

# Work instructions: How to tell what to do

Adobe® PDF for bidirectional communications address as-built and compliance issues

By Malcolm Wheatley

There's a problem on the night shift. With a truck due to collect a rush order soon after 7 a.m., the assembly supervisor realizes that it has been built to a now-obsolete specification, and incorporates the wrong components. Worse, the labeling attached to both product and cartons reflects this, and must also be changed.

The problem can be corrected—if the right information can be located. Which components are the correct ones? And

what codes should be printed on the replacement labels? Recognizing that something is out of specification is one thing—knowing the details of how to bring it back within specification is quite another.

In this case, the answers are close at hand—yet irredeemably distant.

The information is on the corporate network, accessible from the supervisor's desktop. But the relevant documents reside in a product life-cycle management (PLM) system, a tool used by the plant's manufacturing and sales engineers, who won't show up until

after 8 a.m. Only they have access rights to those systems, and know where to find the right information.

Welcome to a problem that is at once both old and new: the challenge of transmitting work instructions from the systems where product and order information resides, to where the work is actually done: on the shop floor.

This challenge to plant-floor productivity—and other challenges as well—  
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# On the same page, but not necessarily on paper

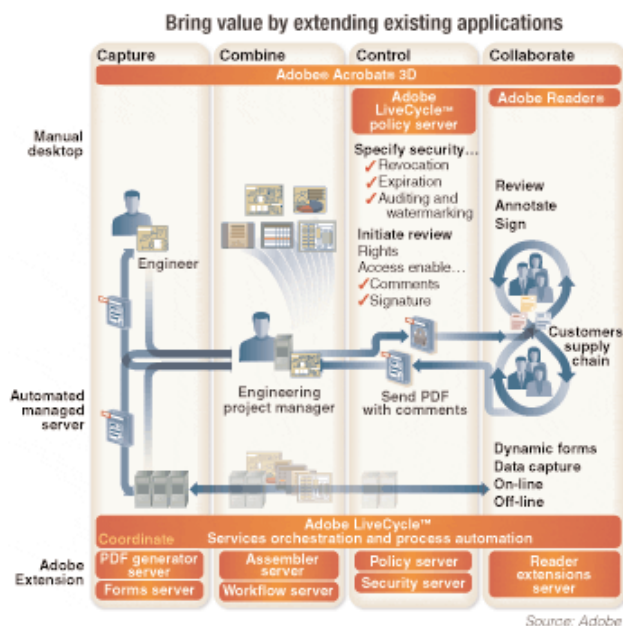
It's a challenge to get work instructions where they need to be—on the factory floor—complete and accurate. That's the most obvious pain point addressed by the Adobe Work Instruction solution. Yet such a perspective obscures the solution's efficacy in addressing another equally intractable problem: the challenge of getting information back from the factory floor.

It's a problem that's surprisingly complex. It's increasingly important, for example, for manufacturers to capture "as-built" information. Yet, at the same time, assembly lines are being relocated thousands of miles away to countries such as China. In such an environment, paper-based systems raise two concerns: capturing shop-floor information, and retaining it.

Language difficulties, as well as distance, raise barriers. When capturing information, it's often easier to get people to tick boxes on a computer rather than fill out a form that might well be composed in a foreign language—English. What's more, once filled-in, paper documents can all too easily be lost, damaged, or mis-routed.

The Adobe Work Instruction solution addresses this challenge by pulling data from corporate information systems such as enterprise resources planning (ERP) or product life-cycle management (PLM), and then pushing updated information right back to those very same systems. This captures—and pre-

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can be addressed by the Adobe Work Instructions solution, based on the Adobe LiveCycle® technologies, allowing work instructions to be formatted as XML-enabled Adobe PDF documents that facilitate data extraction and population for bidirectional enterprise integration.

Other relevant files and file types can be packaged in a single Adobe PDF, and source files that open in their native applications can be attached.

“Think of the PDF as a ‘super container,’ a way of packaging and distributing content in a wide variety of formats and making it available not just to power users such as engineers, but to people in important roles on the plant floor as well,” says Francois le Masne, Adobe Manufacturing Solutions Marketing Manager.

### What's different today

Manufacturers have always supplemented core manufacturing information—such as routings and bills of material—with additional product-, order-, or customer-specific instructions, including

drawings, tolerances, packaging, and other special instructions.

In a paper-based world, such information arrived by paper. It could be copied, and generally accompanied the order onto the shop floor as part of a work-order “traveler.” Even when the necessary information wasn't part of the traveler, lead times were typically less pressured than is the case today, and accessing the physical filing cabinets wasn't usually a problem. This is not often the case anymore.

Modern manufacturing and engineering systems, which have transformed the process of acquiring and storing information, struggle to publish needed information to the factory floor.

Granted there is an irony here, in that despite all the benefits of the digital era, what wasn't a problem has undeniably become one. In today's business world, information pertaining to orders arrives, or is created digitally—including plans, specifications, schedules, spreadsheets, and other diverse documents. These documents also are distributed in diverse data formats, some of which are ill-suited to being translated readily onto paper.

