

An SPS Bulletin

Good Equipment Manuals Are a Key to PBET Training

During the Performance-Based Equipment Training (PBET) Workshop, it is customary at various points to emphasize the bottom line "must haves" in order to develop and deliver a PBET course. Of course the list includes having a working machine or a simulator that closely resembles a working machine with respect to the conditions for the performance.

But a second "must have" is an equipment manual that includes a procedure for *every* task taught. Or if the task is not a "procedure" but rather a problem to be solved, then it includes all relevant information for solving the problem. The manual should model the three Cs: complete, correct, and clear.

The fact remains, however, that while equipment documentation has improved a lot during the last 25 years, many equipment suppliers, especially the smaller ones, have manuals with missing procedures and manuals with numerous errors.

I have had occasion to examine supplier manuals which are hefty, but filled with information that is largely irrelevant. In most of the PBET Workshops, I have brought up the subject of equipment manuals, asking participants whether their company's manual included procedures for all of the tasks that needed to be taught to their customers. Typically the answer is "no," although the degree of incompleteness varies.

In this paper I provide a range of suggestions for improving the equipment manual, ranging from some relatively simple ideas to some very challenging things to implement.

I want to be clear, however that *my expertise is in training, not technical writing*. Still, over the years I have made myself aware of specific factors that affect the ability of an equipment manual to successfully support, or fail to support, the needs of performance-based training.

Solid Performance Solutions helps high tech companies implement best practice in performance based equipment training (PBET) for customers and employees. Contact us concerning our consulting, course auditing, and the PBET Workshop. **Richard Goutal, Owner and Workshop Leader Solid Performance Solutions, Manchester, MA, USA**

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Worthy Influence on Technical Writing #1: Information Mapping®

Information Mapping[®] is both the name of a company that provides services and resources for information and documentation specialists, as well as a documentation methodology championed by the founder and first CEO of that company, Robert E. Horn.¹ Horn was very interested in cognitive load theory (cognitive theory of learning),² and he took the principles and applied them to the written page.

As a side note, Ruth Clark, a highly respected trainer and author of books on training and eLearning, has based all of her books on the fundamentals of cognitive load theory as the research in the field has grown.³

Information Mapping® is both a process and a format. But, just as the principles and steps of the PBET process influence the training result, the principles and steps of the Information Mapping® process influence the documentation formatting result. Just as people often make the mistake of thinking you can convert traditional training into PBET training by simply adding objectives or tests or practice exercises, people often make the mistake of thinking they can convert their manuals to Information Mapping® by reformatting their documents to meet a list of rules. In both cases, the process, or method, is essential.

Information Mapping[®], when done well, will save a company money by saving time and mistakes.

Despite the fact that Information Mapping® regards its method as proprietary, in my view it is not really so unique, but rather is in keeping with the basic approach of performance based analyses taught by many within the International Society of Performance and Instruction (ISPI),⁴ by Robert Mager,⁵ and is therefore very similar to the process taught in the PBET Workshop.⁶ I don't say that to take away from Information Mapping, but rather to show that it integrates well with what is taught in the PBET Workshop. It's worth seeing how Information Mapping® emphasizes the process.⁷

Following the PBET process is just as important for a supplier company's writers as it is for their course developers and trainers. That's because the process includes elements of analysis that ensure completeness and accuracy. There's more to it, to be sure, but the process is fundamental.

Beyond the process is the resulting format. I give lip service to some of the key Information Mapping® format principles during the Workshop, not so much to create competency in these practices for the PBET participant, but to build awareness. I'll highlight a few of their ideas that contribute to *clarity* at the end of this paper.

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¹ Robert E. Horne's <u>website and bio page</u>.

² Cognitive load: <u>article in Wikipedia</u>.

³ See for example, <u>Ruth Clark's *Building Expertise*</u> (on Amazon).

⁴ ISPI <u>website</u>.

⁵ The original PBET Workshop drew heavily from the writings of <u>Robert Mager</u>. (example on Amazon).

⁶ The PBET Process. <u>Access an overview</u> from the Mr-PBET website.

⁷ The "method" as described at the Information Mapping site.

