U.S. ARMY
MATERIEL DEVELOPMENT AND READINESS COMMAND

MANUFACTURING METHODS & TECHNOLOGY

PROGRAM PLAN

CY 1982

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MANUFACTURING TECHNOLOGY DIVISION
U.S. ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
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MANUFACTURING METHODS & TECHNOLOGY
PROGRAM PLAN

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September 1982

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Manufacturing Technology
Manufacturing Methods and Technology
Program Plan

This document briefly summarizes the technical work being executed or planned in the MNT Program for fiscal years 82 through 86.

2. This planning document, developed in accordance with the referenced regulation, describes the DARCOM Manufacturing Methods and Technology (MMT) Program for the period FY 82-86. This plan was completed by amending the 1981 Program Plan to take into account both programming actions which have occurred over the past year (i.e., FY 82 approvals, FY 83 apportionment submission, and FY 84 budget submission) and other Command inputs reflecting FY 85 ad 86 thrusts.

3. Because of the dynamic nature of military material requirements and the constant change in technology, the inclusion of a project in this plan is not a guarantee of funding. However, the plan does indicate the current technology needs and interests of the DARCOM community.

4. Additional copies of this document may be obtained by writing the Defense Technical Information Center, ATTN: DTIC-TSR-1, Cameron Station, Alexandria, VA, 22314.

FRÉDÉRIC J. MICHEL
Director
Manufacturing Technology
FOREWARD

This document presents information for the DARCOM Manufacturing Methods and Technology (MMT) Program for Fiscal Years 1982-1986. The projects and funding levels for the out-years are for planning purposes only and will change based on technological developments and revisions in program requirements. Since total funding for these planned projects exceeds the projected funds for the Army's MMT Program, some projects will not be funded or may be slipped to later fiscal years. HQ, DARCOM and its subcommands and centers have the authority to reprogram funds to projects with higher priority, thereby affording the flexibility to accommodate new opportunities as they arise.
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The MMT Program Plan

The MMT Program Plan, CY 1982, provides within a single source a summary of current and near-term efforts (FY82-FY86) included in the DARCOM MMT Program. Since weapons systems requirements and the technology for these systems are constantly changing, inclusion in the Program Plan is not a guarantee that an individual project will be funded. However, the Plan does serve as an indicator of the areas towards which DARCOM's resources will be directed and the magnitude of the Army's commitment to this program.

Organization of the MMT Program Plan

The Plan provides a section for each DARCOM element which has projects in the FY 82-86 period. Each section includes a summary of the activity, its responsibilities, and its major MMT thrust areas. Following this summary is a listing of each project proposed by that activity.

Individual project information is presented by the last four digits of the project number and includes the project title, funding, a brief description of the problem addressed by the project and the proposed solution. Projects are grouped according to broad categories and then further subdivided according to component. This arrangement points out major areas of emphasis and aids the identification of possible duplication of effort.

Industry Guide

An Industry Guide (Appendix A) has been included to aid in the use of the plan. The section will help clarify the interrelationships between the appropriations, commands, and personnel involved in the DARCOM MMT Program.
PROGRAM IMPACT

The MMT Program

The Manufacturing Methods and Technology (MMT) Program serves the US Army Materiel Development and Readiness Command (DARCOM) as a bridge between research and development and production. The program's primary aim is to reduce the cost of weapons system acquisition by improving the efficiency of manufacturing processes and by implementing new technology. Although cost reduction is a primary concern, the emphasis is also directed toward efforts reducing air and water pollution, increasing safety, conserving energy, reducing dependency on critical material, improving producibility and increasing productivity.

Need for MMT

The United States is currently in a period of low productivity growth resulting in increased product costs. The MMT Program is a major DOD tool to improve productivity and lower end item and spare/repair parts costs. The following excerpts illustrate the emphasis being given to the MMT Program by DOD and Department of Army.

Excerpt from the "Annual Report to the Congress, Fiscal Year 1983" by The Honorable Caspar W. Weinberger, Secretary of Defense:

"The Manufacturing Technology Program is a broad based program designed to improve the productivity and responsiveness of the U.S. Industrial base. Investments made by this primarily procurement funded program have resulted in factory floor applications of productivity enhancing technology and will continue to receive priority emphasis."

