Cyon Research ™

The Adobe Solution for Design Collaboration and Discrete Manufacturing

A Cyon Research White Paper

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Executive Summary

In this white paper, Cyon Research addresses five key questions with regard to the Adobe solution for design collaboration and discrete manufacturing

What problem does the Adobe solution attempt to solve?

The manufacturing design industry requires digital data for better collaboration, in order to accelerate new product introductions and otherwise meet today's unprecedented competitive challenges. In the push for better-faster-cheaper, companies often adopt software tools as point solutions for specific steps in the design/manufacturing cycle. The unintended result is an unmanageable diversity of software installations, file formats, electronic document types, and competing standards. Collaboration is hindered as communications is reduced to the common denominator of paper.

How has the problem of digital data workflow been addressed in the past?

The competitive manufacturing software environment means that, more often than not, manufacturing organizations use different software tools and file formats than their partners and supply chain. Sometimes a standard set of tools or file formats are successfully dictated; more often, collaborators successfully resist such demands. It is not uncommon for manufacturing organizations to run multiple systems in order to stay competitive. In all such cases, the end result becomes task-based "silos of automation" with lowest-common-denominator, paper-based workflows. They may be using software, but these organizations are gaining little or no collaborative benefit from their digital data.

What types of solutions are currently used or proposed in the market?

Typical solutions in use today address only small segments of the overall workflow problem. Some organizations issue all product-team members original authoring software and then install a product document management (PDM) system to match. Others rely on document review/markup products, file-translation software, or file-translation services. Larger firms are starting to install enterprise-based product lifecycle management (PLM) or enterprise application integration (EAI) systems. There are also Web-based collaboration services and

ubiquitous email. Adobe's PDF format is widely used for electronic distribution of individual documents.

These disparate products and services address specific "pain points" in the manufacturing lifecycle; they are not solving the overall problem of digital data workflow.

What is the nature of Adobe's solution to the problem of digital data workflow?

Adobe proposes the intelligent document solution for design collaboration and discrete manufacturing, based on the well-known Adobe PDF (Portable Document Format). Simply put, all relevant documents for a product cycle are gathered into one intelligent document. The intelligence manifests in many ways, including the use of XML and interactive forms, interactive 3D viewing, robust security options, and a variety of commenting tools. With more than 500 million downloads, Adobe PDF is the de facto worldwide standard for document exchange. Adobe PDF also integrates with many enterprise applications, including popular products in manufacturing firms from such vendors as SAP, PTC, UGS, and Agile Software. The Adobe intelligent document solution seeks to extend these partnerships.

What is Cyon Research's opinion of Adobe's solution?

Cyon Research believes that Adobe's approach is a comprehensive and workable solution that addresses the complete manufacturing digital-data workflow problem. Adobe's solution is well-positioned for success, given its stature in document publishing. As manufacturing firms discover how the Adobe solution provides adequate functionality and performance for all types of manufacturing documents, it should have an easy time becoming a dominant format for product-development documentation.

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Introduction

Automation of the many and varied activities in manufacturing has led to an unmanageable diversity of digital document formats, each requiring its own software to be read and marked-up for editing. So overwhelming is this challenge, its complexities threaten to outweigh the productivity gains attained by the automation.

At the same time, digital documents offer unprecedented opportunities for better communication, reducing time and cost. But the maze of document diversity has prevented their exploitation.

The Adobe solution for design collaboration and discrete manufacturing, based on the popular Adobe PDF (Portable Document Format), confronts these challenges squarely. Is it the answer? Are there any objections to its universal deployment? In this white paper, Cyon Research takes a close look and gives you its unvarnished appraisal.

The Nature of the Problem

Manufacturing Business Processes Today

The competitive pressures facing the typical manufacturing firm today are without precedent. In the Internet era, the traditional goals of better, faster, and cheaper have been redefined and become more interconnected. "Better" is not only about quality, but how fast a new level of quality can be delivered. "Faster" is not just about time to market for a product, but the speed at which a product moves through its competitive lifecycle. "Cheaper" is not just about lowering the cost of goods, but also about streamlining the supply chain so it can respond more quickly to specification changes.

The new world of global communications makes outsourcing viable. But reductions in materials and labor costs can be offset by delays in the timely communication of project data. Any delay in a product-development cycle is a cost; unfortunately, communication delays are difficult to identify and quantify. The rise in outsourcing also creates new challenges for document security and the protection of intellectual property.

