ISSUES IN MANAGING TOTAL TRAINING SYSTEM DEVELOPMENT

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ABSTRACT

Redefining the contractor's product as a fully trained individual rather than a supplied training capability has posed management problems that are new to the simulation industry. Different management approaches and techniques are required to deal with the larger goals of a total training system contract, both at program management levels and at higher levels. Program managers must coordinate the efforts of an even more diverse group of technical specialists, often from several different companies or user communities. Existing disciplines supporting training device development remain essential capabilities, but they now must be augmented as early in the acquisition process as possible with those disciplines necessary to identify a training need and translate it into an engineering specification. Senior managers must find ways of smoothly integrating these new disciplines within existing organizational structures, preserving existing technical strengths while accommodating a shift in business emphasis from the delivery of a defined product to the supply of a long-term service.

INTRODUCTION

Since 1980, customers have been telling the training support industry that they need something new. Instead of training equipment or training materials, their acquisition initiatives are now for training systems. This is not simply a new name for the same product; it identifies a substantial change in the nature of our customers' needs and in the nature of our business. We are now being asked to do and supply everything required to generate fully proficient operators and maintainers of the weapon system. Our product is now a support system for a specific job, and its sole purpose is to ensure an adequate supply of individuals who will proficiently perform that job. It exists as long as the job exists and changes as the job changes. To succeed, it must be based on long-term planning, yet adapt in real time to each unique set of circumstances that arises in the job environment.

Since the concept of a total training system is still relatively new, it seems worthwhile to once again offer a definition of such a system. While most concepts of a training system have grown beyond the strictly developmental and now also address training operations, most definitions stop after considering a single cycle of the curriculum. Typically, we hear that a training system consists of everything it takes to bring a student to job performance proficiency. While true, this definition is still too limited, because it fails to address the long-term nature of the support relationship upon which the training system is built.

A training system is the total set of data, materials, equipment, procedures, and techniques required to sustain the production of proficient system operators and maintainers over the life cycle of the system. It must develop and deliver instruction in a controlled and managed environment, so that any student will achieve the required level of job proficiency established for him by measurable, criterion-referenced objectives. The system should produce immediate feedback to the student and also modify itself as a result of that student's experience within it. It is an interactive system, which relies on the synergism generated by its components to ensure task achievements at defined and measurable levels of performance. It should be adaptive, proactive, and prescriptive, as well as self-validating.

Responding to a training system initiative requires that a company take a hard look at its basic mission, organization, assets, and capabilities. More than likely, this fundamentally different way of doing business will require subtle, yet major changes in the basic nature of a typical product-oriented company. Its major business relationships are now based upon supplying a service: the operation and maintenance of the source of trained personnel.

This transition from a producing to a serving operation does not eliminate product-oriented activities. These products are the resources which the training system must have in order to operate. The major difference that must be faced is that these products are now specified by, delivered to, and used by units within the company itself. This basic change affects every management level from the program upward. Program managers must coordinate the efforts of an even more diverse group of technical specialists, augmenting engineering disciplines as early in the development process as possible with those disciplines necessary to identify a training need and translate it into an engineering specification. Senior managers must find ways to smoothly integrate these new disciplines within existing organizational structures or develop newer, more suitable organizations. They must preserve existing technical strengths while accommodating the shift in business emphasis from the delivery of a defined product to the supply of a long-term service. The balance of this paper explores five issues that arise from the training support industry's new role.

TRAINING TOOLS VS. TRAINING SYSTEMS: SOME KEY DIFFERENCES

Redefining the contractor's product as a fully trained individual rather than a supplied training capability means that the contractor has in effect become the customer for his own products. We no longer have external customer-furnished requirements and standards to guide our development efforts; because we use the devices and materials ourselves, these requirements and standards are internal. Our ultimate standard of performance is now the same one our customers have been using for years: How proficient is the student we graduate, and how efficiently do we get him there?

The changes in our industry are neither superficial nor merely cosmetic. They are truly basic, analogous to those faced by a textbook publisher or laboratory equipment manufacturer who takes it into his head to found a university. This expansion of scope requires a broader base of skills not entirely possessed by any single company in the industry today, ranging from manufacturing to teaching, and sometimes even to flight operations. A challenge we all face is the acquisition of skills new to our organizations, merging them within a service-oriented framework to provide a complete support structure for our customers. We must take a new look at many aspects of our business we have previously taken for granted.

