THE SIMULATOR TRAINING MATRIX

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ABSTRACT

There are five basic questions that should be answered by various DOD personnel prior to selection and procurement of a training device. The sequence of these questions and who does the answering is a critical determinate of whether or not the ultimate user actually gets what he wants or needs to fulfill the training requirement. An example of a simplified sequence of events or matrix is included, which can be applied universally to all new simulator procurements, modification to existing devices (CILOP - Conversion In Lieu Of Procurement), or new concepts incorporating "non training" requirements.

The rapidly changing threat environment has created a technology race that has finally reached a point in which the human factor must be removed from mundane operations. New weapon systems being delivered have attempted to accomplish this by increasing system capability and complexity, but the results have been an increase in the operators task loading. Although the manual manipulation of knobs and processing of information may have been decreased under routine conditions, the assimilation of data from several sources and abnormal situations which occur only in combat scenarios have actually increased the operator's task. To properly evaluate the equipment within the limited time frame of combat requires thorough knowledge and working experience with the individual black boxes and the whole weapon system. This, then, sets the requirement for a training program capable of realistically reproducing as much of the actual combat scenario and equipment capabilities/deficiencies and abnormalities (malfunctions) as possible.

We have now reached the point where the training system is necessarily more complex than the actual prime equipment it simulates. At some point in the not so distant past, this phenomenon would have resulted in instant turn-off and the training would have been scaled to a point less than necessary. Fortunately, the increased training system complexity commanded more budget attention, which opened the doors to more professional educators. These professionals then proved that the advantages of the super training system far off-set the heavy initial investment.

Many people have asked why systems are not made simpler, requiring less training, and thereby causing less budget strain. This paper will not dispute the virtues of either side, but only state that U.S. defense policy is to compete against "numerical superiority" with "qualitative superiority". It is a plain and simple numbers game where they have the manpower numbers in abundance - we don't.

The problem is to supply the needed training device with the sophistication required within the available budget. Since funding for specific programs of significant size is either funded within the prime budget or assigned a separate line number, timing of the requirement can be significant. If the program is new, such as a new aircraft buy or modification, the funding level asked takes trainers (new or modifications) into consideration. In cases where modification is no longer applicable or the trainer is procured after the prime is operational, a new line number is assigned and funding must be justified based on the merits of the trainer itself.

Maximizing the use of each budget dollar is easy to say, but difficult to accomplish. Alignment of priorities within the DOD budget starts after the known personnel costs are deducted. What is left is hardware and R&D. Training is relegated to the bottom rung of the ladder. This is where training dollar utilization is scrutinized. This is also where I believe the injustice is done. A system that uses checks and balances enhances the probability of fair and impartial decisions, but in this case provides for waste by contractor and military alike. No one can effectively argue that good training does not add to the effectiveness of any combat system. Regardless of the weapon system's age or complexity, training of some degree (whether operator, maintenance, or both) will add to its utility and efficiency. The waste comes from the different directions each agency takes. In each service we can account for at least four inputs; the Washington community that has to justify the budget figure; the using Command that inputs its priority list; the procuring Command (NTEC, PM-TRADE, AFSC), which may be further subdivided, and the user who has to actually utilize the device.

The breakdown and subsequent confusion results from the importance each agency attaches to the issues relevant to the requirement. I can think of five basic questions which are pertinent to any requirement:

1) What type device is best to satisfy the requirement.

2) Sophistication/fidelity required?

3) Number of devices needed for best return?

4) Value of the trade-offs (savings possible)?

5) New concepts availability/adviseability?

Each of these questions is asked and partially answered by at least one of the directing agencies. In some cases, the answers will cause

program delays, late RFPs, or even total redirection of the program. The priority given each factor is the key issue. Who should control the priority assigned is the key problem, and just as significant, where should the compromise be made?

