EMPHASIS ON QUALITY: A PROCEDURAL MODEL FOR ACQUIRING AND MANAGING TECHNICAL SUPPORT DOCUMENTATION

Thomas E. Gwise, Ed.D
Naval Training Systems Center
Orlando, Florida 32813-7100

ABSTRACT

Acquiring and maintaining high quality technical support documentation is vital to the Naval Training Systems Center's mission. To this end, a comprehensive plan for managing the Technical Support Documentation Program has been implemented by the Center. The plan ensures that all technical support documentation products receive "cradle to grave" quality assurance. These products include training documentation, technical publications, vendor data, engineering and maintenance drawings, and other support data items. The plan's heart is a procedural model designed to address six prime drivers: (1) STREAMLINING requirements, (2) user needs, (3) cost reduction, (4) scarce personnel resources, (5) a requirement for quality products, and (6) a need for control during the product life cycle. The model was developed by integrating three constructs: (1) improved acquisition management techniques, (2) technological applications, and (3) stringent product monitoring. When fully integrated, these elements are in constant interaction, ensuring that each construct's variables are fused into a cohesive, comprehensive whole. This paper discusses the constructs, the variables and their importance in achieving the quality required by the CENTER OF EXCELLENCE concept.

INTRODUCTION

Acquisition reform, with an explicit emphasis on quality, is a high priority Department of Defense goal. Directly supporting this goal are the Streamlining initiatives, which mandate efficient and cost-effective acquisition procedures.(1) These initiatives provide form and substance to what has been a growing concern of Government and industry acquisition and logistics managers. For the past several years, there has been an increased emphasis on reducing the costs and improving the quality of logistic support materials. This trend was given a needed focus by the Carlucci initiatives in the early 1980s. The impact of these initiatives on logistics was noted in a 1982 Society of Logistics Engineers newsletter.(2) Among the areas singled out as needing improvement and addressed in a paper to the 4th Interservice/Industry Training Equipment Conference were deficiencies in management attention, front end logistics analysis, organization, and technical capability.(3) From the beginning, the Naval Training Systems Center has played a key role in defining these problems as they apply to training systems and in proposing timely and effective solutions. With industry's cooperation, improvements in all aspects of logistic support are beginning to emerge. As a result of heightened attention from the top management levels and of the refinement in Logistics Support Analysis as applied to training systems, individual logistics elements, such as Technical Support Documentation, can now be placed in the proper perspective and adequately addressed.

Technical Support Documentation consists of the documentation required to support the hardware, software and personnel elements of a system. This paper presents a procedural model for managing a Technical Support Documentation Program throughout a system's life cycle. The model, as presented, specifically focuses on the Naval Training System Center's approach to acquiring and managing the life cycle support documentation applicable to the instructor, operator, maintainer functions of a training system. However, with modification, the model should be adaptable to any support documentation program. The documentation addressed by the model includes training materials for instructor, operator, maintainer qualification programs, technical manuals and publications, vendor manuals and data, engineering drawings used for maintenance, and other support data items. These products, which are essential to meeting maintainability, and operational goals, are a subset of an overall Technical Support Documentation Program. At the Naval Training Systems Center, the elements of this subset have been integrated into a Technical Data Support Package for training systems. The Technical Data Support Package is one of four integrated logistics elements that is absolutely essential for successful trainer operation and maintenance, (the other three are qualified support personnel, spares, and support and test equipment). If any of these four elements is missing, no system can operate successfully for a sustained period.

As with the other three critical logistics elements, the Technical Data Support Package must be considered from two separate but equally important perspectives: product acquisition and product life cycle maintenance. During the acquisition phase, attention is focused on cost, schedule, accuracy, and development of a high quality product. During the life cycle maintenance phase, attention is focused on the usability, effectiveness, and currency of the product. The Technical Data Support Package concept was implemented to address and cope with six primary drivers: (1) changing user needs, (2) requirements for high quality products, (3) life cycle product control, (4) limited personnel resources, (5) cost reduction, and (6) STREAMLINING principles. The first three drivers emerged during the transition from organic to contractor support; the second

three evolved from the need for improved resource utilization during the acquisition and life cycle phases of the systems.

