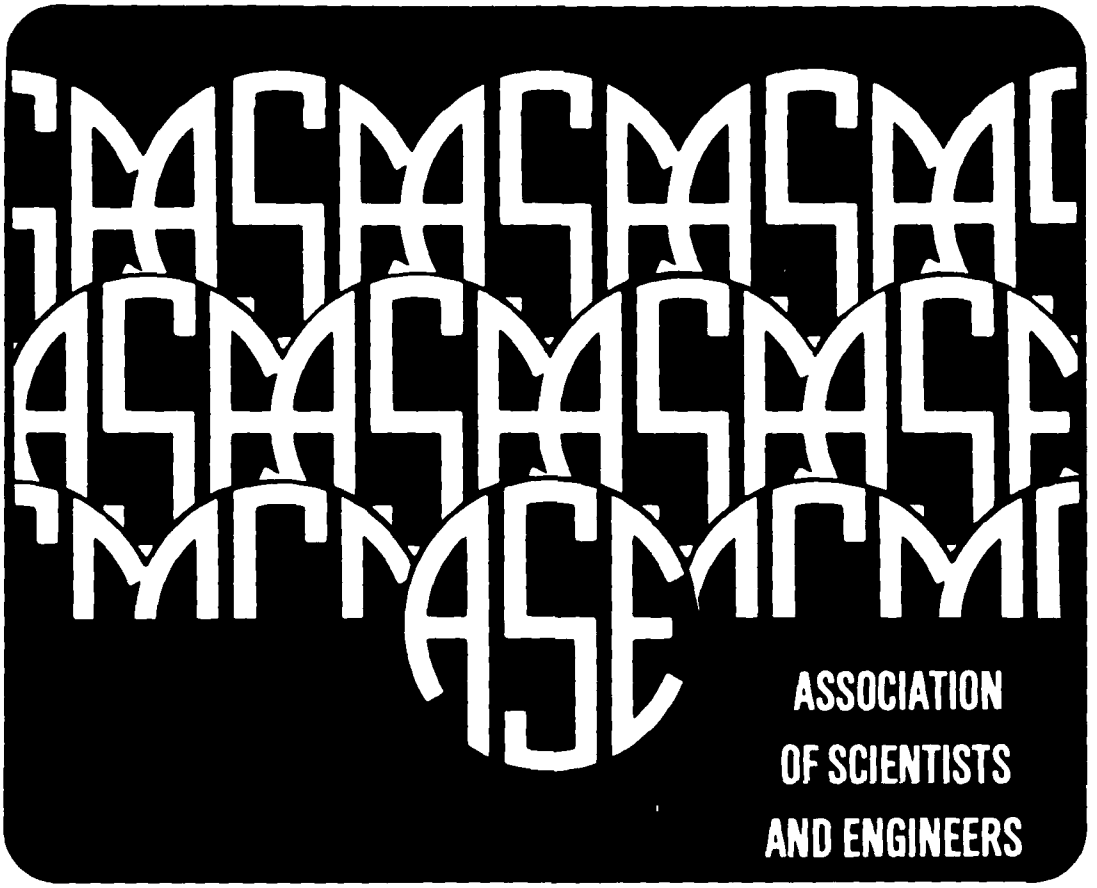
AD-A114 223 ASSOCIATION OF SCIENTISTS AND ENGINEERS OF THE NAVAL --ETC F/G 5/9
THE TECHNICAL VACUUM, AND WAYS OF FILLING IT,(U)
APR 82 D P BROWN

UNCLASSIFIED NL

END
DATE FILMED
05-82
DTIC



THE TECHNICAL VACUUM, AND WAYS OF FILLING IT

DAVID P. BROWN

19TH ANNUAL TECHNICAL SYMPOSIUM 1982

ASSOCIATION OF SCIENTISTS AND ENGINEERS OF
THE NAVAL SEA SYSTEMS COMMAND
DEPARTMENT OF THE NAVY WASHINGTON, D C 20360

THE TECHNICAL VACUUM, AND WAYS OF FILLING IT

David P. Brown
Electronics Engineer
Combat Systems Design and Implementation Branch, SEA 61X22
Naval Sea Systems Command
April, 1982