Excerpt from "The Industrial Base of Defense," remarks delivered by the Honorable Frank C. Carlucci, Deputy Secretary of Defense to the National Security Industrial Association, 17 September 1981:

"The costs of producing the product are directly related to the quality of the manufacturing process. Industry has the prime responsibility for identifying and for implementing improvements to manufacturing technology, including full use of such processes as computer aided design and computer aided manufacturing, including robotics.

"Of paramount importance, is the quality and reliability of the product delivered. These are vital elements of an effective weapon system. Much has been written in recent months regarding the alleged inability of American industry to match the standards of its international competitors, especially the Japanese. This is all the more ironic, since the Japanese attributed much of their success to the use of American concepts and methodology for quality improvement. I can't imagine a more provocative challenge to U.S. industry than to demonstrate the ability to build the highest quality products, using the most efficient manufacturing technology."
"I, therefore, suggest that the industry leadership of this country establish a national commitment to improve the quality and reliability of its products, along with a dedication to improve our national productivity across-the-board."

Excerpt from "The FY 1983 Department of Defense Program for Research, Development and Acquisition" by the Honorable Richard D. DeLauer, Under Secretary of Defense, Research and Engineering to the 97th Congress, Second Session, 1982:

"The Technology Modernization (or Tech Mod) Program is a joint venture with industry wherein we invest in enabling manufacturing technologies and industry invests in capitalization for modernization of a factory, plant, facility, assembly line, etc. The approach involves a formal structured analysis of the manufacturing operation to be modernized followed by contractual agreements as to who will do what and the benefits sharing to result. The Tech Mod contract is linked to one or more acquisition contracts, providing the leverage, shared benefits, and contractor risk protection. The end result benefits all; industry is modernized through technology and capitalization, the government saves money on acquisition, industrial capacity/capability is increased, and industry reaps additional profits."

Excerpts from a Memorandum for the Secretaries of the Military Departments, 2 September 1981, subject: Manufacturing Technology Program, by the Honorable Richard D. DeLauer, Under Secretary of Defense, Research and Engineering:

"During the past several months, the Congress and the Department of Defense have had considerable dialogue concerning the health and vitality of the Defense Industrial base. Numerous Congressional hearings have brought focus to the fact that our Industrial base must be strengthened if we are to continue to provide a strong national defense. Secretary Weinberger has been personally involved in these discussions and has provided guidance on initiatives he would like undertaken. Last April, Deputy Secretary Carlucci issued a major policy statement on "Improving the Acquisition Process" which addresses many Industrial base issues. One important recommendation points out that a major cause for lagging Defense Industrial base productivity is the low level of capital investment compared to U.S. manufacturing in general. I want to reverse this trend. . .

"The Manufacturing Technology Program has been and continues to be a very sound investment. Its basic purpose is to reduce materiel acquisition costs and lead times by providing the advanced manufacturing technology necessary to improve industrial base productivity in those situations where the private sector is unable or unwilling to do so . . ."
"First, the Manufacturing Technology Program needs your continued financial support. During the past five years (FY 1978-1982) DoD budgeted $740 million for new manufacturing technology. Our current plans call for more than doubling that during the next five years. We should view this as a minimum funding level and actively seek to identify where increases are needed in order to provide a more productive and responsive industrial base. There are several areas (e.g., shipbuilding and tracked combat vehicles) which have a high potential payback for key investments in modern, more productive manufacturing technology.

"Second, I believe the Manufacturing Technology Program needs your continued attention to assure that these investments are based on sound business practices. Investment in advanced manufacturing technology should result in improved factory floor productivity. We need strong leadership and effective managers which assure that these investments reduce weapons systems costs. We must also document the benefits achieved to permit us to monitor our own performance and to demonstrate to the taxpayers the soundness of the program.

"I ask you to join me in pursuing the overall goal of improving the strength and vitality of the Defense industrial base. I believe we will be better able to do so if we have a strong Manufacturing Technology Program and supporting organizational structure ..."

