach to calculating a potential risk's cost and schedule impact. This simplistic approach appears very weak in its calculation process and very susceptible to user manipulation. It should be noted, however, that the logging and tracking capabilities along with the ability to document a risk's control plan are very good and would be extremely beneficial in helping to control project risks.

P3e's reporting capabilities include a collection of more than 100 standard reports, a wizard for quick creation of new reports, and a built-in report writer to further customize them. Reports can be saved in Web-ready formats, such as HTML, JPEG, and PNG. Typical available graphics include: histograms and stacked bar charts reflecting planned versus actual versus earned value, over/under resource allocations, and cumulative totals, as well as, as the capability of inserting graphs into the Gantt schedule layouts. P3e provides for split-screen tiling of information to allow the user to view an integrated look at project data on the screen.

The PERT view includes a Trace Logic window that allows the user to focus on an activity's predecessors and successors, one at a time, while also displaying the entire network via split screen. The PERT view does not allow the logic flow to be shown in a time-phased format. The user's activity coding and WBS structures may be used to better organize and layout PERT charts for team review.

In P3e's Gantt chart view, users can see tasks and milestones at the lowest level of detail or roll-up project activities to an appropriate summary level bar that can be based on any of the coding structures established by the user. Users can also customize bar styles, colors, and adjust units and ranges of time within the Gantt chart view.

SAP Integration Capability

While the interface tool for Primavera P3e and SAP PS is currently under development, an interface tool for P3 is available to the market.

Primavera has been partnering with SAP since 1996 and through this partnership along with a third party relationship, IMPRESS Software Inc., an interface solution has been developed that provides bi-directional data exchange between Primavera P3 and SAP/R3. The IMPRESS Engine allows synchronization of business processes between the two systems and delivers management data, such as: costs, organizational information, materials, capacities, production plans, service requests, inventory or procurement information from SAP to Primavera P3.



IMPRESS is also able to take planning results and progress information back from Primavera to SAP for procurement, funds control, accounting purposes, or to release payments. Depending on business requirements, the connections between SAP and Primavera P3 can be established as synchronous, where one system waits for the other to respond, or asynchronous allowing for immediate response between the two systems.

SAP Project Systems (PS) Module

Note: The following evaluation is based on limited access to the actual SAP PS module. The PMTWG-II did not have the same level of access to SAP PS as with the other tools evaluated in this study.

Tool Capability Summary

The PS module, with its multifaceted functionality, supports project management in all phases of the business. This fully integrated module is a project management tool that provides a framework for cost and schedule integration for medium to large-sized projects with collaboration and enterprise requirements. The PS module is integrated with the other applicable modules of SAP and is built on Oracle relational databases for enterprise-wide scalability. This application is intended to be used as a management tool in a multi-user, multi-project environment. Although not designed for use by MAC users, this product supports the Windows environments and can be accessed by MAC users via Citrix Metaframe.

There are a number of options available for sharing data when using this application. SAP has an Open PS solution developed as an "add-on" tool that will provide portal communications with other project systems including legacy systems. Additionally, SAP has defined open software interfaces to the PS module that enable DDE with Microsoft Word, Microsoft Excel, Microsoft Access, Microsoft Project and programs. Other formats or control interfaces supported through these open interfaces include HTML, BAPI, RFC, OLE, OCX, and ASCII. The data integration

features of the PS module are some of its most noteworthy characteristics and provide a wide range of functionality. This impressive potential is also present in the security area of the program. Security can be established at the field level for individual users or user groups.

The PS module, by virtue of its inclusion in SAP, demonstrates strong networking and work group capabilities. Email can be sent to other SAP users via a system that is entirely contained within SAP. These emails may contain text and other data objects that the user designates. Data may be imported and exported in a number of formats (HTML, BAPI, RFC, OLE, OCX, and ASCII). Standard reports and other sections of data may also be exchanged directly with Microsoft products such as Word, Excel, Project and Access. This ability enables the user to save data to file formats other than an SAP printed report for incorporation into other documents. All of the information entered or edited by users is saved in a common database and integrated with other applicable data. The networking architecture provides multi-user access to shared data from workstations with the necessary software installed. Users with the proper security profile can access SAP and the PS module from any properly configured workstation.

The user help system within the PS module is quite extensive. There are also a number of tutorials available to assist new users in becoming familiar with the program. However, it should be noted that PS module navigation is not inherently intuitive. Menu options are not similar in content or format to the typical Microsoft software menus, for example, that most users are currently comfortable with. Additionally, due to the size and complexity of the PS module, necessary for the data integration functionality noted earlier, there are a large number of screens, or menu choices, available. Not all of these options are necessary for all users, but a certain level of training will be required for personnel that will be using this application for the first time in order to familiarize them with the capabilities of the software and the requirements of their job functions.