In response to these pressures, a variety of computer-based tools have been developed. Elaborate three-dimensional design tools are becoming more common, replacing the 2D drafting tools of the past. Strong competition between CAD vendors means that each solution displays data in a unique format, which has in turn led to the development of a variety of other software products designed to translate and communicate design intent.

Engineering geometry is just one of many kinds of project data, created by one genre of engineering software. Other software genres exist for every aspect of the manufacturing process, with competitive products in each category offering a different slant on how product data should be created, managed, and shared. As point-solution software products proliferate, so do document types and resulting information requirements. The software industry has responded with further escalation, offering manufacturing software "super-genres" like enterprise resource planning (ERP), supply chain management (SCM), electronic document management (EDM), and product lifecycle management (PLM).

The net result is an unmanageable diversity of software installations, file formats, electronic document types, and competing standards. In many situations, it becomes easier to print and distribute product information than to organize and standardize on electronic solutions.

How the Problem Has Been Addressed in the Past

Manufacturing solutions have become silos of automation. There is PLM on the design side, supplier relationship management (SRM) and SCM for external sourcing and procurement, and enterprise resource management (ERM) for internal management. What these solutions lack is a common format for collaboration, one that can cross enterprise boundaries. The result is a continued use of paper-based forms and processes—which is both inefficient and costly.

The paper-based workflow (even if electronically augmented) is inefficient because every time a document is distributed, the creator loses control of the information. As the document moves along, key-in errors or readability issues corrupt the information flow; sticky notes fall off or get misplaced. Electronic documents issued in authoring formats can be modified, and the document's creator often has no control—or even knowledge—of the changes.

The paper-based workflow is costly. There is the cost of the paper as well as the cost of printing, delivering, and storage. It is costly to manage accountability and confidentiality. It is costly to archive the final documentation. And most costly of all is the potential for undetected mistakes. Each year in the US more automobiles are recalled due to product defects than are manufactured. This happens despite—or perhaps, because of—Detroit's love affair with information technology solutions.

In the final analysis, information technology has to-date automated the various steps in the manufacturing process. There remains a fundamental need to streamline the collaborative, document-based business processes in manufacturing.

Solutions Currently Used or Proposed in the Market

Integration Tools for Large Enterprises

Many software applications exist to help manufacturing firms capture, organize, and manage business transaction data. We know them by their three-letter acronyms: SRM (supplier

relationship management), CRM (customer relationship management), ERP (enterprise resource planning), and PLM (product lifecycle management). One by one, each application type came to market to automate business processes. Unfortunately, the goals of these application types overlap, leaving many businesses wondering which product's workflow philosophy best supports their unique needs.

In response to this overlap comes enterprise application integration (EAI), which seeks to federate applications and their data outputs. Two approaches exist: point-to-point connections and middleware-based architecture. Both are big-budget approaches with high license fees and higher implementation costs. EAI can reorganize the business processes in a single enterprise, but EAI represents a significant barrier to small manufacturers who contribute to a larger firm's workflow. Failure comes when little suppliers are overlooked in such a system.

Authoring Tools on Every Computer

Electronic documents are often substituted for paper, but in a form that requires the authoring tool for viewing. If you send a CAD model via email, the person you send it to must either have the same CAD tool or a translator in order to view and use the file. The same is true for sharing native data from other applications. Research has shown that for every one person requiring access to CAD data in its original, editable form, four team members need read-only access—and ten team members don't need access to the drawings in any form. Yet many organizations supply CAD or PLM software on every desktop, at considerable expense for deployment, maintenance, and training. Many organizations limit the size of files that can be received or sent via email, adding one more level of difficulty to the process.

In addition to the expense, the required use of authoring software throughout the organization affects liability, confidentiality, and project control. For example, an engineer may repackage varied pieces of a design deliverable to put into a particular supplier contract. That supplier may then further break up the package into smaller pieces. If only the original authoring software is used to disseminate this information, there are few controls on the data; there is no way to ensure that it is not changed at one or more of its "stops"—thus breaking the accountability chain. There is no record of who made changes, and no electronic process for making sure changes are incorporated back into the original CAD document.

The Nature of Adobe's Solution to the Problem

The Adobe Solution for Design Collaboration and Discrete Manufacturing

Consider a routine business process in manufacturing, in which you must communicate with an offshore design team. If someone in the corporate office notices a problem in a plant assembly design, the issue is reported back to the offshore design team. Traditionally, this is a one-way, point-to-point communication; there is no mechanism to inform other team members that someone noticed a problem. If anyone else has comments or changes, their information must also find its way back to the offshore design team (possibly with a separate round or two of review/approval), and then the cycle of gather/print/collate/distribute starts over.