Excerpt from a Memorandum for Deputy Chief of Staff for Research, Development, and Acquisition, 31 December 1981, subject: Manufacturing Technology Program by The Honorable J. R. Sculley, Assistant Secretary of the Army (Research, Development and Acquisition):

"I fully support the Manufacturing Technology Program and request your continuing personal support and attention in two major areas.

"First, Investments in the Manufacturing Technology Program need increased emphasis in the budget formulation process to ensure increased paybacks of future production procurements. Since 1979, Manufacturing Technology Investments have been considerably less than one percent of the procurement budget. While recognizing that a percentage of the procurement budget is an arbitrary measure, I request your support in achieving a full 1.0 percent of the budget in the POM 84-88 formulation process, especially for high cost major weapons systems.

Second, Investments in the Industrial Productivity Improvement Program are sound and require emphasis and funding. The thrust is somewhat different from Manufacturing Technology, but the goal of increased productivity is the same. This program is the specific Army action resulting from Acquisition Initiative #5. I also request you support for this program in the POM 84-88 formulation process with special emphasis for support in the early years."
"I believe selected investments in the Productivity Improvement Program at key plants, combined with an increased emphasis on the more generic Manufacturing Technology Program addressed above, will have enormous paybacks in future acquisition costs, as well as providing a more responsive industrial base. Prior budgetary decisions have been influenced greatly by operational readiness issues. With your help, the two areas addressed above will provide the avenue by which investment/industrial base considerations will be able to compete on a more equitable basis."

**New Systems**

The MMT program is necessary to support the production base being established for the new weapons systems required to modernize our forces and improve our readiness in the 1980's. These new systems will perform a variety of offensive and defensive missions, from the national command center to the forward edge of the battlefield. They run the gamut from mundane tools for digging foxholes to sophisticated information systems which coordinate the identification and destruction of hostile forces. New guns, ammunition, vehicles, missiles, aircraft, and communications equipment are included. Two new fighting vehicles, the M2 and M3 Bradleys, are beginning to roll off the assembly lines. The M2 Bradley is a personnel carrier and weapons platform for the motorized infantry. The M3 Bradley will keep pace with the highly mobile M1 Abrams Tank and will suppress the anti-armor threat from opposing infantry forces. In addition, the DIVAD Gun System, now in early production stages, will give us better low altitude air defenses. A new attack helicopter, the Apache, armed with Hellfire missiles will devastate hardened targets. Our infantry, equipped with improved TOW and Viper missiles, and our artillery batteries, equipped with Copperhead and SADARM munitions, will achieve new armor defeating capabilities.

In the area of air defense, the Division Air Defense (DIVAD) Gun System will replace the 20mm Vulcan. DIVAD is a radar directed automatic gun system for the defense of the Abrams Tank, the Bradley Fighting Vehicles, and forward maneuver battalions. Mounted on a modified M48A5 tank chassis, the DIVAD system includes NATO standard Bofors L/70 40mm guns, ammunition which is loaded by a linkless feed system, and Westinghouse F-16 derived search and track radar. DIVAD embodies reasonable balances between system performance, reliability, and cost. Electronic component reliability is expected to be much superior to that of older systems. Use of integrated circuits instead of discreet components, digital instead of analog computers, and improved manufacturing and inspection processes are examples of these advances. Development has been completed and deployment of the Roland and Patriot missile systems is underway. Roland is a French/German all weather short range surface to air system adopted by the Army. Patriot is the replacement for NIKE-Hercules and Improved Hawk to provide low and medium altitude air defense.