New Measures of Product Quality

Over the past two decades, a substantial body of common understanding has guided the development of training devices. The same is true for systematically developed training materials, although the gestation period has been somewhat shorter. These viewpoints have become so well established that detailed regulations and procurement standards have been developed around them, some specific examples of which are FAA Circular AC 120-40 and MIL-T-29053B (TD). Both of these documents define essential elements of training systems, especially for aircrew members. Even so, they are both representative of the way in which most of our current documented practices and standards focus on components of the training system rather than on global processes. These documents are still useful and are widely specified and cited. As standards for the ultimate performance of the training system itself, they lack adequate breadth. The reason for this is the nature of the training system product. The true product of a training system program is not the system itself but the student it produces. Here there is only one standard of quality that applies: full job proficiency of every system graduate.

The training system acquisitions we have seen to date require the contractor to guarantee this level of graduate performance, often assessing penalties for every graduate who does not meet this standard. To reach this goal, we need to derive enabling standards of quality to guide the development or acquisition of our own resources and to guide and integrate our operations using these resources.

New Factors Affecting Cost and Schedule

Supplying total training systems capability is a long-term effort. A service that is required for the life of the platform supported, it requires planning time frames that are considerably longer than the norm for product suppliers. The typical schedule used for flight simulator development may comprise only ten to fifteen percent of the total life cycle of the training system in which this simulator will be employed. For example, the C-130 ATS initiative now before the industry requires the contractor to provide priced options for 20 years of training system operations.

Program staffing requirements also depart from the product-based norm. In addition to the personnel required to develop the training system and construct its components, the total training system contractor must provide for a stable, reliable supply of instructors and operations support personnel over a schedule long enough to comprise most of an individual's career. It has often been said that one of the major advantages of a contractor-operated training system is the stability over time of the instructor force. This preserves for the life of the weapons system the knowledge and skills which an instructor builds over time and long association with the platform. To actually realize this benefit, the contractor must address training, career progression problems, and salary requirements, providing sufficient incentives to ensure high retention of the instructor staff. This has a direct bearing on program costing. Now, in addition to price escalations caused by the economy itself, escalation to cover the increasing cost of personnel must also be included if the contractor is to provide the benefits of a stable base of knowledge.

Additional problems can arise from customer funding profiles. This is not new to the industry; program schedules have often been adjusted to accommodate funding profiles that have been spread over a greater time frame than originally planned. Unfortunately, this has usually meant delays in delivery of the required training capability, leaving the customer to support his operations as best he can until the money for the training tools he needs becomes available. The problem can be exacerbated by the long program life of a total training system. Often, the customer can fund only one year at a time, with no guarantees of funding continuation past the current budgeting cycles. The training system supplier must accept this as a risk. Obviously, finding some way to smooth out the cost profile and adjusting it to meet the vendor's cash flow needs is a worthwhile goal.

These schedule and cost issues can be addressed from both sides of the contracting equation. Long-term contracting with multi-year funding is the obvious response of the vendor; however, this is very difficult to provide under current budgetary and procurement legislation now controlling our industry. On the other hand, the contractor could make the long-term commitment, accepting the risks it poses. Under this operating philosophy, pricing can be smoothed to match funding, and escalations can be anticipated to the extent that acquisition regulations permit.

Obviously, the optimum solution lies somewhere between these two extremes. Given that acquisition regulations are likely to be relatively immutable in the near future, the initiative would seem to rest with the contracting community. The extent to which total training system contractors are willing and able to take long-term risks will determine the extent to which our customers' funding profiles can be accommodated.

Finally, the long development schedule of the total training system requires a commitment to the business of supplying this service if the customer is to be assured of the continuing support he needs. Planning that stops after the equipment development cycle leaves the ultimate output of the system -- the students themselves -- unsupported in a company's overall strategic picture. In many ways, the end of the development cycle marks the beginning of a program; this is the point at which the contractor begins to produce the product which he has contracted to supply.

To make a commitment to a contract for this length of time, the contractor must be firmly committed to the support of our industry as a primary business priority over the long term. This means much more than commitment to the business, however. Simply to maintain capability and credibility, we need to evaluate each innovation and aggressively adopt each promising new approach. To meet our customers' long-term needs, we must invest in more than just our current business. Training the operators and maintainers of the weapons systems that are now being planned will require increased investment in behavioral research and studies to define optimum organization and management plans, as well as continuing research in simulation technology.

Specification Generation vs. Specification Compliance

It is now well understood by the industry that training system customers typically do not provide detailed equipment specifications, or if they do, require the contractor to verify these specifications through in-depth front-end analysis. We as contractors must be prepared to develop our own technical specifications, demonstrate to our customers that we have chosen the optimum mix of features and functions, and validate the results of these choices in actual use as the training system is implemented. This requires sound, documented methodology with demonstratable accuracy in identifying requirements, and freedom from bias in specifying mediation.

