TECHNICAL PUBLICATIONS AND TRAINING AND THEIR IMPACT ON COST

MR. FRANK E. WINSHIP
Director - Support Data Engineering
McDonnell Aircraft Company

Last spring, when I first saw the list of proposed agenda topics for this
meeting, I was disappointed at the apparent lack of attention to the inter-
relationship of technical publications and training and their impact on the
cost of ownership. Much emphasis seemed to be placed on new training hard-
ware, primarily audiovisual systems. It seemed to me that far too little
interest was displayed in the data which necessarily forms the basis for
the primary training on any individual weapon system, namely the technical
publications. I certainly do not mean to downgrade the advantages or the
advances made in the training field by these and other proposed mechanical
aids. I am sure that most are calculated to enhance training and in the
process reduce costs. However, whatever the method employed in any training
program, the basis for that training is found in the technical publications.
It is, therefore, my firm belief that the training community and the publi-
cations community must work more closely together than has been my experience
in the past. Improvements in technical data meant to enhance its use in
training have been excruciatingly slow. Demands from the training community
that improvements be made in publications have been very low-key or non-
existent. True, the Training Commands of both the Navy and the Air Force
are represented at numerous logistic support meetings, conferences, etc.
During which the contractors are given guidance and direction. Seldom,
however, are their requirements or desires permitted to influence the publi-
cations program one way or another.

What are we, the so-called "Military Industrial Complex," doing to ourselves
as a result of all this? Our combined efforts, at present, are doing very
little to significantly reduce the exorbitantly high cost of maintaining
weapon systems in their operational environment. The annual tab for all
DOD maintenance is in the order of magnitude of $20 billion, and more than
half of that figure is spent for personnel and their training and the rest
for hardware and equipment.

It is our firm belief that very significant cost savings can and should be
realized by the military by the introduction of improved, complete, work
packaged procedures conveyed in a medium, with indexing, appropriate to the
size and/or complexity of the hardware. Savings can and should be realized
in two areas--training and maintenance--realizing that the cost of main-
tenance is largely effected by the quality of prior training. Numerous
studies and a few evaluations of data systems have been conducted by the
services as well as industry covering almost all facets of technical data
from preparation and reproduction to its use in the field. These studies
have covered Standard Publications, Job Performance Aids (JPA), Job Guides,
Symbolic Integrated Maintenance Manuals (SIMM), Presentation of Information

for Maintenance and Operation (PIMO), Maintenance Dependency Charts (MDC), Weapon System Maintenance Action Center (WSMAC), the Navy's current Microfilm Information Automated Retrieval System (MIARS), and many others. Statistics have been shown and judgments have been made on many of these systems regarding potential cost reductions in training. For example, as a result of a PIMO Study, it was shown that a decrease in the time a one-term enlistee spends in training could be reduced by 25%, and departure reliability and operational-readiness time improved by 50 to 65% and 38 to 40% respectively. The study continues by asserting that should Job Guides be widely adopted and formal training reduced, very significant savings could be made in training costs. The report goes on to state that there were in 1969 approximately 5,700 aircraft mechanics assigned to flight line main-tenance of the C-141A. Assuming only 1,000 new men per year due to turnover and a per-man cost of $3,500 for OJT and $4,500 for formal training, over $7 million per year could be saved in this speciality by cutting training from 28 to 4 weeks. Savings such as these, which impinge largely on the training area, extrapolated to cover the entire DOD maintenance population would optimistically result in savings of over $1 billion per year. Realis-tically, of course, this is not feasible, since JPA's in their present form are not appropriate for all maintenance tasks. However, it would be a step in the right direction, since additional benefits derived would include such things as better equipment availability and fewer zero defect removals. Most of the more recent studies, regardless of the system, may seem to be aimed at a Work Package Concept. The Work Package Concept is fine as far as it goes, whether it be called PIMO, WSMAC, MIARS, or whatever. You will recall that earlier I called attention to several things including complete data and appropriate methods of indexing. By complete data I refer to all of the data which could be required to perform a particular task including theory of operation, description, removal and installation, checkout, trouble-shooting, parts catalog information, etc. This requirement in itself can be very ponderous when applied to a complex weapon system. The inclusion of all these data in one small pocket size publication (restricted in page count) is virtually out of the question. It is also virtually impossible in the Micro-film MIARS Concept due to the simple linear type coding in that system. As Dr. Thomas C. Rowan says in his report on "Improving DOD Maintenance Through Better Performance Aids" (March 1973), "One feature that would probably im-prove MIARS is random access coding of the microfilm." But whatever the system is called, as long as it provides accurate, complete, simplified data in work package form, it should assist in the reduction of training costs.