Approved for Public Release
Distribution Unlimited

The views herein are the personal opinions
of the author and are not necessarily the official
views of the Department of Defense or of
the Department of the Navy

ABSTRACT

In light of the Naval Sea Systems Command`s (NAVSEA) growing dependance on commercial engineering talent, training programs for new engineers should be geared toward developing a stronger technical expertise. The engineer in training (EIT) at NAVSEA is faced with an overwhelming engineering management workload and the adjustment of the EIT to these conditions during the vital initial training phase may obscure the development of technical proficiency outlined in NAVSEAINST 12410.2.(1)

The decision to strengthen NAVSEA`s technical expertise has already been made and the discussion herein is proposed to support areas of interest toward NAVSEA`s future technical development. Discussion is centered on the training phase of recently hired engineers and is directed toward training plans which would make the most of the new engineers` talents and at the same time develop the EIT`s education so as to produce technical proficiency on a higher level than presently exists.

TABLE OF CONTENTS

INTRODUCTION

As the need for a stronger naval defense posture presents itself, and with a large portion of that strength dependant on electronic systems necessary for effective operation of naval vessels, the deficiency of the Navy`s technical personnel becomes more and more apparent. The increase in NAVSEA`s ship design workload contracted out to commercial firms has been about 33% since 1971 when NAVSEA`s contract workload was about 37%.(2) This increase in contractor dependance has been noted by the Commander of NAVSEA and was discussed at an ASE luncheon for EIT`s in September of 1980. In brief the Commander of NAVSEA has shown great interest in developing strong technical expertise in NAVSEA personnel and has taken steps to bring about this change.

At present, NAVSEA is in need of numerous technically trained personnel to offset its current contractor dependance. Disciplines such as Electronics, Computer Design, Systems Integration, Naval Architecture, Power Systems, Material Science, and Structural Design have always been necessary to provide mission reliable naval ships, but the majority of these disciplines are centralized in private industry due, possibly, to higher salaries or more desirable work locations. The above disciplines, as well as effective management personnel to coordinate the design effort, should be recruited from as many areas as possible to accumulate the technical expertise needed to meet the future design responsibilities of NAVSEA.

Since this paper is directed towards EIT`s, I will address recruitment of college graduates with BS or MS degrees.

TODAY`S ENGINEERING GRADUATE

Undergraduate engineering curriculums are not necessarily geared towards the degree of insight that would make an ideal NAVSEA engineer. The basic engineering fundamentals; physics, calculus, circuit theory, mechanics etc. are surely a necessary part of an aspiring engineers repetoire, but the higher level courses tend to channel a student into more specialized fields of study. In the electronics field, for instance, one such drift has been from systems design to semiconductor technology. This sort of specialization in undergraduate curriculums is usually in preparation for Masters Study. The result is a large number of engineers with Masters Degrees suffering from a sort of tunnel vision when released into the work force. Although NAVSEA may have a place for these persons, it would seem that courses that are more system oriented would be the optimum curriculum for eligible NAVSEA engineers. Needless to say, NAVSEA can do little to influence an Engineering school`s curriculum, other than to provide CO-OP type opportunities for undergraduate engineering students and,

thereby, foster an interest in ship design which may influence a students choice of courses. Unfortunately, so many undergraduates are overwhelmed with CO-OP opportunities in the private sector that in many instances interest in Federal careers doesn`t develop until hiring interviews are held with prospective graduate candidates.