ORGANIC VERSUS CONTRACTOR SUPPORT

The transition from organic to contractor support has tremendously impacted the logistics support methodology for training systems.(4) As a technical support documentation user, a contractor's needs are considerably different than those of an organic support group. First, the need for extensive formal operator and maintainer training has been eliminated, since it is assumed that the contractor will be able to provide qualified technical personnel. This formal training has been replaced with self-paced, individualized qualification material which the contractor can use to rapidly familiarize his people with the unique characteristics of each system. Next, contractor support forces attention towards ensuring high quality initial deliverables. While high quality documentation has always been important, organic support provided the capability of using the formal and on-the-job training programs during the initial or interim support period to find errors and ensure corrections. This capability no longer exists. Since it is the Government's responsibility to deliver an accurate, usable Technical Data Support Package to the support contractor just month's after device acceptance, a high quality Technical Data Support Package must be delivered with the training system. Finally, contractor support requires that the Government procure and maintain an accurate and effective Technical Data Support Package. Under organic maintenance, Government military and civilian personnel assigned to support a training system had a vested interest in both the system and the documentation. Short term work-arounds were devised until discrepancies could be resolved. With contractor support, the Government cannot afford to compromise on product quality, since support contractors cannot be expected to assume Government responsibilities, nor can they be expected to achieve the required availability from figures if they are provided with incomplete, ambiguous documentation.

IMPROVED RESOURCE UTILIZATION

Personnel costs comprise a significant portion of any program, including the procurement of technical support documentation. To reduce personnel costs, innovative procedures are required which allow more work to be accomplished with fewer people while maintaining the same quality and quantity of output. Creative management is needed to eliminate excessive requirements, decrease the number of times something must be done over before it is done right, and effectively apply available technology. Because acquiring and maintaining technical support documentation is such a labor intensive task, operating with limited personnel resources is one of the major challenges in ensuring a high quality product.

Excess requirements which result from an inadequate analysis of user needs and system design contribute greatly to unnecessary Technical Support Documentation costs. To reduce such costs, these products must be treated as an integral part of the overall training system acquisition. During the engineering analysis which is applied to system development, the question must consistently be asked as to what is the minimum documentation required to support any particular aspect of that system or subsystem. Constant alertness is necessary to eliminate excessive documentation requirements, duplication of effort, unnecessary degrees of perfection and unwarranted quantities. Further, each proposed item of data or documentation should be justifiable on it's own merits, and it should be so critical that without it, the project and the life cycle support program would be in jeopardy.

Personnel costs and excessive requirements are the two primary cost drivers. Within these boundaries, documentation costs are driven upwards by a lack of understanding of the overall and the specific documentation requirements, by the failure to adequately and clearly specify requirements, and by the perceived need to be all things to all people. Compounding this problem is the lack of accepted standards to which documents are contractor developed and Government accepted. While Data Item Descriptions, Military Standards and other regulations attempt to solve this problem, they cannot correct the problems associated with the contractor who submits slipshod deliverables and the Government reviewer who accepts these deliverables or, conversely, the Government reviewer who applies overly stringent criteria to a perfectly acceptable contractor deliverable. In either case, increased costs result.

A PROCEDURAL MODEL

Each of the six drivers discussed has had a significant impact on technical support documentation acquisition and maintenance. To address these drivers, both individually and collectively, a procedural model has been developed. This model, which plans for and integrates improved acquisition management procedures, advanced technology applications, and strigent product monitoring controls, is currently being utilized to procure the Technical Data Support Package. The goal is to ensure that all Technical Data Support Package products receive "cradle to grave" quality assurance. To accomplish the desired goals, the three constructs of improved acquisition procedures, application of advanced technology, and stringent product monitoring must be in constant interaction to fuse the variables within each construct into a cohesive, comprehensive whole. The discussion below presents the techniques and procedures currently employed by the Naval Training Systems Center to implement the model. These techniques and procedures have been tailored specifically for the acquisition and life cycle maintenance of the Technical Data Support Package. However, the principles can be applied to any technical support documentation program.