The first question of what type device is best to accomplish the objectives appears easy to answer for the uninitiated. The user almost always will opt for the most elaborate innovative new contraption "available". Available is an important word because he wants it now. The budgeteer attempts to use the existing device with a minor modification effort. This is the CILOP (Conversion In Lieu Of Procurement) principle and is a very effective method of getting a needed training capability at a relatively inexpensive price - sometimes. A third approach comes from the engineering faculty that tends to push technology that favors an innovative approach, and a full scale development. Neither of the three methods should be eliminated but they should be harnessed into a useable matrix where they are treated fairly in accordance with operational priorities.

Agreement can be reached on the correct type of device for most situations when no present device exists and funds are either limited or capable of sustaining the latest technology. Throwing a hitch in at this early stage is the non-training requirement. This elusive non-training related capability can come in several flavors. Another important aspect affecting relatively large programs is politics. Politics play an obvious part in the budget cycle, but often forgotten are the issues of foreign buys, State favoritism, and reelection commitments/promises. Images and morale are also aspects to be considered.

A good example of a program caught in the clutches of both the non-training requirements and the conflict between agencies is the Air Force's Companion Trainer Aircraft (CTA) program.

Originally heralded by Strategic Air Command as the answer to several near and far term problems, the CTA has yet (as of 1 July 1981) to be clearly defined and into a contractors hands.

Senator Barry Goldwater spoke at the 1st Interservice/Industry Training Equipment Conference in 1979 calling the CTA program " .... an innovative way to have real flying training with significant fuel and dollar savings." The original concept did that. It would save in fuel by providing B-52 crews training in an aircraft at less than one-tenth the fuel of a B-52, and unlike a ground trainer it provided actual flight training that could be judged as a positive for pilot morale as well as proficiency.

The CTA program utilizes an off-the-shelf business jet with both real and simulated equipment in the passenger compartment to train a B-52 crew. The electronic warfare portion was to be closed-loop simulation whereas the offensive system would use simulated bombing controls, but real-time radar.

The cockpit would receive only minor instrumentation changes to reflect the B-52 environment. Analyzing the CTA program, it becomes very easy to see how it was sidetracked so often. The problems started with Congress were aggravated by the contractors, and finally ran into internal Air Force problems related to solving the first two conflicts. Problems from Congress came in funding profiles, foreign politics, and basic civilian trust of the military objectives. Normally non-defense contractors jumped in early to exercise their political muscle to see this new avenue of potential sales start up. In this innovative new approach to training, civilian products would find a relatively large market not previously open. Finally, the user (SAC) and the buyer (ASD) fought over the requirements and procurement method.

Back to the type of device to be utilized. Assuming no non-training aspects are apparent, the real requirements should be decided by the user, then negotiated with the buyer. Only after this procedure is complete and fully agreed to by both parties should contractors be allowed entry. Now the draft RFP and industry comments. Unfortunately it never seems to happen this way. In most cases the user states the requirement in general terms and the buying engineers attempt to design the product within budget constraints. The user does not object strongly to the procurement approach or the specific requirements the buyer described in the RFP.

With this scenario, the emphasis is placed on budgetary constraints and how the service estimates the program profile. Whereas this may be a totally realistic approach, it is not in the best interest of the service.

Quite often the cost estimating by the service is off considerably in either direction. This can serve to slow down or kill a particular project before it has a chance to begin. If the project is assumed to cost more than the budget will allow, the requirements may be cut to a minimum. This leads to a mediocre training device that won't do the required job, but the user has no choice - take this item or none at all. When the RFP is issued with the reduced requirement, industry will bid the budget less the winning price strategy. If the original requirement had been pursued, perhaps the competitive nature of our system would have produced the project within budget by innovation. In effect, the Government is robbing itself and stifling innovative competition.

Back to the five basic questions, question two is asking for a qualification of the sophistication or fidelity to do the job. Again the problem rests with who should answer the question. Engineering can certainly investigate or evaluate the competitiveness of analog versus digital, but they should not have the final say in training fidelity. This should be answered by the direct user. The direct user is not the using Command, it is the simulator supervisor or simulator instructor. These are the individuals who can answer the question of device requirements better than anyone. Let the Instructional Systems Development (ISD) personnel determine the training goal for the device and the simulator supervisor determine what "he" needs to achieve that goal.