Now consider the same process using Adobe solutions. What was a one-way, point-to-point communication can be converted into a well-managed two-way email review cycle. Using Adobe Acrobat 7.0 Professional, the product manager binds the drawings and all supporting documents, such as ECOs (engineering change orders)—regardless of file format—into a single, protected Adobe PDF and sends it out for review. At any step in the process, comments can be added to the documents by reviewers, who aren't required to purchase specialized software to review it (as long as the PDF creator turned on the ability to comment) With one command, all reviewer comments are merged back into the original Adobe PDF. Comments are centralized; the entire team stays informed.

Using Adobe LiveCycle Forms and Adobe Workflow Server, the product manager may also apply workflow-based rules to the document for a server-based review and approval cycle. These capabilities allow the document to travel to separate departments in the appropriate order for approvals—first engineering, then manufacturing, and finally to the business owners.

This process can also be driven by an enterprise document-management solution like Documentum, by integrating Adobe PDF and Acrobat reviewing tools. Depending on the authoring software in use, the originator can merge the comments in the Adobe PDF file back into the original report files. It is also possible to conduct the review session as a browser-based process (Windows only), posting the Adobe PDF on a website instead of sending it out as an email attachment.

Compare the Adobe solution with the traditional approach:

> **Two-Way Communications:** With paper, once information is printed it is frozen in time. If a detail changes in the afternoon, the drawing you printed this morning is now wrong. The only way to update the information is to print and distribute again. In the Adobe intelligent document workflow, electronic-information transfer becomes a two-way street. Review comments are used to update original documents, and then a new Adobe PDF set is created as needed, instantly updating the previous version.

> **One Container for All Documents:** Using Adobe Acrobat to gather documents for distribution, it is easy to mix-and-match as needed. Wide-format drawings, BOM charts, supply chain timelines, and various forms can all co-exist in one Adobe PDF file. The use of bookmarks in the Adobe PDF file makes it easy to organize (by part, by product division, etc.) allowing quick access to the exact content reviewers seek.

> **Instant Standardization:** The use of the Adobe solution in manufacturing creates instant standardization around an existing de facto industry standard. No matter the level of technology sophistication in the firm, all players can share one format for all project documents. The forthcoming PDF/A archival-quality version of Adobe PDF will address the growing need to electronically archive documents in a way that will ensure the preservation of their contents over an extended period of time.

Most participants will already have the free Adobe Reader 7.0; some will need Adobe Acrobat 7.0 Standard or Adobe Acrobat 7.0 Professional. The standard version simplifies the process of creating and sharing Adobe PDF documents; the professional version is optimized for more secure exchange, collaboration, and archiving of engineering document sets,

including large-format files and 3D models, from virtually any application. One of the most interesting new features of the professional version is its ability to "awaken" additional review and commenting features in Adobe Reader 7.0.

Improving the Ad Hoc Electronic Workflow

Manufacturers that have moved from paper-based workflows to electronic-document publishing have generally improvised a workflow based on the original paper trail. Such an ad hoc solution creates as many new problems as it solves. The Adobe solution for design collaboration and discrete manufacturing significantly improves upon typical electronic document publishing methods:

Universal Readability: It is no longer necessary for every reviewer to have a copy of each authoring program in use on the project, or for information creators to take time from their primary tasks to do file conversion for reviewers. Publishing documents to Adobe PDF insures that every person on the project can read the documents, as they were intended to be read.

Publishing Ease: Most of the primary authoring tools used in manufacturing now support direct-to-PDF "printing." With Adobe Acrobat Professional installed, users can right-click on one or more selected files in Windows Explorer—of virtually all file types—and choose "Convert to Adobe PDF," "Combine in Adobe Acrobat," or "Convert to Adobe PDF and Email." There is also one-button Adobe PDF document creation from within Microsoft Internet Explorer (for converting the currently displayed Web page to an Adobe PDF file). Downloadable plug-ins are available for other popular Web browsers for the same purpose.

Business Logic Remains Intact and Accessible: Many popular engineering tools, such as AutoCAD and Microsoft Visio, support the export of drawing layers and other aspects of the internal logic used by drawings and models to Adobe PDF. Links to web sites remain live and usable. Users of all document types benefit because—with the appropriate permissions in place—all resident data becomes accessible for use in downstream applications.