IMPROVED ACQUISITION MANAGEMENT PROCEDURES

Perhaps the greatest challenge in improving acquisition management procedures is the development of standard methods of doing business while

satisfying the requirements of several different sponsors, all of whom have different needs and requirements. While the training systems being delivered to the Aviation and Surface communities are primarily supported by contractors, the Subsurface and Marine communities employ organic support for many of their training systems. Additionally, the Naval Training Systems Center procures or supports the procurement of training systems for the Army and for foreign governments, all of which have their own distinct needs.

Historical Approach

Until 1985, documentation to support instructors, operators and maintainers was procured by two separate disciplinary branches within the Training and Support Media Division. All materials relating to training were procured by the Training Acquisition Branch, and all technical publications, vendor manuals, maintenance drawings and other support data were procured by the Technical Publications Branch. As the impact of the drivers outlined above began to be felt, two major problems became evident. First, the specific needs of the individual warfare sponsors and other customers were not being adequately addressed by the generalist approach to the acquisition of these materials. For example, any given Logistics Element Manager in either of the two disciplinary branches could be and often was tasked with projects for all three warfare sponsors plus Army, Marine Corps and sometimes Foreign Military Sales. Since each sponsor has unique requirements, keeping up with changes in each community was becoming unmanageable. Additionally, the problems of documentation mismatch and redundancy were driving costs up; it was becoming a major effort to ensure that training materials, technical publications and drawings were procured to the same level of support. Finally, much of the material being developed as technical data and documentation was being repackaged into training material format and sold to the government as a separate development effort.(6)

New Approach

In 1985, the Training and Support Media Division was completely restructured into three branches relating to specific warfare and sponsor related Training and Support Media Branches: the Aviation Branch, including Marine Corps aviation trainers, the Sea Branch, which is subdivided into Surface and Subsurface, and the Land and Special Systems Branch, which includes Army, Foreign Military Sales, and Marine Corps ground trainers. Within each of these branches, projects are assigned by major program areas to *interdisciplinary teams of Education/Training* Specialists and Publications Specialists. For example, in the Aviation Branch, all training systems for the F/A-18 program are assigned to one team; in the Sea branch, all TRIDENT related projects are assigned to one team. This interdisciplinary approach has resulted in several significant improvements. Working together during the precontract phase, the team conducts a thorough analysis. During this analysis, the dialectic between the Education/Training Specialist and the Publications Specialist ensures that the problems of documentation mismatch and redundancy are eliminated, and that streamlining principles and standardization are considered. The team also works together to produce a "should cost" analysis for the proposed procurement. The integration of effort greatly simplifies management reviews since all products and costs are submitted in one comprehensive package.

Advantages

The assignment of teams by a sponsor's major programs has greatly increased the efficiency and effectiveness of both the assigned teams and the management structures to which these teams report. Each team is responsible for keeping current with the policies and changes within only one warfare area program rather than the several areas which were previously assigned to individual specialists. By reporting to a smaller number of ILS and Project Managers, the team members can stay more closely attuned to the needs of these managers and provide them with more accurate and timely responses. Conversely, functional and project managers can instantly pinpoint responsibility for project problems and take decisive action to correct these problems. Moreover, the symbiosis which develops between the team members provides the flexibility needed for routine day-to-day operations. While each team member is a specialist in his/her own discipline, each member *is also knowledgeable in the major elements of* the other's discipline. This cross training provides a sorely needed back-up capability in this era of limited personnel resources. For example, if the Education/Training Specialist is absent, the Publications Specialist can respond to all but the most technical questions or tasks, and vice versa. There is no longer any need to wait days for one person to return or to pull a specialist off another project to supply the needed responses.