In the area of aircraft, the Army Helicopter Improvement Program (AHIP) is developing an advanced version of Scout helicopter to provide
intelligence, surveillance, and target acquisition support. The Scout will have laser designation capability to assist our attack helicopters and our field artillery in guiding munitions to their targets. This program is looking at the OH-6 and OH-58 as candidates for an interim Scout helicopter. Following the AHIP Program, if cost justifiable, the design of a new airframe specifically suited for the Scout mission will be pursued. Also, a remotely piloted vehicle is currently being developed to provide surveillance and target designation behind enemy lines. The Apache Attack Helicopter, now in transition from R&D to production, will possess immense survivability. The rotary dynamic components can tolerate Soviet 23mm anti-aircraft fire. This aircraft can operate at nap-of-the-earth altitudes at night with the aid of an advanced pilot's night vision system. During the hours of darkness or in adverse weather, the gunner's sights can pinpoint long range targets for the on-board Hellfire Missiles. A fire-and-forget seeker that locks on target before missile launch is under development for the Hellfire. The seeker will allow the pilot to take immediate evasive action after missile launch. At present, the pilot must keep the target in sight while the gunner designates it by laser light until the missile strikes. He becomes vulnerable to return fire, unless laser designation tasks are assumed by another aircraft or a man on the ground. Soviet helicopters have the ability to attack ours over the battlefield. The Stinger, a shoulder fired air defense missile that homes in on engine heat, will be adopted for air-to-air use thus providing our crewmen with an additional measure of self protection.

New artillery weapons, including the helicopter transportable 155mm M198 Howitzer and the Multiple Launch Rocket System (MLRS), are being deployed. MLRS is a free flight artillery rocket system consisting of a 12 round launcher mounted on a highly mobile tracked vehicle. Its rockets can be fired one at a time or in rapid ripples. The Army is just beginning to procure anti-tank mines that are fired from the 155 Howitzer. Each round of ammunition dispenses nine mines onto the enemy's path. They are relatively small mines, but they will cause a mobility kill on a tank. Another intriguing submunition development for the standard 8 inch Howitzer is called SADARM (Sense and Destroy Armor). Over the target area, the projectile dispenses a submunition that descends by parachute. As the submunition rotates, its millimeter wave sensor scans the ground for an armored target and fuzes what is called a self forming fragment. The warhead actually forms a metallic slug which is projected at very high velocity into the thinly armored top of target.

The infantry is now receiving the 60mm Lightweight Company Mortar System (LWCMS), the first new mortar in 25 years. It consists of the M224 Mortar and a family of ammunition for indirect fire. The M224 has a range of 3500 meters, nearly twice that of its predecessor, and has a much higher rate of fire. For the defense of the infantryman, the Viper Rocket is under development. Like its predecessor, the LAW, this rocket is contained in a fiberglass tube which has a very simple sighting system.

Bridges have been critical to mobility from the time of the first armies. An assault bridge, capable of supporting 70 tons, is being
developed for the Army's heavy combat divisions. The bridge will be 31 meters long and will be transported and launched by M1 Tank chassis in 5 to 10 minutes. The bridge will incorporate composite materials to minimize its weight. Another new combat engineering item approaching production is the M9 Armored Combat Earthmover (ACE). This versatile vehicle is a combination dozer, scraper, dumper, grader, cargo carrier, and prime mover. One of its most important capabilities involves the excavation of protective fighting positions for tanks and other combat vehicles. Other combat support items that will increase survivability include fox hole diggers, fox hole covers, shelters for weapons and equipment, mobile well drilling equipment, waste water reuse equipment, and rapidly emplaced water storage bladders.

In response to the signatures, signals, and physical indicators that the enemy presents, the world of electronic warfare is ever-expanding. The components of these systems stretch back from the front lines to the national command authorities. Unattended sensors and night vision devices locate enemy movements at the front. In the air, the Stand-Off Target Acquisition System (SOTAS) mounted on a Blackhawk helicopter will radar detect and pinpoint moving ground targets which are miles behind enemy lines, from relatively safe positions behind our lines. The Army is fielding its firefighter radar systems which detect incoming mortar, artillery, and free rockets, and provide instant target data on point of origin before the rounds hit.

The reader may have noted that nearly every weapons system that the Army is planning and bringing to development, in some way, employs microcomputers and microelectronics. Our challenge is to harness the capabilities of the industrial base and to efficiently use the technology to give us cheaper and more capable subsystems.

**MMT Thrusts**

The thrusts of the program are divided into two categories. The first category - Program Thrusts - is aimed at improving the overall management of the program. It is aimed at getting the most out of the program, both for Army and the industrial base, per dollar expended. The second category - Technology Thrusts - is aimed at the technical areas important to fielding the weapons systems of the 1980's.