Worthy Influence on Technical Writing #2: Controlled English and Global English

English is the main language in technical documentation around the world. However, English can be difficult to understand due to its many forms and complexity. This is especially a concern given the global nature of high tech equipment used in factories around the world. The result of misunderstanding or not comprehending English can be frustrating, time-consuming, costly, and even dangerous.

The semiconductor fab and packaging facilities require precise performance and the slightest error can result in loss of hundreds of thousands of dollars, not to mention loss of life and limb. At the same time, a staggeringly high percentage of the workers using our English documentation are not native English speakers, and many do no have a good proficiency in English. The potential for problems is great.

What have other industries in similar situations done? The approach used in the Aerospace and Defense industry is Simplified Technical English (STE).⁸ More generally STE is an example of *controlled English*. The key features are:

- (1) A restricted number of words: Although there are 700,000 actual English words, controlled English uses a generic list of about 900 words (in addition to industry, company, and product specific words). Further, in controlled English, each word is allowed but one meaning.
- (2) There is a set of simplified grammar rules. NOTE- *some* of these rules are similar to those of Information Mapping[®].

At one point, a SEMI training task force looked at making controlled English a SEMI standard for manuals. However, that is no longer a current effort; it is not an easy thing to bring together hundreds of suppliers with their own separate ways of writing manuals. Yet that very fact points to the inherent need for industry consistency.

If your company chooses NOT to implement controlled English on its own, it should certainly consider implementing *Global English*. Global English is best delineated in *The Global English Style Guide* by John Kohl.

What is the difference between controlled English and Global English? Which way should you lean? Helpfully, Kohl answers the question in the opening of his book:⁹

"First, controlled English is not a single entity. The term describes any of several attempts to define a subset of the English language that is simpler and clearer than unrestricted English. Most versions of controlled English specify which grammatical structures are allowed and which terms are allowed, as well as how those terms may be used. In early forms of controlled English, terminology was often restricted to a core vocabulary (in some cases as few as 800-1000 terms), supplemented by technical terms that are necessary for a particular subject area or product.

"Global English could be regarded as a loosely controlled language, yet it was developed using almost the opposite approach. In the development of Global English, the emphasis has been on

⁸ FAQs about STE on the ASD STE web site.

⁹ John Kohl, *<u>The Global English Style Guide</u>*, page 14</u>. (on Amazon)

identifying grammatical structures and terms that should be avoided, rather than on cataloging all of the grammatical structures and terms that are allowed. In other words, anything that is not specifically prohibited or cautioned against is allowed.

"When texts conform to the guidelines and terminology restrictions of the more restrictive forms of controlled English, the style and rhythm of those texts differs noticeably from the style and rhythm of of unrestricted technical English. By contrast, most readers don't notice anything different about the style and rhythm of texts that conform to the Global English guidelines.

"Early versions of controlled English, such as the Kodak International Service Language (KISL), were developed as alternatives to translation. By severely limiting the range of grammatical structures and vocabulary that are allowed, KISL makes technical documents understandable even to readers who have very limited proficiency in English. Kodak found that it is much less expensive to teach service technicians all over the world a limited amount of English than to translate service manuals into 40 or more languages.

"Global English is an alternative to translation only if the non-native speakers in your audience are reasonably proficient in English. Global English can make the difference between documents that those non-native speakers can read easily and documents that are too difficult for that audience to comprehend.

"If you are writing for readers who have limited proficiency in English, then consider using a form of controlled English. However, keep in mind that the amount of effort and knowledge that is required for developing and implementing controlled English is considerable. Consult the Bibliography section of this book for sources of more information about controlled English."

I highly recommend Kohl's book.

A few years ago when the Technician Performance Improvement Council was still active, it invited a representative from Tedores to give a presentation on controlled English.¹⁰ Tedores creates software that restricts the writer to using only approved vocabulary and industry terms, while nudging the writer to use the recommended grammatical structures.¹¹

The Staff Assigned to the Manual Creation Process is Critical

As mentioned on page one of this paper and often during the PBET Workshop, the goal is to have a CCC manual - one that is Correct, Complete, and Clear. In addition, the path to a CCC manual is the PBET process. Let's look at some staffing issues that affect those things.

(1) Native-English speakers should create the English manual. Or at the very least, a native English speaker, who is also technically competent with the relevant equipment, should be used to review documents created by non-native English speaking writers and translators.

