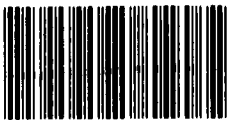
122345
~~21237~~

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

ACCOUNTING AND FINANCIAL MANAGEMENT DIVISION

B-175132

SEPTEMBER 14, 1983


122345

The Honorable Joseph P. Addabbo
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

Subject: Interim Observations on Review of DOD's Manufacturing Technology Program (GAO/AFMD-83-97)

Dear Mr. Chairman:

Your letter of November 5, 1982, asked us to assess the management of the Department of Defense (DOD) Manufacturing Technology (MT) Program, and describe its relationship to other Defense productivity programs, as part of an ongoing review (see p. 2). You asked that we send you an interim report on our work. We have not completed our review and therefore have not reached final conclusions, but are providing these interim observations as you requested.

The Office of the Secretary of Defense (OSD) and the military services have taken several actions to improve the management of the Manufacturing Technology Program since 1979, when we issued a report that pointed to weaknesses in that program's management.[1] However, further management improvements may be warranted in some areas. Some program officials in OSD and the military services acknowledge the need for further management improvements.

In examining the relationship between this program and other Defense productivity programs, we identified two programs with closely related objectives. These are discussed on p. 9 of this letter. However, a complete look at how other Defense productivity programs relate to the MT program would be very time consuming and beyond the scope of this review.

This letter supplements several briefings and discussions we have held with your staff on this subject. One such briefing on the management of the MT program preceded the June 22, 1983,

---

[1]"Manufacturing Technology--A Cost Reduction Tool At The Department of Defense That Needs Sharpening" (PSAD-79-99, Sept. 11, 1979). A copy of the report was provided to your staff.

122345
~~21664~~9

(910364)

hearings on procurement policies and practices of the Department of Defense. To develop our observations on the relationship of manufacturing technology to other programs, we used the results from previous and ongoing GAO reviews of Defense productivity programs.

BACKGROUND ON THE MT PROGRAM

The primary objective of the MT program is to improve productivity and reduce Defense acquisition costs. The program provides funds for demonstrations of new or improved manufacturing processes, techniques, or equipment in defense contractor and DOD-owned manufacturing facilities. It tries to encourage defense contractors and DOD plants to implement or use the results of these demonstration projects in the production of equipment.

The MT program is managed primarily by the military services through centralized program offices and engineering support staffs. Program management offices are located in the Naval Material Command, the Air Force Systems Command, and the Army Materiel Development and Readiness Command. Some major subordinate commands also have small MT program management offices.

Above the service level, the Under Secretary of Defense for Research and Engineering maintains a small staff to provide policy guidance and general oversight for the program. A Manufacturing Technology Advisory Group, comprising representatives from federal agencies and industry associations, assists in coordinating and promoting the program. The program has long been popular among defense contractors, as evidenced by their heavy participation in annual Manufacturing Technology Advisory Group conferences and workshops.

Identifying MT program funding in the military services' budgets requires analysis of several accounts. Most Navy funding is identified as one line item in one account--"Other Procurement, Navy." Most Air Force funding is included in three procurement accounts while the Army, until fiscal year 1983, used four separate procurement accounts to fund its MT program. Each service also funds portions of its MT program through research and development, or operations and maintenance accounts.

Our review was initiated last year at the request of the Chairman, Subcommittee on Economic Stabilization, House Banking, Finance, and Urban Affairs Committee, because Defense was planning a major expansion of the Manufacturing Technology Program. In February 1982, the Deputy Secretary of Defense called for more than double the level of funding--from $0.7 billion spent from 1978 to 1982, to $1.6 billion to be spent from 1983 to 1987. The MT program was funded at $142 million in 1983; funding is expected to increase to $210 million in 1984 and continue to increase each fiscal year through 1988.