Information Fidelity: Files shared as Adobe intelligent documents display the end representation of the original data, but without the unnecessary (and sometimes confidential or embarrassing) metadata from the original file format. The data is locked down; access is set by the one who creates and distributes the Adobe PDF.

Document Standards: Industry-specific standards initiatives have resulted in a proposed PDF archive standard, PDF/A. The PDF engineering documentation format— PDF/E—is currently under review by a working group. PDF/A is expected to be finalized by the middle of 2005; PDF/E is expected to be finalized late 2006.

Moving to the Next Level: Process-Based Intelligent Workflow

It would be a noteworthy advance for discrete manufacturing if the Adobe solution's only contribution would be the automation of existing paper-based process. But this technology also offers manufacturing firms the opportunity to redefine and improve server-based workflow, using intelligent-document processes. Proper security is an especially important

aspect of the new digital design collaboration environment, and is a key ingredient of the Adobe process-based workflow.

Server-based intelligent documents look like standard manufacturing paper-based documents, but they differ in five key ways

Document Preparation and Presentation: Intelligent documents follow the structure and style of familiar paper documents. The Adobe "one-button" approach to document preparation makes it easy to combine multiple document types (CAD and product information) into one Adobe PDF.

Business Logic: The use of active or intelligent forms in Adobe PDF documents allows widespread participation in the gathering of project information, without compromising original documents. Such forms can include access rights and embedded business logic such as calculations, validations, and routing instructions. Collaboration is simplified as such documents and forms replace paper-based processes.

Security: The Adobe solution supports electronic signatures and document control, to protect document authenticity, integrity, accountability, and confidentiality. Security features are tied specifically to the document, providing enhanced security even when the document moves outside of a controlled network. This provides persistent security for the document—online or off-line, inside or outside the firewall—for the entire life cycle of the document. Also, permissions can be revoked or modified as needed. Procurement and supplier communications can be combined with relevant contracts and distributed widely, yet access to specific information can be controlled on a user-by-user basis. It is also possible to track when and how each team member uses each document.

Information Transport: An intelligent document can gather information from back-end enterprise systems and move it to the people and applications that require the information. This process is aided by the use of XML schemas and other tools that can move data between authoring systems and consuming systems. Keeping the data "live" during transport is especially useful when the process flow requires human intervention along the way, for approvals or assignment.

Archiving: Intelligent documents can lock down content to create auditable, searchable, complete documents of record.

In a process-based Adobe intelligent-document manufacturing workflow, all project information becomes transactional data; it is accessible and usable in electronic form by project participants. This includes project metadata—information that explains what specific data is about. The Adobe PDF format now includes support for XML formatting, opening up additional opportunities for transforming paperwork into intelligent documents.

Desktop or Server? You Decide

Manufacturing firms come in all sizes, from a single designer and a small shop to the giants of automotive and aerospace manufacturing. The level of automation and electronic sophistication in manufacturing varies as much as organization size. The Adobe solution

makes sense because it is not a one-size-must-fit-all technology. One copy of Adobe Acrobat Professional can put into play the essential benefits of intelligent-document workflow by a sole proprietor or a small firm, supported by the use of the free Adobe Reader. A small firm could automate the mixing of customer contact information with custom design specifications by creating an Adobe PDF form that would be reused for each request, combined with other product information as required for each task. As the organization and requirements grow, so can the Adobe Solution.

Cyon Research's Opinion of the Adobe Solution for Design Collaboration and Discrete Manufacturing

Too Many Solutions Chasing Narrowly Defined Problems

Manufacturing automation today suffers from an overabundance of tools. Each participant in the process—from conceptual design and finite-element analysis to cost-analysis and marketing—works with specific tools that automate specific tasks. Too often "collaboration" amounts to manually re-entering data obtained from a document created by a different software product.

Cyon Research believes that the Adobe approach offers a path from today's paper-based workflows to a more streamlined and profitable workflow based on intelligent documents. The beauty of this solution is that it gently guides the user into the realms of increased efficiency and productivity.

Because Adobe PDF documents can be generated from virtually any program available today, it becomes a simple process to combine multiple documents, each utilizing different file formats, into a single package. Users can grow with the software, moving from review and markup to the creation and use of PDF-based forms and XML data. The Adobe solution complements all existing engineering software tools, making them more productive by extending their reach across the enterprise.