THE PRESENT STATE OF NAVSEA EIT`S

One question that may arise in light of the above discussion is; exactly how well prepared are graduate engineers to perform the type of engineering required by NAVSEA? Being an administrative arm of the Department of the Navy, the type of work expected of NAVSEA engineers is not the sort of engineering that a recent graduate may be accustomed to. The specialized training that a new graduate has received must be augmented by an understanding of the system nature of ship design in order to gain familiarity with the operation of NAVSEA and avoid the inevitable confusion of whether one is an engineer or engineering manager. The realization that no single discipline takes precedence over any other in ship design only serves to further confuse the specialized EIT. The new engineer may feel that he is lost in a bureaucratic maze when the majority of work he is first required to perform has no relation to his college studies. Many colleges do not offer engineering management courses as a requisite for a bachelors degree; this type of study is usually reserved for Masters curriculums. Thus, many technically proficient graduates suffer due to the lack of understanding of proper management procedures and how to gear their efforts in support of management objectives. This area is where the presence of a good supervisor can alleviate a great deal of confusion for the EIT.

It is usually after coming to grips with the management aspects of NAVSEA engineering that EIT`s are better able to determine if they are ready to accept engineering management versus hands-on design work. This is a time when EIT`s realize that much of the work they have been trained for is being contracted out to the private sector and that future job assignments will consist mostly of managing these design efforts. One of the most satisfying aspects of engineering design is that the ideas that one has can be transformed into something physical. The accomplishment of something on your own from start to finish gives any person a feeling of achievement and success. The desire to utilize the design skills learned in college is a primary driving force for young engineers and at NAVSEA a lot of new ideas that engineers have for a design or development of a project may be passed on to contractors. It is rather upsetting for the EIT to see projects that he was trained to do in college being done by outside companies when both time and money could be saved if

done in-house. An EIT could start to have doubts as to the importance of his contribution to the organization when jobs that could be done by in house personnel are trusted rather, to a private contractor. The most dangerous repercussion caused by the above feelings is an impression by the EIT that NAVSEA is not a technically challenging and stimulating environment and, career wise, not a place where advancement is most promising. Many new graduates have a fair amount of experience in the design of various basic systems and feel that these basic skills are the foundation on which their technical development should be built. Not being able to directly utilize the skills gained during college is frustrating for the EIT because of a feeling that the job NAVSEA has does not fully utilize or develop his talents to their full potential. In fact it is at this point in an EIT`s training where he really must make a decision as to whether NAVSEA is the best place for him. Hopefully, the majority of EIT`s will remain, but inevitably some will choose careers elsewhere, possibly supplying contractor support to their previous employer.

What nòw, can be done to provide positions at NAVSEA that do not seem so alien to an engineering student and provide an atmosphere of technical expertise that will interest new engineers. First, a summary of the issues that contribute to the EIT`s problems at NAVSEA:

1. College curriculums do not provide an insight into highly system-oriented disciplines

2. Naval Ship Design does not emphasize one particular engineering discipline.

3. NAVSEA`s mission is to provide Engineering Design and Management of current technology for U. S. naval ships and their associated systems.

4. Training programs are not specific enough to uniformly settle EIT`s into their jobs.

To alleviate the first three problems there is little that can be done short of developing a prospective engineers interest in Naval Engineering at an early stage of their higher education. Holding seminars and lectures at Universities may be a way of fostering some interest in Naval Ship Design, or possibly TV ads similar to service recruitment ads would help.

It is only through the EIT`s training program that a viable solution to the problem of properly developing NAVSEA engineers can be found.