GAO'S EARLIER RECOMMENDATIONS TO IMPROVE THE MANUFACTURING TECHNOLOGY PROGRAM

In our 1979 report, we recommended that the Secretary of Defense:

"--Ensure that the services exercise their criteria for funding projects so they specifically focus on achieving the program's primary goals; that is, improving manufacturing productivity and reducing material acquisition costs.

--Devise and institute a consistent project ranking system, applicable to all services, to assure that program resources are spent on the most beneficial projects within each service.

--Develop and institute a uniform, centralized management data system that would allow program managers to evaluate and control program effectiveness.

--Insist that the services comply with their own implementing instructions regarding the reporting of cost savings and lessons learned.

--Have the services make regular evaluations of their programs and identify and correct deficiencies. Quantifiable measures of effectiveness must be developed that correspond to program goals.

--Have the services actively promote the use of Manufacturing Technology project results. At the very minimum, the services should have a plan for implementing project results into the production contract of the target system the Manufacturing Technology project was demonstrated on.

--Have the services account for use of program funds by documenting for each project what was spent, where it was spent, what benefits were expected, and what benefits were actually realized."

These recommendations reflected our view of the need for improvement in the program's management controls and procedures. More importantly, the recommendations intended to encourage DOD to (1) devise procedures that would ensure that MT project results are implemented into the production of defense systems and (2) track and document such implementations and the ensuing benefits. We felt the MT program could not satisfy its stated goals without procedures to accomplish these tasks.

DOD RESPONSES TO GAO'S RECOMMENDATIONS

The Office of the Secretary of Defense and the military services have taken actions to implement some of our 1979 recommendations although none of the recommendations have been fully implemented Defense-wide.

In commenting on a draft of that earlier report, DOD disagreed with our first two recommendations. On the first recommendation, Defense asserted that project selection criteria should permit the funding of manufacturing technology projects that go beyond the primary aims of cost reduction and productivity enhancement. These might include safety, health, pollution abatement, energy conservation, and others. On the second recommendation, Defense asserted that a consolidated project ranking system would not improve the project selection process because the program is funded from various appropriations and funds are not transferred among appropriations. In our final report, we disagreed with DOD's assertions--stating that (1) the MT program objectives are distorted by funding some types of projects, and (2) our second recommendation would not involve transfer of funds.

Defense concurred with our five other recommendations and stated that strengthening centralized program management within each service would provide a positive response to most of our conclusions and recommendations. In its written response to our draft report, DOD attached a June 1, 1978, memorandum from the Undersecretary of Defense for Research and Engineering directing the military departments to strengthen centralized MT program management and improve program evaluation.[2] Eight program improvement needs were cited. One was the need to continue performing production "cost-driver"[3] analyses which help identify and rank high payback manufacturing technology areas. In this regard, the Undersecretary directed the development of a long range triservice plan to make sure key areas are not overlooked. Other needs cited were more effective linking of weapon system offices and MT program offices, and stronger government/industry coordination and cooperation. (See encl. 1 for a copy of the DOD memorandum.)

DOD and the military services view various management improvements made since 1979 as responsive to both the Undersecretary's memorandum and our recommendations. These include improvements to (1) program planning and project selection, (2) monitoring, (3) implementation, and (4) evaluation. As part of our ongoing review,

---

[2]This memorandum reinforces an April 11, 1975, memorandum from the Deputy Secretary of Defense requesting that the military departments increase emphasis on manufacturing technology including centralized management, increased funding and visibility, and identification of significant cost reduction initiatives.

[3]A factor in the production process that contributes significantly to the cost of the product.

we are attempting to fully document and evaluate all significant management improvements since 1979. The following pages briefly discuss some of the improvements and some areas in which action has not been taken. Our final report, of course, will more fully address these and other areas.

Program planning and project selection

Regarding program planning and selection, the military services cite the following management actions taken since 1979:

--Continuing use of planning workshops and conferences to define and rank critical manufacturing technology needs from an industry perspective.