The third question is for those staffers that have finally seen the "big picture". The number of devices needed is related to manning and the particular operation. This question must be coordinated between the user and buyer. The user can state the number of places the devices will be required and the time required on each per day. The buyer can utilize this requirement, combine it with the engineering assessment of life-cycle cost and MTBF (Mean Time Between Failure) rates, and a fairly accurate number can be arrived at. Although the questions of number is usually answered by a pseudo-reliable method, problems arise in funding profiles and force structure changes. Since multi-year funding is probably a dream in simulator procurement and changing administrations bring new modernizing ideas for the military, stability in numbers will probably be no more accurate in the future than they are now.

Evaluating the trade-offs for training (question 4) can be hazardous to one's career in government service. Although the weapon systems training expert may evaluate procurement timing as the important factor overriding a cost penalty, the final result may not even consider the device availability. Again, as in the other questions, the value assigned to specific features or requirements are generally stipulated too late in the game (causing them to be slanted due to cost, politics, or other known inputs) and by the people least affected by the outcome. Up-front assignment of values to different aspects should be completed and agreed upon at the same time the requirements are laid out. The value points should be assigned by requirement priority, rather than realistic expectations. Too often cost becomes predominate. The question of how much will be allotted to spend on this system should not be utilized as a criteria for establishing requirements or priorities. The training needs are first. Potential savings should be evaluated after realistic cost and performance data is evaluated in response to the requirement. Looking for the cheap way out or the paper savings that everyone claims have jeopardized some training programs and on occasion have produced a product of little actual training value because the program structure was decided before the facts were in or the requirements were defined.