¹⁰ The <u>Controlled English presentation to TPIC</u>, Feb, 2007. (PDF Download from Mr-PBET.com)

¹¹ Tedopres <u>company web site</u>.

This is an especially important point for suppliers headquartered in Europe and Asia. It baffles me, for example, that an Asian supplier would originate an equipment manual and the English translation in their own country using non-native English speakers as writers and translators; yet, that is commonplace. Ironically, most of these suppliers do not take advantage of the native English speakers in their employ who, as service engineers can also bring technical accuracy to the task along with natural English. Yes, there are obstacles to using these employees, notably that they are stationed in other countries such as England, the United States, and so on. But it would be worth it!

My advice about using native English speakers as the equipment manual writer or translation reviewer is not principally to get a resulting manual that pleases native English speakers. It is about a resulting manual that (1) is technically accurate in English and (2) is written in English such that it is clear to other non native English speakers. The importance of using a native English speaker is not just my idea, nor is it just the concern of many native English speaking trainers and service engineers that have expressed themselves to me during the PBET Workshops for the last 18 years. Here again is an excerpt from John Kohl:¹²

"As noted above, native speakers of English probably constitute a significant portion of the audience for much of your documentation. Therefore, be sure to follow the cardinal rule of Global English even while you are taking into account the needs of non-native speakers and translators:

"The Cardinal Rule of Global English: Don't make any change that will sound unnatural to native speakers of English.

"At the same time consider the following corollary to the cardinal rule:

"*Corollary*: There is always a natural-sounding alternative if you are creative enough (and if you have enough time) to find it!

"In other words, if following one of the Global English guidelines would cause a sentence to sound stilted or unnatural, then either find a different way to improve the sentence, or leave the sentence alone.

"If you are a non-native speaker of English, your instincts about what sounds natural in English and what doesn't might not always be reliable. If you are not sure whether you are following the cardinal rule successfully, consult a native speaker whose judgement you trust.

"Native speakers also benefit from consulting other native speakers on occasion. A colleague might quickly find one of those 'natural sounding alternatives' that eluded you."

(2) Those assigned to manual creation should have ready access to the equipment. I think that is just common sense. But I have met...

• contract technical writers who only visited the equipment supplier facility once a month to see the machine while writing the manual. Making matters worse this contract writer also was a non-native English speaker, working from home, with no technical background, and not given access to the engineers either! Not good!!

¹² John Kohl, *<u>The Global English Style Guide</u>*, page 5. (on Amazon)

• writers who were asked to create a manual but only given access to half the machine. The other half had already been shipped to the customer! Not good.

(3) The technical writer(s), technical trainer(s), and field servce engineer(s) who are assigned should actually work as a team – together. Creating a manual, creating a training course, and preparing for an installation of a new machine all have a common core of activities and needs. These are all best accomplished as a team.

Most importantly, it's the best way to ensure the three Cs. I call this approach the New Product Customer Support Development Team (CSDT), and I have been promoting it in the PBET Workshop during the last ten years.¹³ But this requires management permission, if not management direction.

The idea is to create this cross-functional team with at least one member from at least each of these three areas:

- **Field Service:** Motivation: this is the individual (or individuals) who will be responsible for machine installation when the time comes. She will want to know everything relevant to that task as well enough to assist with maintenance and troubleshooting.
- **Customer Training:** Motivation: this is the individual (or individuals) who will be responsible for developing the training course and delivering the course for the first few months thereafter (at least).
- **Technical Writing:** Motivation: this is the individual (or individuals) who will be responsible for creating and delivering the new Equipment Manual when the new machine ships or shortly thereafter.

Not ony do each of these company employees and probably others (no matter what job titles you use at your company) play a significant part in providing customer support and assuring customer satisfaction, they have a compelling motive to help each other, rooted in similar needs. Here's a closer look:

- (1) First and foremost, all of these specialists need the same core information to fulfill their own responsibilities:
 - a list of the major assemblies and parts along with information about the function and associated hazards of each.
 - a complete list of all the tasks that the customer will need to perform on the equipment in terms of operation, maintenance, proprietary programming, and troubleshooting.
 - a correct and clear step-by-step procedure for every task on the list.
- (2) So since they need this information, which they will each be passing on to their customer, it is to everyone's advantage that they work together to learn that information, leveraging each other's skills. Very importantly, by working together they can develop a single vocabulary and structure that satisfies all of their purposes while providing a unified and consistent delivery of terminology and procedures in the manual, in training, and during support in the field.

