"PROPERLY DESIGNED JOB PERFORMANCE AIDS WILL IMPROVE PERFORMANCE IN MANUFACTURING OPERATIONS TO A GREATER DEGREE THAN ANY OTHER DEVICE — INCLUDING FORMAL TRAINING PROGRAMS."

MANUFACTURING TRAINING — A TWO-STEP PROCESS

BY STANLEY J. HOLDEN

Over the past several years I have come to understand the difficulties associated with training operators and maintenance personnel in a manufacturing environment.

These are:

1. The amount of detail required to make a manufacturing training program work is often enormous.
2. The people to be trained usually have poor verbal skills.
3. The solutions to scrap and downtime problems must be quick or production numbers will suffer.
4. The cost of developing and delivering the training must allow management to obtain a good return on investment.
5. Implementation and delivery of the training must be designed to take cognizance of equipment availability and a three-shift environment.
6. Finding a suitable place to conduct the training is often difficult.
7. Each manufacturing operation has a unique set of conditions and problems which must be addressed specifically.

A solution to these difficulties is possible if a rigorous two-step process is followed in analyzing, designing, and delivering the training: (1) Perform a detailed task analysis; (2) Vigorously pursue a program of information reduction.

The first step of this process is better known and more obvious to many of the trainers involved in manufacturing training, although I don't believe that most of them carry the process to its logical conclusion.

The second process is, unfortunately, often ignored by training designers and program developers responsible for manufacturing training programs. Yet, it is this step that ultimately determines the viability of a training program. More often than not, compendious training programs which have more than sufficient detail, but whose very weight and size mitigates against their usefulness. I have adopted a rigid rule to avoid falling into this trap. Let's call it the "now or never" rule. In essence it says that unless the specific information to perform a task is available *now*, it will *never* be used. A more measurable way of stating this rule is, "If the necessary specific task information cannot be accessed in less than one minute, its usefulness is greatly diminished." A monument to the truth of this statement could be built using all the equipment manuals which are found locked in supervisors' offices and which are never seen in use on the manufacturing floor by operators and mechanics.

Let's see how difficulties encountered in manufacturing training can be nullified by the use of one or both of the processes already discussed.

Manufacturing training programs often deal with extensive machine lines in which many machines are hooked together or one large machine that performs a multitude of functions. In today's world, to add to the complexity, many of them are digitally controlled — using microprocessors or microcomputers. As a result, a careful task analysis can produce many yellow pads or notebooks full of detailed task listings. Think, for

example, of the number of tasks associated with operating the control room of a nuclear power plant! What is one to do with all this data? How can it be reduced to manageable proportions?

The first part of the answer lies in further analysis of the task listings which have been collected. All tasks are not of equal importance. I have found that careful analysis will usually allow the various tasks to be segregated into three groups.

1. Those tasks which are critical — unless performed properly they would cause injury or great financial loss.

2. Those tasks which must be performed frequently — hence, there is great cost benefit in ensuring they are done correctly.

3. Those tasks which are non-critical and non-frequent — and, thus, do not merit the same degree of training effort as the first two categories.

For critical tasks some form of training and extensive job performance aids are required. There should also be hands-on criterion checks for critical tasks.

Frequent, but non-critical tasks must also be trained. However, the training need not be quite as intensive. Heavier reliance can be placed on job performance aids. Once again, hands-on criterion checks are essential but in this case they should not have to be used for very long since the tasks are performed frequently and, thus, the process is internalized relatively quickly by the operators and mechanics.

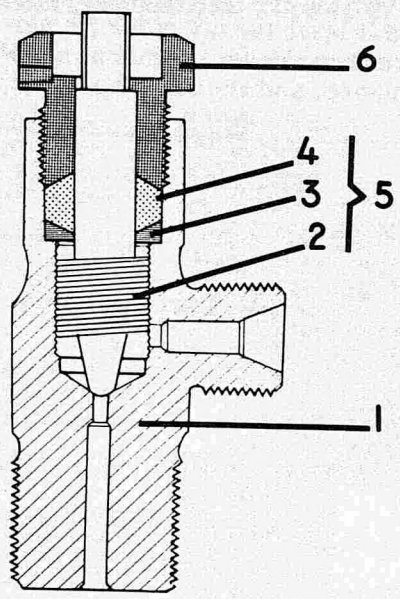
The last group, non-critical, non-frequent tasks, can be handled either with job performance aids or, in rare cases, by reference to specific places in the equipment manual (if the maintenance department has access to the plant manager's safe). It is usually not cost effective to design training for this large body of seldom-used procedures.

Further Design Aids

Although the process outlined herein will go a long way toward reducing the amount of information which must be transferred, it will not address all of the difficulties associated with manufacturing training discussed at the beginning of this article.