Based on our analysis, Cyon Research believes that the Adobe solution for collaborative design and manufacturing is suitable for use by firms of every size, for these four reasons:

- **The learning curve in adopting Adobe solutions is minimal.** All primary functions are presented to the user as processes, not as tools. Think of this as Help Files that do the task instead of just explaining it. Such non-threatening access to increased efficiency is a rare and welcome achievement.

- **Adobe's solution extends control of product information.** A supplier on one project may be a competitor on another. Adobe's solution makes it possible to permanently control access to information. Documents can be safely shared today beyond the corporate firewall, yet be impossible to open once the project lifecycle objectives are achieved.

- **Improved review cycle.** Manufacturing teams can use the Adobe solution to conduct completely automated reviews. CAD documents can be marked up, comments can be

added to spreadsheets, and forms can be completed. The new information starts electronic and stays electronic. Specific types of information do not have to be compromised when added to the intelligent-document workflow.

Reduced IT infrastructure. Deployment and maintenance costs are streamlined, saving time for IT staff as well as saving money on software.

A Workable, Comprehensive Solution

Cyon Research has examined the current state of document workflow in manufacturing and has found it to be a hodge-podge of old manual methods, faxes, emails, and a plethora of software approaches—with no standards. Many small and medium-size manufacturing firms still employ a CAD-centric document-management strategy. Document translators, general-purpose multi-format markup/viewers, and single-point enforced approaches address only parts of the challenge.

The Adobe solution for design collaboration and discrete manufacturing may be the first workable, comprehensive solution to the problem. It is based on the familiar and widely accepted Adobe PDF format, recently enhanced to address many manufacturing-specific needs, such as drawing layers, multiple formats within a single package, security, markup, document integrity, display of 3D models, and more.

We are encouraged by both the accessible nature of Adobe PDF and Adobe's eagerness to form strategic alliances with leading manufacturing software vendors. Because Adobe PDF is a published, referenced standard, many companies have created value-added products that increase its utility. Adobe welcomes such initiatives. Adobe is also working directly with software vendors including SAP, Documentum/EMC, Agile, PTC, UGS, and OpenText, to improve the use of Adobe solutions in manufacturing. We believe engineering software firms should see Adobe as a partner, not a competitor.

The Adobe solution for design collaboration and discrete manufacturing provides adequate functionality and performance for all types of manufacturing documents. Once users and software vendors realize this, the Adobe solution is sure to become a dominant method for transmitting product information. Pilot projects will be the quickest way for industry firms to come to terms with how the Adobe approach will work for them. While Adobe PDF is already a widely used format within the manufacturing space for the publishing of single documents, the Adobe solution goes beyond PDF and is likely to become a dominant method going forward.

Like any ambitious undertaking, this solution has areas that will undoubtedly be improved in coming releases. But as it stands right now, the Adobe solution for design collaboration and discrete manufacturing is more than adequate to the challenge of providing a smoothly functioning modern digital-design collaboration workflow.

About Cyon Research…

Cyon Research is a consulting firm that provides design, engineering, construction, and manufacturing firms with a strategic outlook on the software tools and processes they rely on to create the world around us. Cyon Research also supports the vendor community with unbiased insight, vision, and expertise to help them understand the complex nature of their markets, and to grow by serving the needs of their customer base.

Cyon Research brings to its clients a unique combination of experience, perspective, and insight, supported by an extensive network of well-established industry relationships. Our close contacts throughout the user, analyst, vendor, and developer communities provide surprising benefits for our clients and add significant value to our services.

Those relationships are enhanced by our publications and events. While consulting is the heart of our activities, our publications and websites—including *CADCAMNet*, *Engineering Automation Report*, *AECNews*, and *CADwire.net*—are our voice. Through them, we connect daily and monthly with the user and vendor communities. And COFES: The Congress on the Future of Engineering Software, our annual, invitation-only event, is our face—the place where we can make the types of connections that just aren't possible through any other means than face-to-face.

The focus of our research within the realm of design, engineering, construction, and manufacturing is technologies and markets that are likely to become real within the next two to six years.

The domain of our research includes the tools, processes, and procedures used in the design, engineering, management, and production of the built environment and manufactured goods.

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Cyon Research ™

Cyon Research Corporation
8220 Stone Trail Drive
Bethesda, MD 20817-4556 USA

phone: 301-365-9085
fax: 301-365-4586
Web: www.cyonresearch.com