¹³ Slides used in the Workshop to explain the CSDT idea: <u>Download PDF</u>

- (3) Technical writers need to conduct a task analysis in order to write a procedure, in other words, watch a procedure as it is performed and take notes. In the PBET Workshop we stress that this is a "two-person" activity (as opposed to assigning the most experienced person with a specific task to also be the writer for the task). The team approach makes at least two technically skilled and experienced staff members (the FSE and trainer) readily available on an ongoing basis.
- (4) Meanwhile, the trainer and FSE both have a direct interest in the content of the manual, and they are in a position to influence that as a team member.
- (5) The three-way check and balance will go a long way to ensure that the manual is complete (has *all* the tasks that need to be performed by the customer), correct, and clear.

Normally, the service engineers, trainers, and writers act more or less on their own. Typically none of them are involved in a supplier's new product until very late in the process, often just before the first installation. I recommend the opposite:



- The service engineer, trainer, and writer work as a *team*. Each has their own product responsibility (installation, training course, manual) but each assists the other in getting all things done.
- The team gets involved much earlier in the process, about half way through the prototype build, more or less.
- The team works *with* the engineering techs in building the prototype for roughly half their working day. In this way, they not only learn more, their involvement at the machine becomes more fully accepted and welcomed by the engineering department. They are not just takers but givers.
- I recommend the CSDT spend roughly half the day contributing directly to the needs of the engineering lab effort to build the prototype, especially during their first month. During the second half of the day, I recommend the CSDT document and maintain what they are learning with particular attention to the lists and procedures mentioned in three bullets at the bottom of page 6.

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Summarizing the three suggestions about staffing that affects a CCC manual:

- (1) Use native English speakers as technical writers, and or translators. Or at the very least, transfer one of your own native English speaking service engineers to working on reviewing manuals NOT in addition to everything else he does, but as a key part of his job description.
- (2) Make sure that equipment (the machine) is available to the writers.
- (3) Have your writer and trainer and service engineer work as a crossfunctional team, temporarily assigned to a new product.

If an equipment supplier would apply those suggestions, the fundamentals will be established for a manual that is complete, correct, and clear.

Apply What is Taught in the PBET Workshop

Finally, in conjunction with all of the above, apply what is taught in the PBET Workshop concerning equipment manuals. A summary of the relevant instruction follows.

(1) Make a list of tasks. The first concern for CSDT is the creation of *a list of tasks that anyone will need to perform* on the machine. Compiling this list will evolve throughout the months that the team works together. While it is true that the immediate concern of the CSDT are the tasks that the customer must be able to perform during the first 6 to 12 months of ownership, it isn't always clear which tasks are going to be considered FSE tasks and which will be customer tasks. That can be sorted out later. In any case, ultimately a list of *all the tasks that anyone will perform* on the machine will be needed because ultimately there will be both customer training and internal training.

The CSDT team might find it helpful to compile the list with the help of a database or a spreadsheet. That way, each task can be tracked and sorted with notations like:

- The task's tentatively assigned "Level" (with perhaps a "Level" assigned as supplier-only).
- The task's complete performance objective (includes conditions and standards).
- The task's progress through the stages of becoming a final "written aid" ready for the manual.

(2) State each task correctly. (All rules are discussed in the PBET Workshop). But at the least, begin the task with an action verb. Doing this greatly focuses everyone's understanding (the training developer, the manual writer, and ultimately the customer). Examples:

Do Not Say	Say Instead
• The elevator alignment procedure.	Align the elevator.
• The power regulation board.	 Calibrate the power regulation board, <i>AND/OR</i> Troubleshoot faults on the power regulation board. <i>AND/OR</i> Replace the power regulation board.
The machine shut down task. <i>OR</i>Perform the machine shut down.	• Shut down the machine.