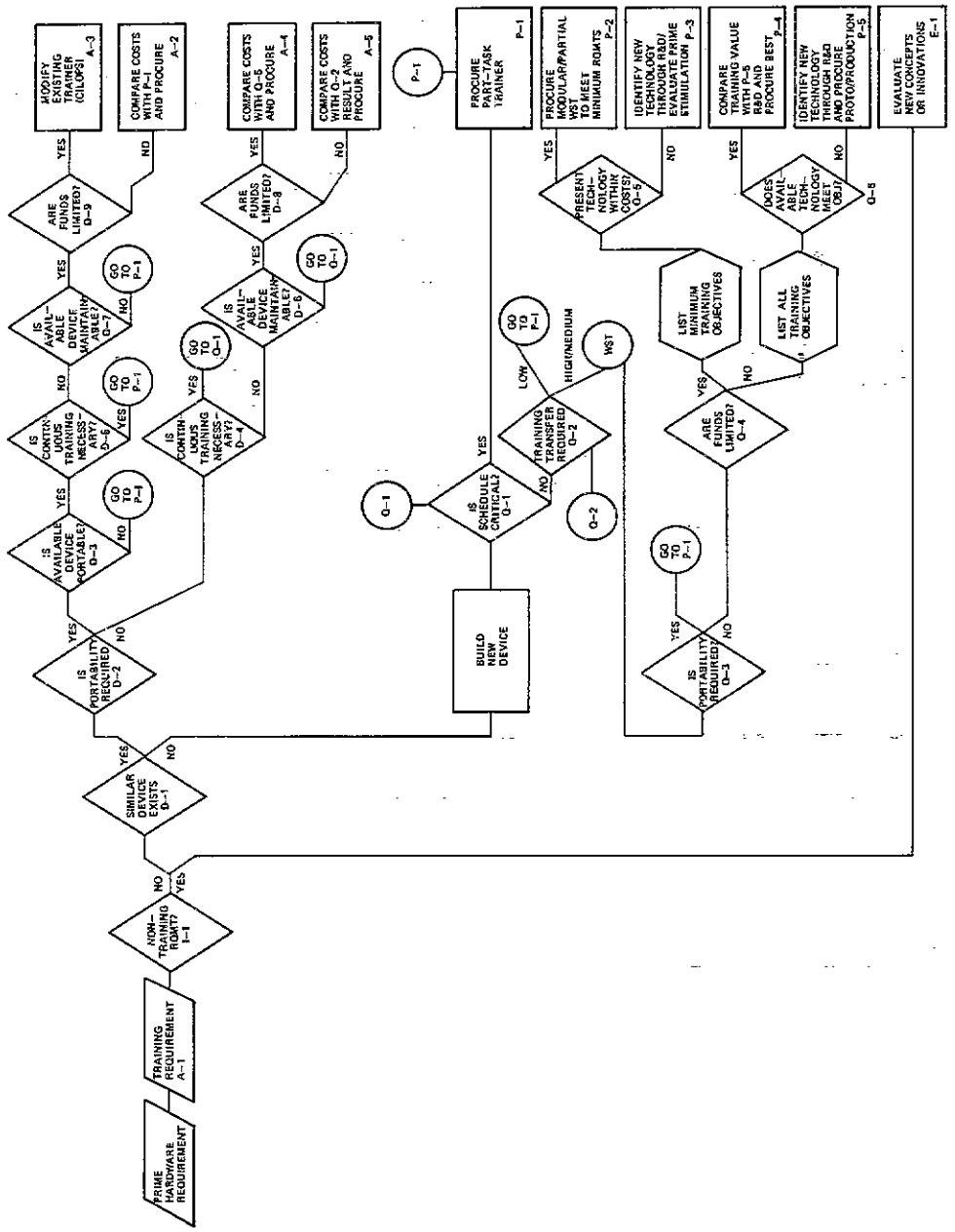
Many times the contractors will bid to the budget rather than to the requirements, or even worse, bid for the "buy-in" with the expectation of ECP's (Engineering Change Proposals) to pull them out of the "red". When this occurs, the usual result is the end user gets an inferior product with idle hopes of recovery far down stream. Perhaps the answer is a complete reversal of DOD buying strategy. Don't set a budget for individual items, but rather a total figure for each service with further breakdowns for such categories as strategic or tactical. Issue the RFP's for projects deemed worthwhile on a priority basis each year and assign budgets to the programs when the proposals are evaluated. Perhaps a tougher way to do business, maybe impossible to convince Congress (for major sums of such projects as MX, CX, Trident, LRCA), but it might eliminate buy-ins and products of lesser value than originally requested. This concept will seem totally irresponsible if not closely thought over. Isn't the DOD budget already decided this way? Real growth is projected against the inflation and when added to the previous years figure, a new budget is born. For those of us not involved in the budget process, isn't it odd that the yearly budgets always increase by a small, but semi-predictable growth factor. Can anyone remember when the DOD budget showed radical movement, either up or down, in response to real weapon system costs (except possibly during actual war periods)? Don't major weapon system costs get spread over a period of years to alleviate major deviations in the upward straight-line graph? Now, without changing this method, let's lump all minor cost (relatively speaking) items such as training devices into a pot, large enough to compare favorably with the overall budget increase, and draw our individual allocation by program priority after the costs are in. Costs are now real and the user gets the required capabilities on his "top priority" devices.

Back once-more to the question of trade-offs or savings, the question today is loaded with problems. Who decides the trade-off at any point during the program acquisition cycle? The difference between a full visual system or motion base can be significant in cost, but the training obtained or lost by elimination may be of a much higher value. Negotiation should not have to occur once the requirements are written. If the front-end analysis was done correctly in the beginning, the training requirement is a true requirement and should not be reduced or eliminated to achieve cost trade-offs.

The question of whether to proceed or not with a new concept should be answered within the engineering faculty of the procuring agency. They are best suited to decide the merits and risks in a new approach to solving the requirements. This question must not be asked until all requirements are defined, costs are evaluated, and the procurement timing is agreed upon. The tendency for engineering to explore new areas and concepts is natural, but must be avoided if it will destroy the integrity of the program structure such as operational viability or cost.