Figure 1.
MAJOR ASSEMBLY STEPS

1. Place stamped brass valve bodies in assembly fixture and close toggle clamp on fixture to hold valve bodies upright and steady.
2. Place greased stems in the valve bodies two at a time, and start them by hand. Continue until all valve bodies have stems.
3. Slide brass packing glands over the stems. The flat side should face down toward the threads.
4. Slide greased packing washers over the stems so that they rest on the packing glands.
5. Use the air wrench to tighten the stems into the bodies until they are snug. Do not overtighten.
6. Place packing nuts (bonnets) over the stems and thread them into the bodies by hand. Use the pre-set torque controlled air driver to tighten the packing nuts (bonnets). Remove the valves from the fixture and place in the crate.



Once the task data has been collected, and the tasks have been categorized, the information must be reduced further; must be designed for quick access; and must be made less verbal-skills dependent. To solve these problems it is usually necessary to design:

- Easy-to-use, quick-access job performance aids, and
- Audio-visual training modules.

There are at least three requirements which must be met in designing job performance aids, in addition to accuracy. The job performance aids must be graphic, they must use as few and as simple words as possible, and they must reduce information further by stripping away all but the essential steps. Figures 1 and 2 are examples of job performance aids that meet these criteria. Figure 1 is a job performance aid for valve assembly, it is graphic and uses short, simple language. Figure 2 is a troubleshooting algorithm. I have found this type of job performance aid to be almost indispensable in dealing with complex troubleshooting problems, especially if the corrections or adjustments which must be made are interrelated. In addition, these algorithms lend themselves well to being computerized, which makes troubleshooting feedback almost instantaneous.

I cannot stress the importance of these job performance aids too strongly. Perhaps the most important message I can convey in this article is the following: *Properly designed job performance aids will improve performance in manufacturing operations to a greater degree than any other device — including formal training programs.* They are the focus of any performance improvement system in manufacturing; they are used day-in and day-out, long after the information in the formal training program has faded from the memory of the trainee. In fact, much of the formal training I design has as its purpose training operators and mechanics to use the job performance aids. The criterion test is usually a hands-on certification of the trainee by the supervisor to certify that the trainee can use the job performance aids properly.

Audio-Visual Training Aids

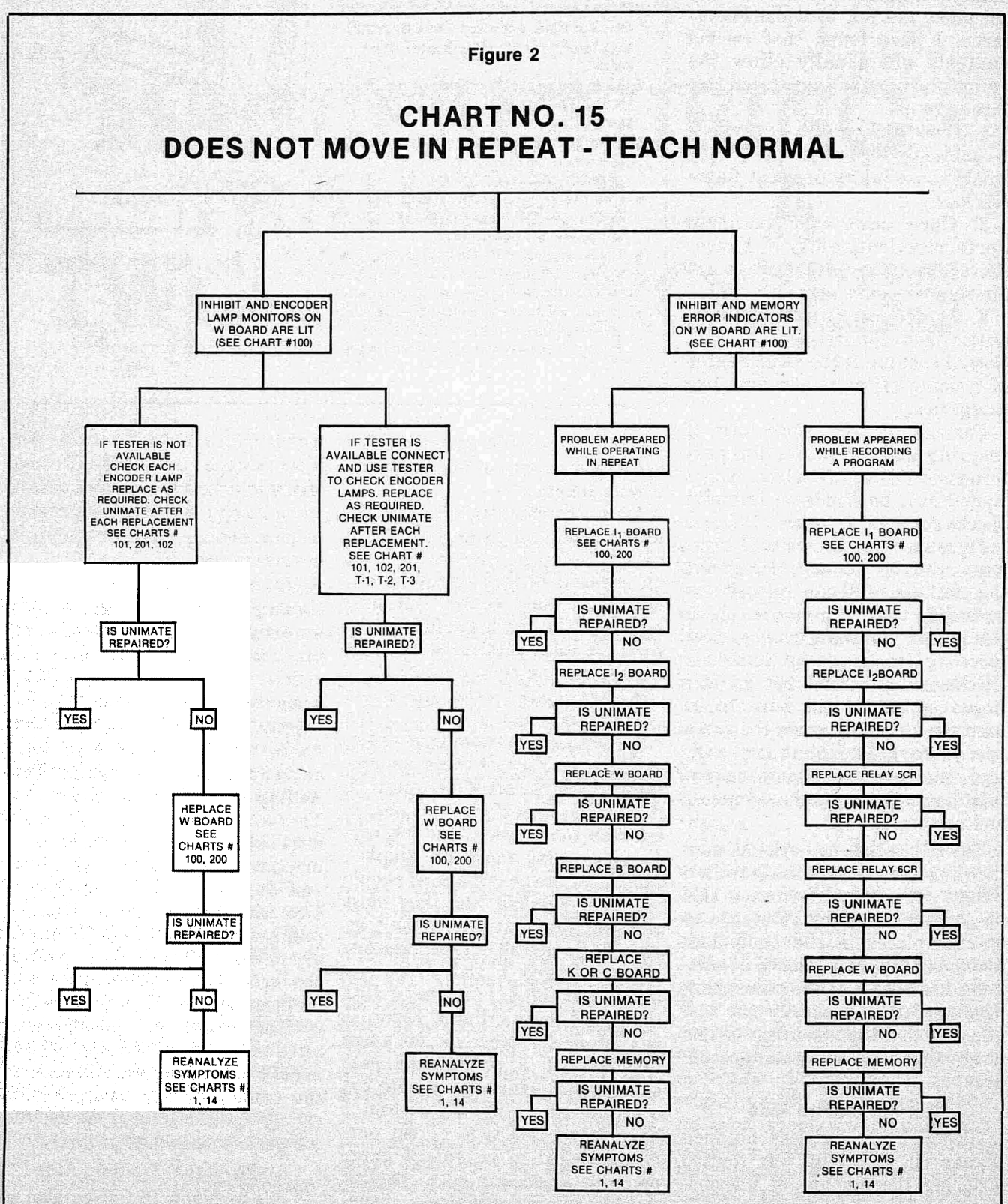
Let's turn now to a discussion of the audio-visual training modules.