What's more, product information may be stored in several systems, not all of which can or should be directly accessible from the factory floor.

Finally, correct interpretation of data held in PLM systems requires some training. And, perhaps most important, uncontrolled access to depositories of intellectual property raises security concerns.

The shop floor has changed, too. For one thing, given modern manufacturing execution or shop-floor systems, use of the traveler is fast becoming obsolete. Interface screens have replaced job tickets and traditional work orders. In fact, the modern shop floor no longer needs to be physically proximate to the people and systems holding the information in question. Engineering might be centralized, while manufacturing might be scattered across a country or a continent. Manufacturing might even be outsourced to an overseas partner—a prospect that raises even more sharply the issue of intellectual property loss.

In short, vital information that in theory should be digitally accessible, turns out to be digitally trapped.

## On the same page, but not necessarily on paper

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serves—a detailed history of how each order was actually manufactured.

### Build a business process

With Adobe Work Instructions, companies develop structured “dynamic” Adobe LiveCycle® forms for input from—and output to—multiple sources, and which can be filled in on- or off-line. In addition, the forms carry business logic such as built-in calculations and data validations, which reduce the delays and errors associated with manual processing.

The implications of the solution for quality and engineering processes are as exciting as they are for compliance and traceability efforts.

“In terms of how products are built, there's a huge disconnect between manufacturing and engineering,” warns Dr. Michael Grieves, a principal with Los Angeles-based management and IT consulting firm Core Strategies, and author of *Product Lifecycle Management: Driving the Next Generation of Lean Thinking*. “It's very common to find that the engineers think that something is being built one way, and that manufacturing is building it in a very different way.”

In extreme situations, he notes, this can

compromise the integrity of the product.

“I've come across situations where manufacturing found a need to cut a hole in a product to gain access to tighten a bolt—and engineering hadn't known about it. The hole-cutting may not turn out to be critical, but it certainly invalidates the Failure Mode and Effect Analysis,” says Grieves.

In short, by furnishing a means of communicating such manufacturing workarounds, Grieves adds, the Adobe Work Instruction solution bridges the gap between manufacturing and engineering.

“There's a huge challenge in integrating and ‘de-siloing’ information from manu-

## Problem solved

The Adobe Work Instruction solution can be used to deliver up-to-date work instructions to the plant floor without compromising security, duplicating systems, or resorting to costly integrations. It offers a secure and reliable means of creating timely packages of structured information published in an electronic document format accessible by anyone inside or outside the firewall, using only free Adobe Reader software installed on hundreds of millions of computers worldwide.

The same documents can be used to communicate “as-built” information, and other data back to engineering and business enterprise systems (See feature, *On the same page*, for more.)

XML-enabled Adobe PDFs already are a proven way to share rich information during the new product development process—including CAD files, 3D drawings, Excel spreadsheets, Word documents, PowerPoint presentations, and email attachments. The server products known collectively as Adobe LiveCycle manage forms-based business processes—including sensitive electronic docu-

ments beyond the firewall—and incorporate digital signature, 128-bit encryption, and persistent document control.

The Work Instruction solution applies the same core technology to extract information from manufacturing and engineering systems, package it, and make it available on the factory floor in an easy-to-access format.

There are obvious productivity gains: information doesn't have to be sought, but instead arrives pre-packaged, says le Masne. “With data available at the desktop, there's less time spent hunting for where the required information is kept,” he says.

Yet the most obvious productivity gains aren't necessarily the most significant. Says le Masne, “The real gain is from the speed and accuracy of interpretation. Typically, the people in question aren't power users. Assembly-line supervisors and technicians may not be IT-literate, but even manufacturing engineers aren't expert users when it comes to 3D CAD. Their expertise is assembly, not design engineering. With packaged work instructions, there's less time spent figur-

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facturing and engineering,” he says. “Getting the two functions on the same page can have a dramatic impact on efficiencies and time-to-market.”

## Reduced development cycles

By automating the document-creation process, the Adobe Work Instruction solution actually can reduce the time it takes to bring a product to market, concurs Francois le Masne, Adobe Manufacturing Solutions Marketing Manager.

According to a recent study by Boston-based AMR Research, le Masne points out, within the average product development cycle, manufacturing accounts for an

average of 5 months, a third of which is spent managing content and documents. Reducing that time can significantly shorten development cycles and improve quality, while still managing to keep costs under control.

With manufacturers facing unprecedented pressure to do just that, the Adobe Work Instruction solution is a timely innovation from a company that, for many manufacturers, is rewriting the rule book on what constitutes a document, as well as how they are used. While relatively unregarded in standard practice, work instructions are set to assume their rightful place as a force for, rather than a drag on, manufacturing productivity. ■

## The basics of work instructions

### What is a work instruction (WI)?

- A set of step-by-step instructions distributed to shop-floor workstations and production assembly lines that describes the operations and rules needed to assemble parts.
- WIs are generally presented as a multilevel, hierarchical/structured list where each level can include text, technical drawings, and assembly specifications.
- The complexity of the WI is determined by several factors: number of products and people involved, plants, range, parts, processes, and manufacturing operations.
- The efficiency of WI systems and processes has a direct and significant impact on enterprise business performance.