--Continuing use of cost-driver conferences and studies to identify and rank high payback manufacturing technology investment areas. The Army has held three cost-driver conferences since 1978. The Air Force has also funded conferences and studies but the number was not readily available. The Navy has not funded any in recent years.

--Efforts to link potential MT projects to specific production requirements. The Army, for example, now requires that project proposals include implementation plans to show how the MT project's results fit into the life cycle of the target systems. The Air Force Systems Command now requires that its product divisions brief its MT program office on specific production requirements and how the program can help.

--Efforts to improve project selection by strengthening formal project documentation. The Air Force, for example, expanded the project descriptions it prepares for budget estimates and financial plan submissions so that they identify the target system on which project results are to be implemented, and better document the need for the project.

On the other hand, neither the services nor OSD have developed servicewide or DOD-wide project ranking systems. All three services have procedures to rank projects below the servicewide level. A long range triservice plan to improve program planning, as envisioned in the Undersecretary's 1978 memorandum, has not yet been developed.

Monitoring

The military services have taken several actions since 1979 to strengthen their project monitoring procedures. For example, the Navy has recently shifted the primary focus of its centralized MT program support staff from proposal review to monitoring. To assist the monitoring role, the Navy established in June 1983 a management information system which, according to Navy officials, contains information on about 200 proposed and ongoing projects dating from fiscal year 1977 forward.

The Army, in fiscal year 1982, formally instituted semiannual on-site reviews of active projects by top program staff. The reviews are intended to ensure that projects are completed on time and that applicable policies are carried out. Army officials said 12 reviews were held in 1983 and 3 more were planned. Also, the Army has had a management information system for monitoring Manufacturing Technology projects since 1976. The Army's system is not fully compatible with the Navy's recently established system.

The Air Force does not have a management information system to monitor MT projects, but it is planning one. Its MT program office currently receives administrative and procurement information from the management information systems of other Air Force programs, but these systems do not provide detailed information on MT project status or results.

The Office of the Secretary of Defense does not yet have the triservice management information system we recommended in 1979; however, it acknowledges that such a system is needed for monitoring. (See pp. 7 and 8 for further discussion.)

Implementation

Since 1979, the military services have taken various steps to increase the likelihood that the results of Manufacturing Technology projects will be used to benefit the production of Defense systems. The steps taken, however, only increase the probability that Defense systems will benefit from MT--there is no guarantee.

All three services, for example, now require that an implementation plan be prepared before an MT project is completed. Implementation plans encourage the use of MT project results in production by linking projects more directly with specific production requirements. The Navy requires an implementation plan 3 months before project completion. The Air Force and Army require a preliminary implementation plan at project initiation which is updated and made final when the project is completed.

Beginning with fiscal year 1982 MT projects, the Navy requires that a "memorandum of understanding" with the responsible acquisition manager be signed before projects are funded. These memoranda are intended to ensure that acquisition managers understand the anticipated benefits and are willing to implement MT project results in the systems they are acquiring.

Further management actions regarding implementation may be necessary since the results of many projects still do not directly benefit the production of Defense systems. OSD officials in 1981 and again in 1982 reiterated the need to ensure that the results of the MT projects are used in the production of Defense systems. As part of our ongoing review, we are seeking to identify additional management actions needed to encourage implementation.

Evaluation

All services have taken some actions to identify how results of Manufacturing Technology projects are used after project completion. However, the efforts to assess the results of completed projects vary, and are subject to differing interpretations.

The Army, for example, has conducted annual surveys since 1979 to determine the benefits derived from completed projects. The results of these surveys are summarized and distributed to interested parties in and out of DOD. While the Army's evaluation efforts are more comprehensive than those of the other two services, the Army's reports can be misleading without a clear understanding of the reporting instructions. For example, "implemented" projects include planned implementations, as well as those actually in use.

In 1983 the Navy assigned its program support staff the responsibility to track and assess the benefits of completed projects. In the same year, on a special one-time basis, the Navy inventoried the status of all the projects it had funded since 1977.