These brief discussions of the five basic questions are incomplete at best. A full answer to each question would take an entire paper in itself. By utilizing a matrix of decision flow and assigning the responsibility for the decision points, the questions are put in perspective, thereby eliminating some of the current problems and reducing others to manageable levels. The crude matrix I have drawn here is elementary, but is should serve as an adequate example. It assumes the dimensions enclosed by the five questions, and the relative sequence in which the decisions should be made.

Rather than following the matrix point-by-point to the conclusion, I will point out only specific areas and relationships. Note first that funding is considered last. The entire basis of my paper is that we have short-changed


PRIME HARDWARE REQUIREMENT
TRAINING REQUIREMENT A-1
NON-TRAINING ROM? I-1
SIMILAR DEVICE EXISTS D-1
IS PORTABILITY REQUIRED D-2
IS AVAILABLE DEVICE PORTABLE? D-3
IS CONTIN-UOUS TRAINING NECESS-ARY? D-4
IS AVAIL-ABLE DEVICE MAINTAIN-ABLE? D-6
ARE FUNDS LIMITED? D-9
MODIFY EXISTING TRAINER (CILOR) A-3
COMPARE COSTS WITH P-1 AND PROCURE A-2
GO TO P-1
GO TO P-1
GO TO P-1
IS CONTIN-UOUS TRAINING NECESS-ARY? D-4
IS AVAIL-ABLE DEVICE MAINTAIN-ABLE? D-6
ARE FUNDS LIMITED? D-8
COMPARE COSTS WITH O-5 AND PROCURE A-4
COMPARE COSTS WITH O-3 RESULT AND PROCURE A-5
GO TO O-1
GO TO O-1
P-1
PROCURE PART-TASK TRAINER P-1
BUILD NEW DEVICE
O-1
IS SCHEDULE CRITICAL? O-1
TRAINING TRANSFER REQUIRED O-2
O-2
GO TO P-1
LOW
HIGH/MEDIUM
WST
PROCURE MODULAR/PARTIAL WST TO MEET MINIMUM ROM'S P-2
IDENTIFY NEW TECHNOLOGY THAT COULD MEET/ EVALUATE PRIME STIMULATION P-3
PRESENT TECH-NOLOGY WITHIN COSTS? O-5
YES
NO
LIST MINIMUM TRAINING OBJECTIVES
ARE FUNDS LIMITED? O-4
IS PORTABILITY REQUIRED? O-3
GO TO P-1
YES
NO
COMPARE TRAINING VALUE WITH P-5 RESULTS AND PROCURE BEST P-4
DOES AVAIL-ABLE TECH-NOLOGY MEET OBJ? O-8
IDENTIFY NEW TECHNOLOGY THAT COULD MEET AND PROCURE PROTO/PRODUCTION P-5
LIST ALL TRAINING OBJECTIVES
EVALUATE NEW CONCEPTS OR INNOVATIONS E-1

ourselves by purchasing the wrong item because it "fit the budget profile." Define the product first, then budget to accomplish the task.

The inclusion of a non-training requirement is a significant factor normally left out. Obviously more detail could be placed between the decision of a non-training requirement to be fulfilled and the resultant buy of a new concept. CILOP also has a place up front. This block is where the initial "training" requirement should be detailed by the user. Allow the user command or the buyer engineers to determine the applicability of the CLIOP principle.

The rest of the matrix involves a simplistic decision tree that need not be detailed in this paper. The necessary factors to be considered in any acquisition cycle are listed; the order or priority and the decision maker are the important concepts. It is the obligation of both industry and DOD agencies to assure the public that each dollar spent is based on a real need. Purchasing a device because it fits the budget does not guarantee that the dollar was spent wisely. Only when the total training requirement is satisfied and an industry's competitive nature is exercised is the public being assured of getting its money's worth.

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Mr. Michael Paul Scher is currently Head of Air Force Advanced Program Development for Hughes Aircraft Company's Training and Data Systems Engineering Operation. His main responsibilities involve market analysis for Air Force simulator requirements and program budgeting. His previous experience includes eleven years with Strategic Air Command (SAC), U.S. Air Force, as an Electronic Warfare Instructor and Simulator Supervisor.