The current methodology of the ISD tradition tends to focus on media selection, or the allocation of training requirements to an a priori media pool. Functional requirements definition methods borrowed from engineering disciplines typically begin with the characteristics of a platform as the final design goal. A discipline which systematically relates media features and functions to platform characteristics by way of training requirements is still under development. Our customers have been working toward this goal for some time; we must now undertake the same goal and accelerate our progress in order to specify the equipment we need to deliver training whose effectiveness we can guarantee.

In spite of the fact that the methodology we all need is not yet truly stable, the requirement to develop our own media design specifications offers a significant opportunity. The industry is able to focus on developing the most cost- and training-effective suite of equipment without most of the regulatory constraints which are often applied to the acquisition of equipment. Our customers are offering the perfect vehicle -- and the support -- for us to fully understand their needs. The effort required to develop an adequate design methodology seems a small price to pay for this opportunity.

Managing an Interdisciplinary Design Team

In order to develop the new design methodologies required and to execute those methods to obtain a design, specialists in training and engineering disciplines need to learn to work in harness together. This becomes a management problem in the area of communications. Each of these disciplines needs the information the other can provide, but it is often difficult to establish a common technical vocabulary. In addition, both of these disciplines have traditionally sought different qualities in their end products, and, typically, neither has had much experience in carrying out the integration of engineering features and training activities that must occur for maximized training effectiveness.

The management team must pay a great deal of attention to the establishment and maintenance of communications between these divergent disciplines. In fact, a program manager probably cannot assume that all members of his design team even understand the problem in the same way. This requires clearly establishing the design team's objectives as early as possible. The program manager must be very clear in his own understanding of these objectives as well, avoiding the parochial views that he may hold as a result of his own background. His goal is the most efficient set of training events and environments that can be achieved; it is neither the highest-fidelity simulation nor the most innovative instructional strategy possible. He must then communicate this goal to the program team, ensuring that his training designers understand the practical limits of mediating the training environment and that his hardware designers understand the uses that will be made of the equipment they produce.

Getting the design process moving requires some hard work up front to establish this common understanding. Training and engineering specialists must agree upon ways of storing and communicating training requirements, simulation fidelity levels, platform characteristics, and a great many other sets of data. A true meeting of minds may never be achieved, but at the very least, a sequence of events, their inputs and outputs, and the forms that this information will take must be carefully worked out, then followed in a highly disciplined manner. These procedures will at least ensure that the team members understand and perform their tasks as part of a coherent whole.

Standardized procedures are especially important in developing the training equipment to be used in the system, because this is the way in which the data which must take the place of a customer-furnished requirements specification are produced and transmitted. Even if informal communications among design team members are smooth and easy, it is probably worthwhile to maintain a high level of formality about the specification process; internal system and method must take the place of external contract requirements.

Differences in Managing Training Systems Development and Training Systems Operations

The transition from system development to system operation is the point at which the essential nature of our business operations changes. We move from a product-oriented set of tasks and procedures to providing a long-term service. Products have been produced, but these tasks, large and costly as they are, are only waypoints in a subset of our total task. In the producing role, we have had explicit specifications to guide product development, even though we have generated them ourselves. In the service role, different criteria apply, and very little is explicit:

- The customer receiving the service gets nothing tangible; value depends on personal experience
- Quality of service is largely subjective
- There is no such thing as customer loyalty
- The more people a customer encounters, the less likely it is that he will be satisfied

The above statements are adapted from Albrecht and Zemke's book on the management of service companies. As with most generalizations, they are probably overgeneralizations; even so, they point out what must remain uppermost in mind when training operations begin: the student, who has been considered the product up until now, has become the customer. Even though his bill is paid by the gaining organization, his needs are paramount from this point forward.

If this seems to conflict with much of what has been said up until now, that is because there truly is a conflict to be addressed here. Program managers must be closely concerned with managing each student's experience, with providing him the best possible service. At the same time, the program manager must ensure that students continue to graduate, thus carrying out his fiscal responsibilities to his company. Each student is a unique individual and will require a significant amount of attention and accommodation. However, the gaining organization which pays for his training needs him at full competency on time. The resolution of this conflict is readily apparent, however. If good service is provided to the student, a good product is produced for the gaining organization, and produced on time.