In April 1982 the Air Force contracted with a private company to assess the technical results, implementation, and resulting benefits of 77 completed MT projects at nine contractors. The final results of this assessment are not yet available.

OSD has also attempted to demonstrate program benefits. For example, it requested both in 1982 and 1983 that the military services identify their "top 10" success stories. Our ongoing review includes an attempt to substantiate selected results of these two efforts.

These efforts by the military services and OSD indicate partial response to our 1979 recommendations. However, DOD still has no uniform system to readily ascertain how the results of all completed projects were used, and what actual benefits were realized.

CURRENT DOD CONCERNS IN MANAGING THE MANUFACTURING TECHNOLOGY PROGRAM

Manufacturing Technology officials in OSD and the military services have differing views on progress made toward better management of the MT program. On the one hand, some officials perceive that significant progress has been made. They cite the management improvement actions described in the previous sections. On the other hand, some officials expressed concern that more progress had not been made to correct known management weaknesses.

Manufacturing Technology officials at OSD level believe three major initiatives are still needed to improve overall program management:

--Updated program policy. The DOD instruction for the Manufacturing Technology Program has not been updated since 1972

despite significant program changes at the military services level. OSD has had a formal draft revision of the instruction in process since April 1982.

--A triservice management information system. OSD has been attempting to develop a triservice management information system since 1976 but progress has been slow. OSD officials said they intend to mandate development of a triservice system in the revised DOD instruction for the program.

--A Manufacturing Technology information analysis center. DOD officials said a center is needed to summarize and analyze technical data to more effectively transfer and diffuse Manufacturing Technology project results to defense contractors and others in the public and private sectors.[4] OSD asked the Army in 1980 to fund a study to plan such a center. In July 1983 OSD requested proposals, subject to availability of funding, to establish and operate a center.

Program officials point to disagreements between OSD and the military services regarding the appropriate extent of OSD's management direction and control, as contributing to delays in finalizing the first two management initiatives. OSD officials want more management control; the military services want OSD to have less. They say a lack of funding has delayed the Manufacturing Technology information analysis center.

Navy officials point to a different problem. They believe reprogramming of Navy MT funds to other programs prevents effective program planning and disrupts management. Some officials expressed concern that the Navy program has been subjected to significant reductions in annual funding over the past few years, after the budget has been approved and funding appropriated.

OSD and Army officials also express concern about recent reductions in funding and a change in the type of funding for the Army MT program. The Congress reduced a request for $120 million for the Army program to about $51 million for fiscal year 1983. The Congress also shifted all 1983 Army funding from procurement accounts to research and development accounts. Some Army and OSD officials believe these actions may be detrimental to their ability to effectively plan and manage the Army program.

---

[4]The center would be similar to nine other information analysis centers now managed and funded by the Defense Logistics Agency and the Defense Technical Information Center. These contractor operated centers collect, analyze, and store available information on subjects of highly specialized technical areas of concern. The information is then repackaged and disseminated to users in the public and private sectors.

RELATIONSHIP OF THE MANUFACTURING TECHNOLOGY PROGRAM TO OTHER DEFENSE PRODUCTIVITY PROGRAMS

While we have not made comprehensive reviews of all DOD's productivity improvement initiatives, we have examined some aspects of several major Defense productivity programs. Two programs with objectives closely related to the MT program are

--the Industrial Modernization Incentives Program, which is still in an experimental stage, and

--the Productivity Enhancing Capital Investment Program.

The Industrial Modernization Incentives Program is a test program initiated in 1982 to develop, test, and refine contract incentives which encourage companies to use their own funds to improve productivity by making capital investments. These incentives include contract termination protection and shared savings rewards. The aim is to overcome two problems frequently cited in Defense as inhibiting capital investments by defense contractors--acquisition program uncertainties and a profit policy that is based on cost. DOD's approach is to test "packages" of contractual incentives among several defense contractors to learn what works and what does not work. The experiment, if successful, could increase the likelihood that the results of some MT projects will be used in actual production of Defense items.