NAVSEAINST 12410.2,(1) which describes The Engineer in Training (EIT) Program, leaves much of the EIT`s training up to

his or her supervisor. This actually makes the EIT`s training dependent upon the supervisor`s dedication to furthering NAVSEA`s engineering proficiency. I don`t wish to imply that supervisors aren`t interested in developing NAVSEA`s engineers, but apparently many aren`t as interested in producing well-rounded engineering trainees who will be an asset in any branch of NAVSEA. Certainly, the main concern of all supervisors is getting the job at hand done. Thus, EIT`s usually provide support to the ongoing tasks in their assigned code. It is important that constant exposure of the EIT to one side of a design effort be avoided. At this stage it is essential that the EIT not develop an attitude that one aspect of design takes precedence over all others. The question is whether training plans can be controlled by someone in close contact with EIT`s while allowing them to develop a feel for what NAVSEA is all about and skills to perform more of the type work that is presently contracted out. What is important here is that a training program designed by an EIT`s supervisor may end up tailored to that supervisor`s needs and not take into account the development of the EIT in as many aspects of ship design as can be gained from a particular area in NAVSEA. On the other hand, for the EIT to be in close contact with his supervisor gives the EIT a chance to learn how a design effort evolves and the management levels through which work must pass before it is acted upon. The supervisor`s input to the training plan shows again the separation between engineering and management at NAVSEA. In the case of little influence on the training plan by the supervisor more development of technical aspects can take place. In the case of large influence on the training plan by the supervisor many management methods can be realized by the EIT by more exposure to ways of getting a job done versus learning what is needed to do a job. The training should take place with a specific job in mind for the EIT at the end of the program but encompass as many disciplines as possible that affect that job. Thus, the contacts an EIT makes during training should prove beneficial to both employer and employee after becoming a member of whatever code sponsors the EIT`s training program.

TRAINING PLANS - A DIFFERENT APPROACH

The training plans proposed herein are based on first, a desire to establish technical proficiency, second, letting the EIT decide at the outset of the training plan a particular area of interest at NAVSEA, third, allowing the EIT to experience different aspects of NAVSEA`s mission while still having an idea of how this experience will be utilized at the end of training, fourth, giving the EIT a sense of achievement and development of skills that can be utilized at more than one task. The implementation of the training plans should begin at the EIT`s first orientation session by a training counselor explaining what types of training plans are available to EIT`s

and informing the EIT`s of the end results expected from each training plan. The training plans proposed herein are merely examples of what may be considered useful. The important aspect is that the training plans are tailored to the EIT`s interests and NAVSEA`s needs. The plans cover three areas, namely, Project Management, System Design & Integration, and Shipyard Coordination. The training plans allow an opportunity for an EIT to choose his or her area of initial expertise and still provide room for growth into other areas as his career progresses. It is essential that the EIT understand the options available to him or her if he is to integrate himself into the organization. By providing engineering opportunities of a diverse nature during the training phase the EIT will not only understand his role at NAVSEA, but also see how other groups in both the private and public sector interface with his particular group.

To establish the ground work for these hypothetical training programs we must establish certain given conditions:

1. The training period will last 3 years.

2. The first year is spent in an informal settling in period where the EIT rotates from code to code to become oriented in the jobs the different directorates are involved in and to choose one code to sponsor his training based on staffing availability.

3. The last 2 years are spent in the formal training programs described below.

4. The NAVMAT Employee Development Group shall designate for each EIT a NAVSEA sponsor based on a decision by the EIT on what type of work he or she is interested in. The sponsor shall be responsible for providing the EIT with opportunities and suggestions for development, evaluation of the EIT`s progress and the fielding of comments and criticism on the training program.

5. The EIT shall submit monthly status reports that will itemize tasks performed and denote personal feelings towards the employee`s development. These reports shall be reviewed by the EIT`s sponsor/supervisor and comments supplied by him regarding the EIT`s progress and potential for advancement in grade.

Let us now spell out the evolution of some of the training plans designed to produce happy, creative and technically proficient engineers.

During the first week on board, the EIT shall attend seminars on NAVSEA. The first 3 days will be an intensive 8

hour per day introduction into every directorate at NAVSEA and their responsibilities and contributions to NAVSEA engineering efforts. This introduction period, shall consist of films and lectures presented by higher level individuals in the code. Presentations shall be made by each directorate at the divisional level. The rest of the year is to be spent deciding the sponsoring code for the EIT and choosing a training plan as discussed in item 2 above. This decision period is a time when NAVMAT Employee Development personnel will discuss and suggest various training plans that are available and the new EIT can meet other EIT`s and share their thoughts and opinions about NAVSEA.