This interdisciplinary structure has facilitated the development of the integrated Technical Data Support Package. The replacement of organic support with contract support made it apparent that the training documentation procured for the formal training of organic personnel was no longer needed. Since the contractor is expected to supply competent, qualified support personnel, extensive training is not required. To enable these personnel to understand the unique characteristics of each training system, a qualification package is required to supplement the technical manuals, publications, and data. Using the team concept, it became realistic to design an integrated Technical Data Support Package which ensures that the separate elements do not duplicate each other. Additionally, it became *possible to develop generic procurement standards* and criteria which are flexible enough to be tailored to each training system's specific requirements. This ability has greatly enhanced the articulation of documentation requirements; it has also reduced the problem caused by unnecessary "creative writing" by Government personnel and "creative interpretation" by contractor personnel that were prevalent in the past.

TECHNOLOGICAL APPLICATIONS

The application of advanced technology makes possible dramatic advancements in the acquisition and management of all logistics support elements.[7] When implemented in conjunction with improved acquisition management practices and intensive product monitoring, costs are lowered, personnel resources are employed more efficiently, and a higher quality product is realized. One goal at the Naval Training Systems Center is to apply technology to every step of the Technical Data Support Package acquisition and management process, from initial analysis through life cycle maintenance of the various products. A positive start has been made with the introduction of basic wordprocessing and microcomputer applications to conserve personnel resources and introduce better control in the Request for Proposal phase of the acquisition. In particular, the ability to automate the CDRL development process using microcomputers saves thousands of hours each year. When this system is fully implemented and refined, specialists will be free to devote more attention to product quality assurance.

Computer Aided Drafting

Inroads are also being made in reducing the Technical Data Support Package acquisition costs through the use of Computer Aided Drafting (CAD) equipment. Presently, the CAD system is being used to automate the acquisition, review, maintenance and storage of engineering drawings. This automation became a necessity when it was realized that the Naval Training Systems Center currently holds an inventory of over one million engineering drawings with an increase of approximately ten thousand drawings annually. The manual process of checking, storing and reproducing these drawings became cumbersome, labor intensive, costly and unresponsive to user needs. To rectify this situation, the current drawing inventory, which is stored on aperture cards, is being digitized for storage on magnetic media, and new contracts now specify that final submissions of engineering drawings shall be made on magnetic tape compatible with the CAD system. Magnetic tape requirement reduces the Government's cost for engineering drawings by fifty percent. It also permits more effective configuration control through the use of a data base management system, and it significantly reduces both the storage space and retrieval time required. Moreover, when changes to drawings which are stored on magnetic tape become necessary, the CAD system can effect these changes over twenty times faster than is possible with manual methods. Further, each change results in an original printout of the affected drawing, thus eliminating the loss of intelligence that typically occurs about the third or fourth drawing modification.

Plans are in place to expand the CAD system's capabilities by linking the central system in Orlando to the Regional Offices in Norfolk and San Diego via the Defense Data Network. This linkup will expedite the change process by allowing changes identified by field personnel to be made on an input device and transmitted electronically to the central data base in Orlando. By eliminating the current delays inherent in the manual process tighter configuration control can be maintained. Additionally, as the system expands to include this field input capability, it will become the cornerstone of the Technical Data Support Package Validation and Verification program through an interface with the evolving Automated Publication Storage and Retrieval System.