**Program Thrusts**

Support Procurement
Improve Implementation
Identify Cost Drivers
Apply Foreign Technology
Improve Technology Transfer
Technology Thrusts

Large Scale Integration (LSI)  Flexible Machining Systems
Very High Speed Integrated Group Technology
Circuits (VHSI)  Computer Aided Design and
Gradient Index Optics  Manufacturing
Silicon on Sapphire (SOS)  Computer Integrated Manufacturing
Fiber Optics  Robotics
Pressed Lenses  Laser Applications
Plastic Optics  Materials Substitution
Chalcogenide Glass Optics  Near Net Shape Processing
High Frequency Gallium Arsenide  Surface Treatment
Microwave Integrated Circuits Joining-Automated Control
Composites  Ceramics
Air and Water Pollution Abatement  Metal Removal
Energy Conservation  High Speed Machining
Recycling  Powder Metallurgy
Demilitarization  Safety
Flexible Ammo Metal Parts Lines  Ammunition Cast and Press Loading
Automated Material Handling  Automated Test and Inspection

Planning Synopsis

Expenditures planned by the DARCOM Major Subordinate Commands exceed $705 million during the five year period. Starting at approximately $90 million in FY82, the annual funding level more than doubles at the end of the period.

The Army MMT Program is controlled by a standard accounting system which contains eight different appropriations. In some cases, several of the commands share an appropriation. For example, the Communications/Electronics appropriation is used by three commands: CECOM, DESCOM, and ERADCOM. The distribution of the appropriations among commands is shown in the first table that follows and the level of planned expenditures within each appropriation is illustrated by the second table.

The third table offers a critique of planning process by showing the ratio of projects that were included in previous years' Program Plans to those projects that are currently in the FY83 Apportionment and FY84 Budget review cycles.
<table>
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<tr>
<th>Command</th>
<th>Appropriation</th>
<th>Fiscal Code</th>
<th>FY 82</th>
<th>FY 83</th>
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This table shows the planned expenditures for each fiscal year in the planning period. The "Command" Column identifies the DARCOM Major Subordinate Commands and Activities which participate in the MMT Program.
### SUBMACOM SUBMISSION TO MMT PROGRAM
#### BY APPROPRIATION (Thousands of Dollars)

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<th>Appropriation</th>
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This table shows the planned expenditures for each fiscal year in the planning period. The "Appropriation" column identifies the various Procurement Appropriations established by the US Congress as a standard accounting system.
## ANALYSIS OF PREVIOUS PLANNING DATA

<table>
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<td>1981</td>
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<td>79.3%</td>
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This table shows the percentage of projects that are currently in the fiscal review cycles and that were planned in previous years' long range plans. It illustrates the improved planning accuracy that naturally occurs as the planning process and the budgeting process converge.

*Starting in 1979, the planning period covered was changed to reflect the more immediate future, rather than the POM years.
Factory Modernization Efforts

The MMT Program now incorporates broad based efforts directed toward the improvement of the manufacturing efficiency of an entire facility. The underlying strategy of these efforts is to increase contractors' motivation to maximize manufacturing efficiency. The objective is to achieve actual reductions in the cost of the end items procured by the Army.

Each effort will establish a thorough understanding of what steps need to be taken to improve productivity in a given plant and will identify incentives to insure contractor implementation of high priority opportunities. The effort will operate in three phases:

1. Phase I will be a thorough analysis of all aspects of a specific plant to obtain:
   a. An understanding of the existing manufacturing systems.
   b. A description of the most effective manufacturing system that could be developed in the plant.
   c. A prioritized listing of what has to happen to get from the existing system to the most desirable one.
   d. A proposal to the Army that identifies commitments required by both the contractor and the Army to implement the high priority productivity improvement opportunities.

2. Phase II will be initiated after the negotiation of the Phase I proposal and will develop individual manufacturing technologies necessary to achieve the desirable manufacturing system.

3. Phase III (primarily funded by the contractor) will be the phase that implements the manufacturing technologies developed under Phase II and the other scheduled improvements agreed to during the negotiations that followed Phase I.