With these thoughts in mind, let's go through a little exercise to ascertain the possible effects on maintenance costs during the operational phase.

In 1962 the Air Force Behavioral Sciences Laboratory made an exhaustive study which revealed quite a number of things about publications. The number of that study is AMRL-TDR-62-85. That study plus subsequent Air Force Reports indicated that 30% of the total maintenance manhours expended within the Air Force are spent in seeking information. To better illustrate the magnitude of the statistic, I would like to create a mythical aircraft,

M250, and presuppose this aircraft will be flown in a manner that is not too uncommon with our present-day weapons systems, namely, 30 flying hours per month. We will account for 15 maintenance manhours per flying hour on a direct maintenance manhours basis. We will strive to maintain 75% availability, and since it is a hypothetical aircraft, we can say that on January 1 we will have 500 aircraft in our 10-year inventory. If we were to extract the information on maintenance manhours and these, in turn, converted to dollars, we derive the following figures: 15,000 flight hours per month; 225,000 maintenance manhours per month; at a cost of two and a quarter million dollars a month based on a rate of $10.00 per manhour. Of this $270 million in 10 years and using the 30% figure of the AMRL Report, we find that $81 million is spent seeking information. We are all aware that some maintenance is faulty or need not be done. In no-defect maintenance our 66-1 statistics shows that 30% of the maintenance manhours are spent on no-defect maintenance. Now, this excluded removing and reinstalling good equipment for access to other equipments. This represents another similar expenditure of $81 million over the 10-year life of the aircraft. Changing from manhour dollars to hardware dollars, records indicate that some 30% of electronic units alone which are sent back to the depot actually check no-defect and are reissued ready-for-use. The cost of these erroneously checked electronic units in the pipeline for a typical modern day fighter aircraft such as the M250 can be $134.5 million over the aircraft life cycle.

With these previous cost figures in mind, let's retrace our steps to see what impact an improved binary coded (random access) Microfilm Work Package Data System would have on them.

Recalling the 30% of the maintenance manhours spent in searching for information, with an improved data system, particularly one with better content, format and a media, geared to rapid random access, we could confidently expect a 30% improvement in search time. This amounts to, in dollars, some $202,500 per month, $2.43 million per year or $24.3 million in a 10-year span. A conservative estimate of a 5% improvement factor in "no-defect" maintenance will provide us with a potential savings of $33,750 per month, $405,000 a year, or $4,050,000 in 10-years. Remember, each additional 1% improvement would save you another $810,000. In the Interim Summary Report on the WSMAC System Evaluation (Bethune, 1969), it is noted that a decrease of approximately 64% in "no-defect" maintenance actions resulted from the troubleshooting information as portrayed in that system. If we make an assumption of only 50% improvement in fault isolation and subsequent reduction in components in the pipeline, we have a high potential savings of over 67.28 million hardware dollars in 10 years for electronic components alone. With regard to aircraft availability, we would anticipate an improvement of a minimum of 5%. We and certain individuals in DOD have sought for years unsuccessfully to establish a monetary value for aircraft availability. However, any increase in operational effectiveness is almost invaluable. Please keep in mind that this is only one weapon of the hundreds in the DOD inventory.

It is possible to continue for many hours with examples of possible cost savings through improved data both as the data applies to training and also to maintenance of the weapons system. However, what I have tried to do in the time alloted to me was to stir your imaginations relative to usability as well as cost savings that can be realized with improved basic data. Needless to say, the data of which I speak can be utilized in or with almost any of the sophisticated training equipments which are being discussed at this meeting. I guess my real purpose is to appeal to you as training experts to join forces with the publications experts to jointly sponsor the procurement of more usable and cost-effective technical publications.

ABOUT THE AUTHOR

MR. FRANK E. WINSHIP is Director of Support Data Engineering at the McDonnell Aircraft Company in St. Louis, Missouri. He has an academic background in Liberal Arts and Architecture obtained at the Universities of Valparaiso, Washington (St. Louis), and Minnesota. He is the McDonnell representative on the Maintenance Advisory Committee of NSIA and an alternate member of the Product Support Committee of AIA. Mr. Winship is a Registered Architect of the State of Missouri.