This is not to say that achieving this resolution will be as easy as it is to make the above observation. The disparity in viewpoints which the program manager must reconcile gives rise to a continuing stream of problems to be solved. Accountability and documentation with respect to both fiscal and operational matters are of continuing concern in satisfying the information requirements of the funding organization. This will have been true throughout the development process, and these concerns will carry over to training system operation. The instructor staff has other priorities. They are involved on a daily basis with bringing about a behavior change in each unique individual who crosses their threshold. If a curriculum must be modified, so be it. If courseware must be updated, device configurations modified, operating procedures revised, then they will be, regardless of the consequences to the reporting and management procedures and processes that have been imposed.

This may seem like anarchy, but in fact, this is the way the schoolhouse must be run: the student comes first. The program team commits to managing each student's experiences with the training system, counting upon division/corporate management for support, and to coordinating with other functions within the customer's organization. The burden of change, then, is often upon program managers.

SOME RECOMMENDATIONS FOR ACTION

The five issues discussed above must be dealt with successfully by each of us in order to respond effectively to the need. Each of our approaches will be different depending upon the nature of our prior business and the state of our current organization. But we are now in a new business, and there are some actions we can take individually and as an industry to improve upon our ability to meet our shared commitment to fully support the services' training needs. Some of these are suggested in the following paragraphs. This is by no means an exhaustive list of all the possibilities; we would hope that many more positive steps will be identified and shared.

Improved Techniques for Media Definition and Design

We have said that communications between training designers and training device engineers is one of the significant issues requiring action. One of the most useful tools to improve this communication will be a comprehensive process for systematically associating specific hardware features and functions with training requirements. The major impediment to the development of this type of process -- the huge volume of data involved -- has effectively been removed by the ever-decreasing cost of high-capacity computational hardware. The results from an in-depth examination of each training requirement can now be made useful through data processing techniques; what remains is the much more difficult task of defining the decision rules and processes which will generate the data. At present, we rely mostly upon informed opinion to decide upon the best environment in which to teach and perform the behavior of a training requirement. A broad-based research effort is needed to identify the cause-and-effect relationships which might drive mediation decisions.

Techniques for Transitioning from Production to Operation

This industry as yet probably does not have enough collective experience to identify the best means of managing the transition from the development of training system components to the operation of a training center. What experience does exist needs to be shared and studied. Each of the contracted total training systems now in operation was developed by a different firm under differing management approaches. One means of promulgating this information might be for the customer organizations to summarize the lessons learned from each contract at an open forum or in an open report to provide general guidance to the industry. The I/ITSC conference itself might very well be the best vehicle for this activity.

Internal Enabling Standards of Quality

Developing quality training system components, whether for delivery or for our own use within a contractor-operated training system, requires the same disciplined processes and stringent standards. Whether we do the teaching or our customers do the teaching is immaterial to the student, who is always the ultimate beneficiary of product quality. This commitment to the student must lie at the root of all our development efforts. Any changes in our quality assurance efforts when developing a total training system will result from the need to ensure that training system elements are integrated as well as well-constructed. Some creative thought is needed to define meaningful ways of planning for and ensuring integration of components. Our efforts to improve our quality assurance processes must operate from the total system perspective.

This issue is another that is probably best addressed by a joint team representing our customers and the full range of training support industry viewpoints. Action to be taken here might include encouragement from industry management for publication of new approaches and original thinking in this area, and an initiative on the part of our customers to open a forum for the exploration of quality standards based on training system integration issues.

SUMMARY

Among other things, a total training system requires that we expand by one level our customary frame of reference. Formerly, we provided products to be used by someone else. Our products typically ended up as part of a collection of training aids assembled over time, under a constantly changing training philosophy implemented by a constantly changing training organization. This being the case, the industry worked hard to meet the original training concept, then constantly modified the original product, often beyond all recognition, to keep up with the platform and the training need. This process was linear, stepwise, orderly, readily understandable, and woefully inefficient.

Now, the student is our immediate concern. We must not only develop the training aids and materials, we must also develop the philosophy and methods of operation under which these aids and materials will be used. This process is multilinear, iterative, seldom orderly, and hard to understand. However, it has a great potential for increased efficiency, if we can master its intricacies and ensure that each iteration moves us forward.

For this goal to be achieved, management orientation must shift from production to service. In our industry, production has always taken place in order that a service may be provided. This service is now ours to provide. With this opportunity comes the range of challenges to our management practices which this paper has tried to sample. Its final message is simply this: as an industry, we possess the skill and knowledge to master this challenge. Ways and means must be sought to assemble these component skills and knowledge into a new discipline to meet the challenge our customers have placed before us.

REFERENCES

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