These modules have two purposes: to give trainees an intuitive feel for how the specific system they are working on operates and what is critical to the system's operation, and to teach the use of the job performance aids for operation, maintenance, and troubleshooting. They are used to reduce verbal skills dependence, and to reduce the dependence upon a skilled instructor. They are usually interactive, requiring planned responses in a workbook during the viewing of the program.

A typical list of audio-visual modules which might be designed are:

- Technical overview (what is this beast you are working on?)
- PM checks (preventive maintenance checks which must be made)
- Lubrication checks (what

Figure 2



should be lubricated with what and how often)

- Troubleshooting (how to troubleshoot the most common malfunctions)
- Operation (how to properly operate the equipment)
- Jams and adjustments (how to clear jams and make adjustments)
- Parts inspection (how to know that what's coming out is OK)

There are other modules which are sometimes designed, of course, and not all the above modules are required for each job.

How the training is delivered depends upon two factors, the nature of the material being trained, and/or the equipment which is available for use.

Finally, since the design discussed here can be largely self-instructional, an extensive administrator's guide must be provided, and a detailed implementation plan specific to each manufacturing operation must be designed. However, these are topics for another article.

In summary, to address the difficulties encountered in manufacturing training, it is suggested that the following procedures be followed:

1. Do an exhaustive task analysis.
2. Categorize the tasks as: a) Critical; b) Frequent; c) Non-critical and non-frequent.
3. Design proper job-performance aids — taking cognizance of the task categories.
4. Design audio-visual modules to support the job-performance aids.
5. Select a delivery system which is cost effective for the type of training to be delivered.
6. Construct an extensive administrator's guide and implementation plan.

These procedures work! I use no others in designing manufacturing training.

Stan Holden is president of The Industrial Training Group. He is also director-elect of ASTD's Technical and Skills Training Division. He has a Ph.D. in physics and specializes in engineering, scientific, and technical and skills performance improvement and training in all types of high and low technology industries.

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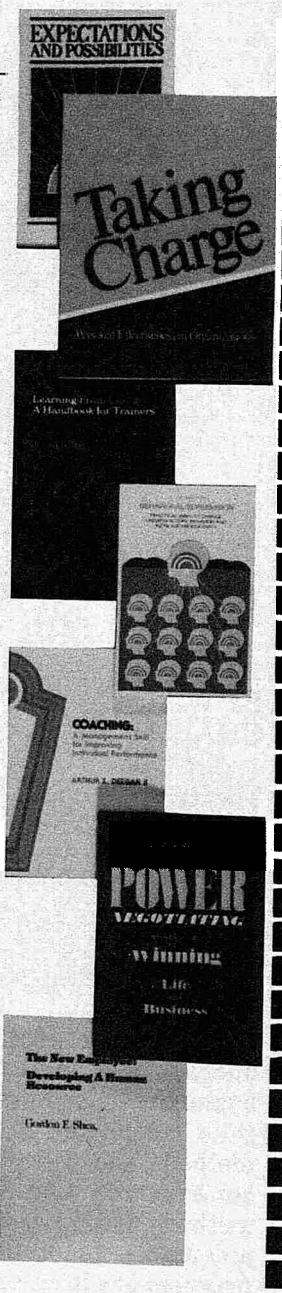

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