The Productivity Enhancing Capital Investment Program funds investments by in-house Defense organizations in "off-the-shelf" (readily available) equipment to improve internal Defense productivity. The MT program, in contrast, prohibits use of its funds for investments in off-the-shelf equipment. Instead, it funds initial demonstrations of first-time applications of new or improved manufacturing technology. Furthermore, most MT projects are directed toward improving defense contractor productivity rather then internal Defense productivity.

We are continuing our review of the Manufacturing Technology Program and plan to complete it in the near future. Our review includes assessing both the management of the program and the results it is achieving. We will give you a copy of our final report when we have completed the assessment.

Because we have not yet reached final conclusions, we did not get official comments from DOD but did discuss the contents of this

letter with Defense personnel. We are sending a copy of this letter to the Chairman, Subcommittee on Economic Stabilization, Committee on Banking, Finance, and Urban Affairs.

Sincerely yours

W. D. Campbell
Acting Director

Enclosure

ENCLOSURE I

RESEARCH AND ENGINEERING

THE UNDER SECRETARY OF DEFENSE
WASHINGTON, D.C. 20301

1 JUN 1978

MEMORANDUM FOR SECRETARIES OF THE MILITARY DEPARTMENTS

SUBJECT: Manufacturing Technology

During the past several months, my staff and I have been developing and implementing materiel acquisition policies strongly emphasizing business management aspects similar to those used by the firms comprising the defense industrial base. Our objective is to formulate an acquisition policy spanning the system life cycle and bringing to bear the business management factors necessary to develop and produce a successful product on time at the lowest possible cost. The challenges are enormous but the potential payoffs are equally large. Part of our strategy is to improve and more fully utilize the strengths of our defense industrial base. We must continue to improve production capability and industrial productivity. This includes emphasizing production management, encouraging capital investment and advancing manufacturing technology.

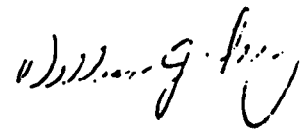
We have had a procurement-funded DoD Manufacturing Technology Program for many years. Its purpose is to reduce production costs by applying recently developed manufacturing technology to new or improved production equipment, processes and methods. It has been and continues to be a very sound investment. In 1975 the Deputy Secretary of Defense requested that the Military Departments provide increased emphasis to manufacturing technology including centralized management, increased funding and visibility and identification of significant cost reduction initiatives (Attachment (1)). I fully support the thrust of that memo. While we have made marked improvements during the past three years, I am confident that further improvements can and should be made. We need a strong, effective manufacturing technology program.

I have outlined eight areas which I believe deserve your attention and support (Attachment (2)). These are aimed at continuous identification and vigorous prosecution of manufacturing technology cost reduction opportunities arising throughout the life cycle of our weapons systems. I want to make sure that we have a strong manufacturing technology organization to plan, program, budget, execute and follow through to see that the results are implemented and diffused throughout our defense industrial base.

Enclosure 1

ENCLOSURE I

Please be prepared to brief me within 120 days of the initial actions and plans you have taken to pursue these items. In addition, I would appreciate any additional ideas that offer the potential for increasing manufacturing productivity. I have asked Dr. Ruth Davis (Deputy Under Secretary of Defense for Research and Engineering (Research and Advanced Technology) to coordinate this effort and she can furnish any additional information you may require.



Attachments 2

ENCLOSURE I

THE DEPUTY SECRETARY OF DEFENSE
WASHINGTON, D. C. 20301

APR 11 1975

MEMORANDUM FOR The Secretaries of the Military Departments

SUBJECT: Cost Reduction Initiatives

Each of you is fully aware of the critical cost problems we have faced and will continue to face in weapons systems acquisition. We have addressed them from almost every conceivable aspect. However, many remain today and it is my intention to make a renewed attack on these problems.