Automated Publications

Another major initiative at the Naval Training Systems Center is to fully automate the processing of training materials and technical publications in a manner similar to that currently employed for engineering drawings. With the increase in training system complexity, the sheer volume of these materials has exceeded the ability to manage them effectively. Printing and storage costs have increased to intolerable limits, the change process is untimely, unresponsive and costly, and personnel resources have been strained to the limit in attempting to successfully apply current methods. To overcome these problems, an Automated Publications Storage and Retrieval System, including an electronic publishing capability, is being established at the Naval Training Systems Center. As with engineering drawings, the first task is to digitize approximately four million pages of hard copy onto laser disks. This will be followed with the requirement for all final deliverables of training materials and technical publications to be submitted on laser disks which will be compatible with the electronic publishing system. Laser disk storage and laser printing are currently the state-of-the-art. One laser disk can store thousands of pages, thus reducing the storage requirement for one Technical Data Support Package from several cubic feet to that required for a single disk. In addition, to eliminating the storage requirement for master Technical Data Support Packages at the Naval Training Systems Center, the laser printing capability will eliminate the need to stockpile publications at the Navy Publications and Printing Office in Philadelphia. The problems associated with responding to an out-of-stock situation will also be eliminated through a print-on-demand feature, thereby appreciably increasing responsiveness to users.

The Automated Publications Storage and Retrieval System will interface with the CAD system to provide complete automation of the Technical Data Support Package. This interface will permit textual material changes to be made in the field and electronically transmitted to the central data base in Orlando. As in the case of engineering drawings, this capability will greatly enhance the configuration management process. It will also advance the Technical Data Support Package validation and verification effort by allowing editorial and other minor deficiencies to be corrected in a cost-effective, timely manner. These capabilities will also provide immediate availability of accurate and high quality technical documentation to field and user personnel.

STRINGENT PRODUCT MONITORING CONTROLS

The final construct of the model is perhaps the most critical if the advantages realized through improving acquisition management procedures and applying advanced technology are to be institutionalized. While product monitoring and quality control procedures have always been important, they are now essential if the six drivers outlined at the beginning of this paper are to be satisfied. Fortunately, as this need has become imperative, the interdisciplinary team approach, the Technical Data Support Package concept, and the application of technology have provided the tools to monitor products efficiently and objectively. The product monitoring construct consists of three elements: implementing and enforcing data warranty clauses in the contract, conducting intensive in-process reviews and establishing independent validation and verification procedures. These three elements are the primary variables in the stringent product monitoring construct. These variables will be reinforced by heightened management attention to the quality of the Technical Data Support Package, and supplemented by controls which are being developed to provide authoritative guidance for Government personnel. This guidance will include objective criteria against which each data item will be judged for acceptance or rejection and which will ensure that quality problems are readily identified, clearly defined, and immediately reported to the appropriate Government and contractor management levels.

Data Warranty Clauses

Data warranty clauses are being made a standard provision in all new contracts for training systems. Although it will be some time before the effectiveness of these clauses can be assessed, there is little doubt that they will be a major factor in future cost reductions. As the cost of data and documentation becomes more visible through procedures such as pricing each data item separately and including the more expensive products such as technical publications as separate contract line items, data warranties will assume the same importance as hardware warranties. This, in turn, will provide the emphasis required to tie acceptance of the hardware and software to acceptance of the Technical Data Support Package and other vital logistics deliverables. However, the reason for any warranty is to effect a correction to a defective product. In the case of data and documentation, these defects may not become apparent for a number of years after delivery. To satisfy user needs, the highest quality product possible must be available when the training system is accepted. To ensure this, intensive in-process reviews are imperative.

In-Process Reviews

Thorough in-process reviews of the Technical Data Support Package will benefit both the Government and the contractor by ensuring that a mutual understanding of all requirements exists throughout a contract's acquisition phase. Here again, the interdisciplinary team approach will be of value. As each team member becomes more skilled in his/her partner's discipline, that team member will be able to accomplish more on his/her required trips to the contractor's facility. For example, if an Education/Training Specialist is required to make a trip for training purposes, he/she will also be able to interface with the contractor's publications people to determine progress and identify any nascent problems which require the attention of the publications specialist. During these reviews, Government personnel will be able to spot check contractor product development and product validation methods and results, and contractor personnel will be able to get questions answered and issues resolved in a timely manner. Through this interactive process, higher quality products will be available at training systems delivery.