The PS module provides basic scheduling functionality with some of the more advanced features. The program adheres to Critical Path Method, or CPM, methodologies. Variable task duration and calendar scaling options are available. Users also have the ability to designate logical relationships between tasks and specify positive or negative lag times. Views can be customized, to an extent. Progress reporting addresses task percent complete and remaining duration as separate and distinct pieces of data that must be updated independently. The same is true for total duration, start date, finish date and work. Constraint dates can be used, if required, for tasks or milestones. There are two different types of milestones used in the scheduling area of the PS module that behave differently. One type is inherited from the project structure defined during the project initialization phase and is restricted in functionality. A more flexible milestone can be created and manipulated by the user.

Scheduled tasks are generated from the project Work Breakdown Structure, or WBS. This ensures traceability and consistency of the schedule WBS codes. The WBS can be automatically generated or user specified during the project initialization phase. Additionally, the PS module offers the capability to create and later use project templates to expedite the process of setting up a new project. Resource leveling and smoothing is not a process that exists in the PS module, but is addressed by a different SAP module. The user's ability to group or organize task and milestones under a summary task is limited. The only rollup capability on a project basis that exists corresponds to the project WBS. User definable fields are provided, however, as is the ability to combine multiple project schedules into a single master schedule. A comments or notes field is also provided that accommodates a large amount of text. Baseline related functions are adequate. Baseline functionality includes the ability to create and store a

project baseline for latter comparison, report ahead or behind the original schedule or revised schedule estimates store multiple baselines, keep, revise, or delete the original baseline, and provide a view of actual work by user specified period.

Resource functions in the PS module include abilities to:

- assign costs to resources
- schedule or reserve resources for use
- define different types of resources
- view resource allocations including periods of over or under allocation
- assignment of more than one resource to a task
- display all task using a particular resource
- allow resource sharing among projects
- generate a Resource Breakdown Structure, or RBS

Calendars may be assigned to resources for payroll purposes. However, this has no impact on scheduling functions. Scheduling calendars are established specifically for tasks or projects and do not pertain to particular resources. Other calendar functionality includes abilities to establish non-working periods such as holidays, create multiple calendars for a single project, set the beginning day of the week and beginning month of the fiscal year, and share calendars between projects.

The PS module does not provide risk management capabilities although users may download actual data from PS to any compatible risk management software.

The management reporting features of the PS module are excellent. There are a number of standard reports covering a wide range of information and formats. The reporting level of detail ranges from reporting across a combination of multiple projects to detailed information within a single project. Users have the capability to further refine the data selected for reporting by entering selection or exclusion criteria. Report data can also be customized by using internal tools or by exporting report data to other applications, such as Microsoft Word or Excel.

The collaboration capabilities of the PS module are another of this product's strong points. The PS module is fully integrated with the other modules of SAP. Workflow capability is enhanced through the use of role-based views that enable users to focus on their areas of responsibility. Email notifications can be generated manually or automatically by user defined events. As mentioned in other areas, data can be exported in a number of formats, including HTML, which easily facilitates data dissemination.

IFMP Integration Discussion

Recently, NASA established the Integrated Financial Management Program (IFMP) to centralize and integrate NASA's current financial systems and processes using current technology infused with commercial best practices. Because the current financial operating environment is supported by hundreds of systems that are interfaced, but not integrated, a single source of information is not available. The promise of IFMP is enhanced data integrity and flow and increased efficiency in financial management. The IFMP will eliminate the need for multiple sets of accounting practices and better identify the real cost drivers and the cost-value relationship.

The functional areas important to NASA's strategic success are financial, human, and physical resources. IFMP will use the SAP ERP system to manage these functional areas. IFMP is aligned with the "Manage Strategically" crosscutting process to provide critical information

management capabilities to internal customers and communication among both internal and external customers. As part of the foundation of NASA's future business environment, the IFM Council defined five Agency-wide business drivers:

- Provide timely, consistent, and reliable information for management decisions,
- Improve NASA's accountability and enable full cost management,
- Achieve efficiencies and operate effectively,
- Exchange information with customers and stakeholders,
- Attract and retain a world-class workforce.

These business drivers support NASA's transformation from its current decentralized business systems to a financial management system that is seamlessly integrated throughout all NASA Centers.

It is expected that each of these functional areas will be managed using a combination of the following SAP modules:

Core Financial	Position Description Management
Budget Formulation	Integrated Asset Management
Procurement Management	Travel Management
Human Resources	Resume Management

Successful deployment of these modules will enable NASA and its enterprises to meet their mission and goals more effectively and efficiently. Implementing the SAP ERP system will also mean that NASA's legacy systems will be replaced, upgraded or eliminated.