During the past several months, I have asked my staff to prepare a list of potential DoD initiatives which, if implemented, would reduce the cost of material acquisition and improve the productivity of our contractors. They have developed a number of separate but closely related tasks we will be considering in the near future. These include such things as: adjustment of weighted guidelines to provide greater incentive for contractor capital investments in modern, more efficient manufacturing facilities; establishing a revolving capital fund for DoD procurement of modern production equipment; Production Support Engineering (PSE) funding - "seed money" aimed at manufacturing productivity improvement (similar to IR&D); evaluating ASPR provisions to insure that cost effective contractor capital equipment investments are encouraged; re-evaluating the feasibility of multi-year contracting, etc. There may be others that you may suggest which we should also consider.

You will recognize that several of these present many complex problems and could require action outside the DoD environment before we could implement them. However, there is one area where I believe we can start immediately with definitive action.

I am convinced there are numerous opportunities to obtain significant cost savings in the production of Defense material by increasing the application of state-of-the-art manufacturing techniques and by the development of new or improved manufacturing technology. For example, not only should we be making more effective use of

ENCLOSURE I

numerically controlled machine tools and other new, highly productive manufacturing processes but we should also be exploiting emerging technologies such as computer aided manufacturing, laser welding, diffusion bonding, use of composites, etc.

I am informed that we are spending approximately $60 billion each year in this country to remove metal from parts where it is not needed. We should therefore develop and apply manufacturing processes that permit fabrication of parts closer to required net shape. This would not only reduce metal removal costs, but would also conserve many critically short, expensive strategic materials.

While I am aware that many of these opportunities are presently being pursued to some degree, I am convinced we must increase our efforts manyfold if we are to get the payoff that is needed to bring DoD systems and equipment costs down significantly.

The recently published guidance in the PPGM on the DoD Manufacturing Technology Program directed significant increases in emphasis and funding levels to realize our productivity goals. To assure that we are directing our efforts to the areas of greatest need and greatest payoff, to prevent duplication of effort and to promote widest possible application of new manufacturing technology advances across the board to all systems this guidance further stated the program should be centrally managed within each Service.

I am therefore directing the organization be structured in each Service to provide for central management and control of this program and that it be adequately staffed with highly qualified personnel that have sufficient authority to promote the objectives of this effort.

As a next step to permit realization of the savings and benefits that I believe exist, I am directing that a new "initiative" be established. Under this new "initiative", I want to identify and then aggressively exploit application of manufacturing technology cost reduction opportunities. Each Military Department is asked to identify a number of new manufacturing technology efforts, and a number of major weapon system programs where the application of existing or new manufacturing technology promises a high return on investment. You should plan to fund the opportunities identified on a demonstration basis. Special funding may be required. If the payoff appears to be significant, and if it is necessary, I am prepared to take this program to Congress.

ENCLOSURE I

Please be prepared to brief me within 120 days of the initial actions and plans that you have taken to pursue this initiative. The briefing should include: A description of the organizational structure that will provide for centralized management and control of the manufacturing technology program in your Service; an identification of the weapon systems that have been selected for the cost reduction efforts, to include a description of proposed manufacturing improvement actions with associated costs; an analysis of potential benefits to be realized; a time-phased plan for implementation; a listing of other major manufacturing technology projects, and a projection of funds identified by program element, that will support the total Manufacturing Technology Program through FY 81. In addition, I would also appreciate any additional ideas that offer the potential for increasing manufacturing productivity and reducing costs.

I believe we cannot delay in taking affirmative action to exploit the cost saving opportunities offered in this area. As a result, I have appointed Jacques S. Gansler, Deputy Assistant Secretary of Defense (Materiel Acquisition), OASD(I&L), to direct this program during the initial stages, and he can furnish any additional information you require. Some initial dialogue has already taken place between OASD(I&L) and representatives of your staff.