Then later, use the same nomenclature for that task consistently, everywhere it is mentioned, including in:

1.	The performance part of the complete performance objective.	Align the elevator.
2.	The name of the procedure in the manual (or chapter heading).	Align the elevator.
3.	The name of the task on the training sign-off sheet.	Align the elevator.
4.	The task or step in the installation instructions.	Align the elevator.
5.	The parallel chapter in the training manual (if any).	Align the elevator.
6.	The task as listed on the service engineer career training master list.	Align the elevator.

Such a small thing can go a long way in creating clarity. Again, this is made so much easier when the wording is established by the CSDT for that machine.

(3) Perform a task analysis for each task. The task analysis is the process used to observe, take notes, and create a written aid for performing a specific task.

NOTE: The end result of a task analysis, or the "written aid," is also called a performance aid, task aid, or job aid. Most commonly the written aid will be a step-by-step procedure; less typically it may be a suggested process with reference information for decision-making, like diagnosing a fault, creating a recipe, or programming for test results, (presented as a table, block diagram, and/ or a flow chart). Also, even the resulting equipment manual, filled with individual task aids, is referred to as a performance aid or job aid.

Keep the following in mind regarding the task analysis:

- Ensure that the subject matter expert (SME) and the person writing the procedure (or other task related materials) *are not the same person*. Often, because it may be faster, you may want to default to having the most experienced person with a given task, also write that procedure. This is not cost-effective since the "one-person" approach leads to a greater chance for errors and a greater liklihood of omissions of important information. This is but another benefit to the CSDT it makes doing two-person task analyses a lot easier and more routine.
- Ensure that every written draft of a task is *verified* by having someone *actually perform the task as written;* even better, by having this verification performed by *two* different people while being observed by the SME and/or the writer. NOTE: having an engineer simply read and sign off on a procedure is NOT at all a reliable form of verification.
- Ensure that every written task is verified at more than one stage in the development of the final version for the manual. For example, the original written *draft* can be verified by having it performed, both before and after the addition of photographs (or before and after the rough textual draft is converted to a flow-chart).

(4) Remember these basic tips when presenting a procedure as text:

- Number the steps. I'm amazed to still see equipment manuals where procedures are presented in paragraphs, where the steps are unclear and buried in words.
- Put only one action in a single "step."
- Display information in a table format.

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- Include a well-produced visual with each step of the procedure, preferably *beside* the text of the step, rather than underneath the text of the step. Obviously a larger image may not allow for that preference. (Consult Information Mapping® for details and reasons.)
- Always refer to the same assembly or part by using the same term. The usage of multiple names for the same part is a very common way that companies confuse their users. Attention to part names should be given early in product development with input from trainers, field service engineers, as well as the other stakeholders like marketing.
- Use short sentences wherever possible.
- Use the Information Mapping[®] chunking tactic. As applied to a procedure, that would mean that no task should have more than 7 steps if it does, consider breaking it into subsections (sub-tasks).
- Apply the guidelines in *The Global English Style Guide* by John Kohl.¹⁴ EXCEPTION: The only reason for NOT applying The Global English Style Guide would be that you are instead implementing a version of controlled English with a restricted vocabulary (see page 4 above).

The Importance of Having a "CCC" Manual

Having a manual that is complete, correct, and clear is essential to implementing PBET. As we know, the PBET guideline states that "every trainee should have the opportunity to practice every task." That and the other PBET "characteristics"¹⁵ already make it a challenge to complete the goals of a training course in a timely way. That challenge is made almost impossible everytime a lesson that does not have a written task that is both accurate and clear. On the other hand, a "CCC" manual can shorten the length of training and increasing technician competency during training.



Obviously, the concern is not just for PBET. Having a "CCC" equipment manual can also mean saving money by...

- Sending out fewer correction pages or "service bulletins."
- Eliminating the need to answer the same question at the customer support desk over and over, in some cases for years. Sometimes, the support desk answers mainly questions that arise from manuals that are inaccurate or incomplete.
- Eliminating the need to send a specialized engineer onsite to determine the problem.
- Reducing liability law suits.

Finally, a "CCC" equipment manual plays a substantial role in customer satisfaction and repeat equipment sales. It's worth it on so many levels!

¹⁴ John Kohl, *<u>The Global English Style Guide</u>*. (on Amazon)

¹⁵ The PBET Characteristics. <u>Access an overview</u> from the Mr-PBET website.