The Technical Satellite

This training plan is under the design and integration category and will be sponsored mainly by the 03, 05, 06 communities. The EIT will be assigned to NAVSEA field activities utilized by the sponsoring code to learn about equipment operation, integration and repair. This program would emphasize hands-on skill and give the EIT a chance to experiment with ships systems and possibly take part in a new design, or configuration of the equipment. The EIT will probably visit shipyards and become marginally familiar with their operation. The EIT should spend approximately 4 to 6 months at a different facility or on different projects or equipments in order to give him a diversity of knowledge of the systems used by his sponsoring code. The EIT`s status reports would be sent to his supervisor and contain the type of systems the EIT is working on and any problems he is having with respect to the environment at the field activity. The supervisor should provide suggestions and ideas about equipment that is of immediate interest to him and possibly assign the EIT to work in those areas only.

The expertise gained by this program will provide the chance for an EIT to do some engineering and design and be familiar enough with the systems to do similar work at his NAVSEA job. The contacts gained by the EIT at the various field activities should make his job a lot easier due to an ability to solicit information and advice from field activity personnel.

Wizards

This training program is designed for those EIT`s who wish to work mainly in Research and Development of new systems for naval application. The formal training period for these individuals will entail assignment to Navy R & D centers to learn about on-going R & D projects and gain familiarity with new technology with an eye towards the future needs of the Fleet. The sponsoring codes for these EIT`s will probably be

in the 03, 05, 06 communities and should be primarily involved in new ship designs. Supervisors should suggest to R & D centers what types of projects they are interested in and make efforts to introduce the EIT`s to these projects early on in the program so as to produce engineers that understand all aspects and usages of the new designs being developed.

Monthly status reports by these EIT`s shall be on the unclassified level and outline progress on projects that they are involved in. Suggestions should be made to the Supervisor as to how the systems of interest can be used on naval vessels, as well as, any problems the EIT is having in the program. With regard to NAVSEA`s future development, this training area may be one of the more important and advantageous to the Navy. To have present at Headquarters individuals cognizant in systems being researched during their training, the implementation and integration of these systems would be easier and much more cost effective in the long run. The money spent having consulting firms determine the feasibility of using the systems will be eliminated by having in-house personnel capable of assessing these areas effectively.

Contractor Clones

This training program will be very important in helping to reduce the current dependance on contractor support in Naval programs. The basic implementation of this training program would be a stipulation in NAVSEA contracts stating that provisions be made by the contractor to supply training in the expedition of the contract to a task engineer and an EIT. For the EIT, gaining knowledge on the systems designed by the private sector or the procedures followed by systems management and engineering consulting firms will make him able to apply this knowledge to other design efforts. It will take time before the contractor could be eliminated and in many cases design assistance from the private sector will still have to be employed but many of the routine management type tasks that are presently contracted out could eventually be accomplished in house. In this training program the EIT would report more to the task engineer than the supervisor, so that the task engineer could spend time managing the task while the EIT would be responsible for gaining the technical knowledge inherent in the contract. This program would be applicable to all the NAVSEA codes as contractor support is solicited in practically every area of naval engineering. The EIT`s that are more technically inclined would have an opportunity to gain expertise in the design phases of many types of shipboard equipment, from sensors to propulsion plants. EIT`s assigned to more management oriented codes will learn the various aspects of engineering management, scheduling, feasibility assessments, design criteria, etc.