In view of the potential for a large return on these investments and the resulting opportunities to demonstrate to Congress that we are making a concerted effort to reduce materiel acquisition costs, I solicit your personal assistance and involvement in carrying out this program.

Signed
W. P. CLEMENTS JR.

ENCLOSURE I

Attachment (2)

Manufacturing Technology Program Improvement Areas

References:

a. DoD I 4200.15, dtd 14 July 1972, "Manufacturing Technology Program"
b. DoD D 5000.1, dtd 18 January 1977, "Major System Acquisitions"
c. DoD D 5000.2, dtd 18 January 1977, "Major System Acquisition Process"
d. DoD D 5000.34, dtd 31 October 1977, "Defense Production Management"

1. Manufacturing Technology Budgets

The Consolidated Guidance calls for specific levels of manufacturing technology funding. Strong, technically sound programs should be identified, supported and given sufficient priority to assure that those levels are actually funded. A $200 million/year program is called for in FY 1983.

2. RDT&E Manufacturing Technology Development Line Item

The procurement funded Manufacturing Technology Program is limited to funding only those generic efforts whose feasibility has been previously demonstrated in an R&D environment. However, manufacturing technology opportunities often surface which have not been previously demonstrated. An RDT&E funding mechanism is needed to pursue them. Once demonstrated, procurement funds can be used to fully exploit them. Navy has established a manufacturing technology development RDT&E line item. Army and Air Force should establish a similar manufacturing technology RDT&E funding source(s).

3. Production Cost Driver Analyses

During the past several years, the manufacturing technology offices have conducted various commodity oriented, production "cost driver" conferences and studies. These efforts have materially assisted us to identify and prioritize high payback manufacturing technology investment areas. These efforts should be continued and a long-range tri-Service plan should be developed to assure key areas are not overlooked.

4. Manufacturing Technology Office/Weapons Program Office Interaction

Our new 5000 series directives (references b, c, and d) require incorporating manufacturing technology assessments and action to correct deficiencies during the DSARC process. Because the manufacturing technology offices have a broad overall perspective of the current state-of-the-art, they can be an invaluable asset to the weapons systems' sponsors if used effectively. An open line of communication between the weapons systems offices and the manufacturing technology offices should be established and maintained.

ENCLOSURE I

5. Manufacturing Technology Office Resources

As a result of implementing References a-d, the manufacturing technology offices will play an important role in the life cycle of our weapons systems. Their involvement in the DSARC process and during full-scale production requires that they be adequately staffed and funded. A review of the manufacturing technology offices should be made to assure they have the resources necessary to do the job expected of them.

6. Industry Interaction/Coordination

The Manufacturing Technology Program cannot be effective in a vacuum. During the past three years, marked improvements have been made in both tri-Service and government/industry interaction and coordination through the efforts of the Manufacturing Technology Advisory Group (MTAG). This has been an evolutionary process and should continue. Manufacturing technology developed by private capital should be used where possible. Unintentional duplication of effort should be avoided. Our manufacturing technology "seed money" should be used where necessary in first case application, but the private sector must then follow through. A synergistic combination will result only if there is full and open lines of communication and technology flow in both directions. MTAG and the manufacturing technology offices should work to strengthen this government/industry coordination and cooperation.

7. Implementation of Manufacturing Technology Project Results

The results of manufacturing technology projects must be implemented as widely as possible if the investment payback potential is to be fully realized. The potential breadth and probability of implementation should be considered during the project review process. Project completion is really the beginning. Implementation cannot be left to chance. Each manufacturing technology office should have an active technology diffusion/implementation program to assure that results are made available to the defense production base.

8. Effective Feedback

The process of determining the effectiveness of the manufacturing technology program needs to be improved. Today, reliance is placed on random samples identifying how project results were utilized and what payoffs were achieved. Many are impressive. But the process must be more disciplined. Each manufacturing technology office should establish a mechanism to monitor program payback.