While intensive in-process reviews are the keystone to ensuring the delivery of high quality documentation, they cannot identify every discrepancy. A thorough contractor validation will still be required, followed by a Government verification of technical publications and drawings and a training effectiveness validation of the training materials. Previously, these Government functions were accomplished by conducting formal and on-the-job training for organic support personnel, during which the various technical publications and vendor manuals were used to train personnel on the system. As they were used, they were also "redlined" and returned to the contractor for correction. By the completion of the interim support period, the majority of discrepancies were identified and corrected.

Independent Verification and Validation

With the shift to contractor support, this capability has been eliminated. To compensate, new Naval Training Systems Center contracts contain a clause requiring the prime contractor to permit an independent contractor to conduct the required validation and verification. In some cases this independent contractor may be the contractor who will support the system, in other cases, it may be a third party contractor. This process will take place during the early stages of prime contractor support period and will be the basis for the acceptance or rejection of the Technical Data Support Pacakge deliverables.

The independent verification and validation task will be a joint effort by the prime contractor, the third party contractor, the Naval Training Systems Center's Technical Data Support Package acquisition team, and the Center's field personnel. Current contracts call for the prime contractor's contract maintenance personnel to assist the third party contractor during the verification and validation. The Center's on-site field personnel will monitor the process, electronically transmit minor changes to Orlando via the CAD system linkup described earlier, and report satisfactory progress and completion to the Contracting Officer's Technical Representative in Orlando. The acquisition team members in Orlando will be responsible for ensuring the correctness of any changes to be entered in the data base and for the adequacy of the verification and validation effort.

CONCLUSION

The task of acquiring and maintaining high quality technical support documentation is labor intensive, fraught with cost risk, and impacted by advances in technology, funding decisions, and policy changes. To help achieve the CENTER OF EXCELLENCE goal and to cope with the dynamics of the life cycle environment, procedures are required which simultaneously provide for maximum flexibility and rigid control. This seeming dichotomy has been resolved by developing a procedural model that integrates improved acquisition management procedures, advanced technology applications, and stringent product monitoring controls throughout acquisition and life cycle processes. Unless proper attention is given to the three constructs, the variables within each construct, and their essential interdependency, no demonstrable progress can be made in reducing the costs and improving the quality and effectiveness of Technical Support Documentation. However, if both Government and industry make a concerted attempt to further develop, refine, and work with the concepts outlined in this paper, quantum improvements can be realized.

REFERENCES

1. Taft, W. H., Improving the Defense Procurement Process: STREAMLINING Begins to Pay - Much Yet to be Done, Government Executive, February 1986, pp. 8-9.

2. Kirchner, D. P., The Carlucci Initiatives, SOLE Letter, Vol. 17, No. 5, May 1982, p.8.

3. Gwise, T. E. and Winsor, M., Needed: A State-of-the-Art Integrated Logistic Support Acquisition Strategy, 4th Interservice/Industry Training Conference Proceedings, November 1982, pp. 437-442.

4. Mathews, T. R., Contractor Support, How Can We Ensure Training Device Availability?, 7th Interservice/Industry Training Equipment Conference Proceedings, November 1985, pp. 429-432.

5. Roscoe, H. E. and Connell, F. M., Availability Guarantees, 7th Interservice/Industry Training Equipment Conference Proceedings, November 1985, pp. 260-265.

6. Gwise, T. E. and Cavitt, W. F., Cost Effective Acquisition of Contractor Maintenance Training, 2nd Interservice/Industry Conference Proceedings, November 1980, pp. 482-487.

7. Stein, R. G., Will Congress See ALS in CALS, Logistics Spectrum, Spring 1986, pp. 37-39.

ABOUT THE AUTHOR

DR. THOMAS E. GWISE is the Training and Support Media Division Head at the Naval Training Systems Center, Orlando, Florida, where he has previously held positions as Training Acquisition Element Manager, Senior Integrated Logistics Support Manager, Assistant Project Director and Branch Head. His experience includes 21 years of Naval service in the fields of electronics, management and training. Dr. Gwise holds an Ed.D in Administration and Supervision from Florida Atlantic University.