Shipyard Diplomats

EIT`s that choose this training program would come primarily from the design directorates and would be assigned to shipyards conducting work under the cognizance of the code the EIT is sponsored by. This training would be likened to a small-scale NAVSEA representative. The EIT would be placed in a particular shipyard code at the request of the supervisor to gain experience in shipyard operations and to make contacts with individuals at the yard who interface with NAVSEA with respect to shipyard projects and design guidance. The EIT would attend all the indoctrination sessions for new shipyard employees and for all intents and purposes be trained as though he were a shipyard employee. The EIT should spend approximately 2 to 4 months in a different shipyard code working on the same ship or ship type so as to gain a feel for how the various shipyard jobs must be coordinated and integrated in order to get a total effort done in a cost effective manner. This type of training would be good for the management oriented EIT, as well as, the technically oriented EIT. For the management oriented EIT, shipyard experience will allow a chance to see what planning and time management is required in order to get a ship built or repaired on time and within cost. For the technically oriented EIT working in the shipyard will give him or her a chance to actually work with the product and provide exposure to ship systems as a whole. This type of training will help EIT`s realize what it really takes as far as manpower, time, planning, equipment delivery and repairs, test and inspection and many other factors to actually produce a mission capable naval vessel. The contacts made by the EIT at this time will prove to be invaluable as time goes on and will help to smooth over some of the communication problems that now exist between NAVSEA and the shipyards.

Management Masters

This training program would be oriented towards producing engineers that are highly trained for managing of ship designs, procurement and contract preparation. The EIT`s training will be mainly at NAVSEA with brief field assignments to areas of interest to the sponsoring code. The EIT would spend the majority of his or her training learning the methods of initiating and monitoring design efforts in order to produce ships on schedule and at targeted cost. For an EIT this may be the most difficult training plan to enter due to the EIT`s lack of familiarity with what is required to effectively manage design efforts therefore, close contact with the EIT`s supervisor is highly recommended. This training program would require that the EIT attend planning sessions and interface with engineers involved in design projects of interest to the sponsoring code. By constant exposure to upper level managers

through meeting attendance and conferences with other engineers, and receiving guidance as to effective management procedures from more experienced managers the EIT will at first develop a feeling for basic management tasks. As the EIT`s understanding increases he or she may be allowed to take a larger responsibility of task management but under the close supervision of a higher level engineer. The training program should involve frequent discussions with the EIT`s supervisor and task engineer to explain the evolution of the management effort and help the EIT identify recurring problems that come up in the management process. After a thorough understanding of the management objectives of one project is acheived by the EIT, another sponsor should be selected in a different area or ship class based on discussions with NAVMAT Employee Development personnel. By moving to different areas after the EIT and sponsor decide that an understanding of a particular management evolution has been reached, the EIT can utilize methods already learned on previous tasks on other management efforts elsewhere. By being able to build on previous knowledge the basic framework of management criteria can be augmented by management techniques particular to different efforts.

CONCLUSION

The training programs discussed herein are again, merely examples of what may possibly fill the technical gap at NAVSEA. What is hoped is that the examples spark an initiative in NAVMAT to review the present training structure and decide if there is adequate opportunity for EIT`s to develop strong technical expertise in shipbuilding and design. The training programs were drafted with more emphasis on the technical development of EIT`s than on development of managerial expertise. The ratio of three technically oriented programs to two management/coodination programs seems a fair proportion for the future design needs of NAVSEA. In the end management skills should be acquired to a reasonable extent by the more technically trained engineers through daily exposure to management constraints on engineering efforts.

An important factor in applying more technically oriented training programs is hiring a constant influx of EIT`s into the programs so effective staffing analyses can be accomplished and future needs assessed. The major factor in attracting graduate engineers is salary and the potential for advancement in a technically stimulating atmosphere. NAVSEA`s present starting salaries for EIT`s are much lower than those offered in private industry. The salary differential may be a determining factor in the quality of engineers hired at NAVSEA. Therefore, a higher paid engineer is usually one who is in greater demand due to more promise of technical expertise and creativity. If the money saved by having more of the work presently contracted out done in house through emphasis on the NAVSEA engineers technical ability offsets the salary differential between NAVSEA engineers and contractor engineers, more funds could be made available to attract even more highly qualified personnel in all areas of NAVSEA concerns. There may even be a surplus of funds to apply not only to salaries but to NAVSEA`s technical development of shipboard systems.