The SAP PS module is another module that may eventually be integrated into the planned IFMP environment outlined above. It should be noted that Core Financial and Budget Execution will have some of the PS functionality. The question then becomes, "Should NASA activate the complete module or suffice with the minimum-required level of functionality to support the remaining modules?"

Since the PS module offers the most seamless interface to the Core Financial Backbone, it would seem natural to utilize the PS module to its full capacity. For example, with the PS module fully-activated, users may pass project performance and cost data from IFM to some other third party COTS PM Tool. Users will have access to true actuals because projects can be created in PS and maintained on third party PM tools. Care must be taken so that third party databases are mapped and synchronized with the IFM data tables.

Other Considerations

1. The Agency Steering Council should be considered the final decision making body with respect to Enterprise Project Management Tool Selection and ERP systems like SAP PS Module.
2. Enterprise-level project management tools are not required to interface with the PS module. It is noted that the current recommended desktop tools - Microsoft 2000 and Primavera P3 are interoperable with the PS module using interface development software. While there is no

urgent need to move toward enterprise PM tools, the Agency may want to consider an enterprise tool standard in the near term since many vendors are beginning to phase out desktop-level suites from their applications. Enterprise-level tools tend to bundle advanced features and functionality into one package while desktop-level tools require additional add-ons. To date, SAP OpenPS version 2.0 interface for MS Project 2002 and SAP PS has been tested by development without issues.

3. The primary advantage that the PS module has is in its ability to integrate and access project data with related cost centers. While its user interface for day-to-day project management is a secondary advantage. On the other hand, the primary advantage of third party enterprise project management tools is the user interface that allows users to easily access and manipulate project data. It appears that the best way to exploit the strengths of both tools is to use the PS module in conjunction with a third party enterprise project management tool. In so doing, users can access actual project data using a tool that they are already comfortable with using.

4. Costs can only be transferred one way, i.e. downloaded from SAP to an interfaced project management tool, due to the complexity of the SAP cost tables and several unique key fields. Program and project managers must consider the impact this will have on the day-to-day management of program and project cost tracking.

5. If the Agency decides to implement the PS module and deploy a standard enterprise-level project management tool, the PMTWG-II recommends that a phased approach be used similar to the deployment of the IFMP Core Financial System. The deployment approach for the Core Financial System consisted of a three-month pilot period followed by a wave roll-out process to other Centers. The pilot period included gathering lessons learned, best practices and process re-engineering. The roll-out phase is to be conducted in waves, where a cluster of Centers will replicate pilot activities and processes, such as Center design, data conversion, testing, and change management. The post implementation phase will follow each roll-out phase and will focus on validating converted data, verifying the integrity of output data from key business processes, and synchronizing business processes to organizational structures.

6. Successful deployment and implementation of an enterprise project management tool will require project management training, process implementation and methodology, and template creation. The technology infrastructure must not be overlooked in the planning of the deployment. It is best to deploy enterprise tools in a phased-approach starting with a pilot group of projects and users. When the pilot is completed, post-pilot implementation reviews should be conducted to identify lessons learned and plan next phase adjustments.

References

<http://www.impress.com/english/downloads/downloads.html> - An overview of Primavera IMPRESS tool.

<http://www.asug.com> – SAP users group forum.

<http://www.sapfans.com> – SAP users group forum.

<http://searchsap.techtarget.com/?Offer=sa2320> - SAP-related technical resources and expert advice.

<http://www.eprojxperts.com> – A portal catering to project management professional of ERP solutions.

http://www.primavera.com/products/ent_comprod.html - An overview of P3e companion products.

<http://www.primavera.com/files/brochures/evpack.pdf> - A *.pdf file that discusses an earned value add-on for P3e.

Appendix A - Independent Individual Evaluation Matrix

Company/Vendor Name:

Product Name:

Version:

Requirement Statement	Evaluation/Rating (-,0,+) - (Does Not Meet), 0 (Meets), + (Exceeds)	Comments
1.0 Open Database Connectivity & Architecture		
allow user/project level access and update control.		
allow multiple users to share same project file(s).		
performs global updates across multiple projects		
platform independent, i.e. deployable on multiple desktop platforms or provide Web-enabled/Internet-enabled access.		
provide multiple views across multiple projects		
allow user(s) to share centralized repository		
use Open Database Connectivity (ODBC) standards to read/write to other databases.		
use Dynamic Data Exchange (DDE)/Object Linking & Embedding (OLE) to link to other applications.		
allow import large blocks of data.		
able to interface with institutional legacy systems.		
2.0 Workgroup Capabilities		
send project reports via E-mail utilizing Simple Mail Transfer Protocol (SMTP) and Multi-part Multi-media (MIME) Protocol.		
have import and export capabilities		
capture report output to files so that they may be incorporated into other documents.		
provide the capability of saving data, information and files		
3.0 Network		
allow for multi-user licensing not tied to an individual by name		
compatible with a variety of networks, i.e. TCP/IP and output devices.		
4.0 Ease of Use		
capability of easily making changes to data		
easy to show progress in a task or project		
consistent with other enterprise-level project management tools		
provide on-line, context-sensitive help on screens and fields and an on-line tutorial.		
5.0 Project Scheduling Methodology		
allow variable scaling (month, week, day, hour) for task duration		
perform Full Critical Path Method (CPM) functionality including capability of showing multiple critical paths (positive and negative) in output reports		
allow user to designate logical relationships, i.e., start-to-start, start-to-finish, finish-to-start, and finish-to-finish.		
allow user(s) to customize tables and views		
allow user(s) specific defaults and create project templates		
generates an Organizational Breakdown Structure (OBS) and a Work Breakdown Structure (WBS) or allow user to impose a WBS		
allow user(s) to assign positive or negative lag/lead		

times on logical relationships		
perform resource leveling and smoothing		
have the capability of "de-linking" and physical percent complete from remaining duration.		
allow user(s) to define and assign constraints to tasks and milestones.		
6.0 Project Task/Field Features		
allow user(s) to specify tasks or milestones to be rolled-up		
allow user(s) to define fields for each project/task/resource		
roll-ups multiple projects into a master schedule		
define a task with the duration being automatically calculated based upon its dependency with another task, i.e., hammock task		
incorporate a large comment/notes field for the project for entry of soft information		
define task start and end dates as fixed, resource-driven, or effort-driven		
allow user(s) to create a read-only version of project (i.e., tables, resources, calendars)		
allow the capability to restrict user access to specified fields		
7.0 Baseline and Tracking Progress of the Project		
create baseline plan to be used for comparisons		
report ahead/behind original or revised schedule estimate		
allow user to store multiple baselines		
calculate percentage of task performed when the start date, end date, and work is entered or start date, duration, and work is entered		
allow user to elect to keep, change, or delete the original estimate (baseline)		
provide view of actual work by user-specified period		
8.0 Resource Features		
assign costs to resources		
perform resource scheduling		
provide flexibility in defining multiple resource types, i.e. dollars, government, and contractor		
display resources that are over-(under)-allocated		
allow multiple resource assignments per task		
display all tasks using a resource		
allow resource sharing among multiple projects		
allow user to create and assign calendars to resources		
9.0 Calendar Features		
allow user to set work and non-work periods for calendars (holidays, rest periods, etc.)		
allow multiple user-defined calendars within a project use system in increments of hours, days, weeks, or months.		
allow user to set starting day of week and/or starting month of the fiscal year.		
allow calendar sharing among multiple projects		
allow user to set calendar to user-defined time periods		
allow distinctive task calendars and resource usage calendars		
10.0 Cost Management Features		
calculate a cost to complete the project		
associate multiple cost accounting codes to a project		
provide earned value analysis		
11.0 Risk Management Features		
assign uncertainty to schedule parameters		

calculate schedule parameter uncertainty		
perform probabilistic schedule risk analysis		
perform probabilistic cost risk analysis		
assign uncertainty to cost parameters and cost estimates		
perform risk simulations, e.g., Monte Carlo, Pert Master or at least utilize risk simulation data that applies to scheduling		
12.0 Project Reports		
view and print Gantt charts, PERT charts and histograms		
display actual vs. projected information		
adjust Gantt chart window view (user-selected start and end dates)		
allow user to customize bar styles and milestone styles for Gantt charts		
create schedules in user-defined increments (e.g. hours, days, and weeks)		
indicate current time		
generate PERT charts; consider time-phased vs. non-time phased and plotter requirements		
allow user to add free text to graphs		
allow user to determine task label placement (i.e., left/right of bar, on bar, above, below)		
create schedule tracking and projection graphs/reports		
create resource over-(under-) utilization graphs/reports		
display negative slack time		
display actual time for organization, project, resource, or contract company by user-specified period, i.e. year-to-date, fiscal year, current month, etc		
report resource requests by project and by available/unavailable status		
apply custom and standard filters to tasks, resources, and dates to generate custom reports		
provides stoplight charts		
13.0 Management Reporting		
provide standard reports		
select data for reporting based on user defined criteria		
generate cost projection graphs/reports		
allow user to customize or create reports via a publishing tool		
allow user to add free text to reports		
provide program level reporting, including multiple projects and subprojects		
14.0 Collaboration		
provide event-based/constraint-based e-mail notification		
provide workflow capability		
able to publish project documents to the Web		
provide threaded discussion		
provide role-based views		
provide project statusing via Web		