### How are they produced?

- Manually, with desktop automation tools for small businesses with low product complexity; and
- Automatically or semi-automatically using PLM (product life-cycle management) and PDM (product data management) applications.

### What is PLM/PDM?

- Core manufacturing applications that manage the following product information: (1) data parts and documents; (2) structure and evolution; (3) process, workflow, and program.
- Upstream, it integrates computer-aided design/digital mock-up (CAD/DMU) tools and workgroups. Downstream, it can be integrated with ERP.
- Automation and synchronization with Design and ERP BOMs (bills of material) is a common issue.
- PLM/PDM can be used as, or connected to, enterprise content management (ECM) systems to produce TechDocs and Maintenance, Repair, and Operating (MRO) instructions.

### What are the challenges for work instruction?

- PDM/PLM is a complex system that only experts can fully exploit. Because it doesn't use a people-centric or document-centric approach, it is very difficult for nonexpert users to extract, structure, present, publish, and enrich information.
- In a global competitive context—with multiple production centers, plants, and supply chains—changes to WIs can result in lengthy order-to-delivery times. ■

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ing out what the information is actually saying.”

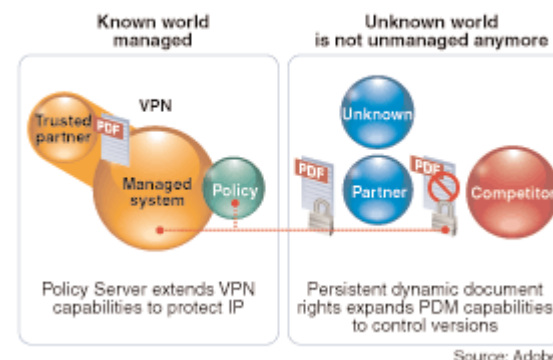
Another productivity gain comes from improved compliance and ensuring real-time information capture of as-built data and historical traceability of as-built records. At a stroke, there is a way to provide a wealth of information relating to every product order, but in a controlled and measured form.

And by leveraging Adobe LiveCycle Policy Server, the rules for how information is accessed and used are systematically enforced. Indeed, it's this capability that can make the Adobe Work Instruction solution so valuable in

industries where compliance is vital. With paper-based documents, it's always difficult to guarantee that a given document is the latest version: with a digital solution such as Adobe's, that guarantee can be made absolute. The result: not only a more efficient way of generating a package of work instructions—but also a fundamental assurance of the integrity of that work package.

Manufacturers also are concerned with the costs and risks associated with the outsourcing of engineering and manufacturing functions. As le Masne observes,

### One version of the truth: information secured and controlled



The control and management capabilities afforded by Adobe Policy Server persist even when documents are taken off-line.

the complexities of the manufacturing-engineering divide have forced some manufacturers to bring back in-house product that was previously outsourced—and re-domesticate production lines once shipped overseas. “The gap between engineering and manufacturing is a worldwide challenge,” he says.

Now, with Adobe's Work Instruction solution, manufacturers can finally solve an age-old, yet surprisingly new, challenge. ■

## The art of the possible

### Macromedia acquisition promises core technologies to solve manufacturing problems

In the spring of 2005, **Adobe Systems** announced its acquisition of Macromedia in an all-stock transaction valued at approximately \$3.4 billion. With Adobe Reader® and Flash® Player software combined on more than 600-million connected PCs and devices worldwide, the rationale behind the acquisition was clear, says Mike Morel, director of manufacturing solutions, Adobe.

“The combination of Adobe and Macromedia gives customers a more powerful set of solutions for creating, managing, and delivering compelling content and experiences across multiple operating systems, devices, and media,” says Morel. “Together, the two companies meet a wider set of customer needs, and have a significantly greater opportunity to grow into new markets, particularly in enterprise segments and across the supply chain.”

Customers want integrated software solutions that deliver compelling content and applications—in media from documents and images to audio and video. By combining Adobe resources with those of Macromedia, a new and evolving vision will be brought to life on an industry-defining technology platform.

For manufacturers wanting to figure out just what the Macromedia acquisition means for them, the biggest challenge is likely to be the mental gear-shifting involved in contemplating the art of the possible.

Time and again, Adobe has taken a core technology and developed it in such a way as to meet the needs of a wide range of businesses, so much so that it becomes hard-wired into the way that business is done. Back in 1982, when Adobe was founded, for example, who could have predicted the extent to which the PostScript printing language, or Adobe Acrobat, would become the forces that they are today?

The Adobe Work Instruction solution leverages both technologies, of course—as well as other capabilities found in Adobe LiveCycle and Adobe Policy Server. In the years to come, manufacturers can expect to see capabilities sourced from Macromedia move from the consumer world to the manufacturing environment. ■

### For more information

To contact a sales representative and learn more about Adobe's solutions for manufacturing, please call:  
1.800.861.9428  
or email us at  
<http://www.adobe.com/enterprise/contactus.html>



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