The above discussion is not advocating that all design be done in house, but that a determination should be made as to which tasks are eligible for in house work and which are beyond the scope of NAVSEA`s technical capability. Surely, many redundant type services that do not require additional guidance, such as, document preparation and full scale industrial development of systems could remain contractual type tasks, but much of the detailed design of systems from preliminary to final package can and should be a totally in house endeavor. Having detailed design done in house would provide NAVSEA with a number of experts on various systems and cut down the time required to identify and correct problems that may arise with systems so designed.

RECOMMENDATIONS

The future of NAVSEA is dependent on three central factors:

1. That the number of engineers hired by the Command continues in a positive trend.

2. That the training of EIT`s be conducted with technical proficiency in shipbuilding and design as the end product.

3. That problems that arise with naval systems can be expediently identified and corrected without having to initiate additional contract support with the manufacturers of the inadequate system.

Hiring is an area where NAVSEA will face the greatest difficulty. With the present starting salary for an EIT barely enough to survive in the Washington, D.C. area, starting salaries will have to be increased to a level comparable to those offered in private industry. Inevitably, college graduates with more technical ability will be attracted to Federal careers at NAVSEA and the savings gained by more engineering done in-house as a result, would more than balance the increase in engineering salaries.

The more advanced engineering graduates that could be attracted with higher salaries would provide NAVSEA with a very strong technical posture that would meet the future needs of NAVSEA. The training of these EIT`s with their knowledge of state of the art technology would further enhance NAVSEA`s shipbuilding industry. Surely, the innovations that could arise are enough to stimulate considerable interest in the areas discussed in the body of this paper.

There may be many who feel that the best way to save money is to have a large portion of the NAVSEA workload contracted out to private industry and thereby lessen the number of in house personnel. This may have been a valid option in the past, but with the complexity of the systems being designed for naval use increasing with each new application the subsequent design services required to support these additional innovations leaves NAVSEA too dependant on the contractor as the sole source of knowledge of those systems. The initial contract agreement for design and procurement of a new system may be highly cost effective, but in the long run having to establish a new contract to upgrade or maintain a system could increase the life cycle cost of the system considerably. The design of additional applications for existing systems, as well as, repair and maintenance of the system could be done in house provided there were personnel that understood the capabilities and the limitations of the systems by utilization of some of

the training plans described herein.

The only area left to discuss is how a new engineer can best be retained at NAVSEA. The beginning of training is the best time to begin making the EIT feel appreciated. To help EIT`s become better oriented they should have someone who has already been through the EIT program guide them through the program, providing someone to talk to when personal problems surface regarding the EIT program or the EIT`s work atmosphere. A confidant of this sort would be extremely helpful in assisting the EIT overcome some of the frustrations and confusion discussed earlier.

In closing, the development of a strong technical future at NAVSEA is a high priority of the Command. The above discussions have been offered as a personal approach to providing technically proficient, well-adjusted, and progressive engineering talent at NAVSEA. Undoubtedly, time alone will tell if any of the ideas herein will be applied to the future development of NAVSEA engineers. Any ideas that may develop as a result of this presentation will only serve to refine and compound the alternatives that NAVSEA can draw from to prepare for the years ahead.

REFERENCES

(1) NAVSEAINST 12410.2, The Engineer-in-Training Program of 27 November 1979 (cancelled by NAVSEANOTE 5215 of 13 April 1979)

(2) Report of the Engineering Resource Alternatives Task, RAdm J. W. Lisanby, Task Director. Naval Sea Systems Command, Dept. of the Navy, Washington, DC, 1980.