The Army's initial factory modernization effort started in the middle of 1981 at the AVCO Corporation, Lycoming Division in Stratford, CT. This plant produces turbine engines for helicopters and the M1 Abrams Tank. A major part of the negotiations at the end of Phase I was deciding which elements of the plant modernization would be undertaken first, and how the resulting savings would be shared between the Army and Lycoming. Phase II at Stratford is just beginning.

The following tables and chart illustrate the size and direction of all factory modernization efforts during the planning period.
The first table highlights the portion of the planned program specified for factory modernization. Parenthetical entries denote the value of these efforts in comparison to the entire MMT Program. The scope of effort and the level of planned expenditures are significant in the aircraft production base.

The sixteen modernization efforts that contribute to the data included in the first table are detailed in the second table. Additional descriptions for the efforts may be found in Section III, Command Plans, under the category called "Factory Modernization."

The bar charts illustrate the tabular funding data graphically. Here, the total planned MMT Program and the planned factory modernization efforts are compared with funding guidelines established by the Five Year Defense Plan (FYDP) Procurement Annex, FY83 President's Budget, dated February 1982. As can be seen in the charts for the Aircraft, Tracked Combat Vehicles, and Communications/Electronics appropriations, hard decisions will have to be made in allocating funds between Factory Modernization MMT and generic MMT if the overall funding guidelines are to remain unchanged.
## FACTORY MODERNIZATION FUNDING
### BY APPROPRIATION (Thousands of Dollars)

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<tr>
<th>Appropriation</th>
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<th>Command</th>
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**NOTE:** The factory modernization share in the MMT Program is shown in parentheses.
PLANNED FACTORY MODERNIZATION EFFORTS
82/09/01.

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2597 - MISSILES

DOLLARS (MILLIONS)

FISCAL YEAR

KEY:

FYDP FUNDING GUIDELINE
MMT
MMT (FACTORY MODERNIZATION)
4250 - AMMUNITION

KEY:
- FYDP FUNDING GUIDELINE
- MMT
- MMT (FACTORY MODERNIZATION)
5197 - TACTICAL AND SUPPORT VEHICLES

DOLLARS (MILLIONS)

FISCAL YEAR

FY82 FY83 FY84 FY85 FY86

KEY:

FYDP FUNDING GUIDELINE

MMT

MMT (FACTORY MODERNIZATION)
5397 - OTHER SUPPORT EQUIPMENT

DOLLARS (MILLIONS)

FISCAL YEAR

KEY:

- FYDP FUNDING GUIDELINE
- MMT
- MMT (FACTORY MODERNIZATION)
ARMAMENT R&D COMMAND
(ARRADCOM)

ARMAMENT MATERIEL READINESS COMMAND
(ARRCOM)
ARRCOM, with headquarters at Rock Island, IL, is the DOD Single Manager for Conventional Ammunition (SMCA). ARRCOM is responsible for integrated logistics (material readiness) management of nuclear and non-nuclear weapons and munitions. This includes follow-on procurement, production, engineering in support of production, industrial management, product assurance, material management, maintenance, value & logistics engineering, international logistics, and transportation and traffic management for assigned armament systems/materiel. As SMCA, it has responsibility for procurement, production and wholesale management of common-user conventional ammunition for the Army, Navy, and Air Force.

ARRCOM's materiel assignments include artillery, infantry, air defense guns, surface vehicle and aircraft mounted weapons systems, rocket and missile warhead sections, demolition munitions, offensive and defensive chemical materiel and related training equipment, test equipment, and tools. ARRCOM directs operations of four assigned arsenals, a Government-owned, Government-operated ammunition plant, twenty-seven Government-owned, contractor-operated (GOCO) ammunition plants, and an Army ammunition activity.

ARRADCOM is responsible for all research, development, and life cycle engineering of assigned weapon systems. Its mission also includes initial low-rate production for conventional systems and life cycle procurement and production for nuclear munitions. ARRADCOM also executes assigned missions in support of other DOD elements having centralized management responsibility for specific weapons systems or items. In addition to large-caliber, small-caliber, mission support and headquarters staffs at Dover, NJ, command elements include the Chemical Systems Laboratory and the Ballistics Research Laboratory at Aberdeen Proving Ground, MD, and Benet Weapons Laboratory at Watervliet, NY.

Integrated into ARRCOM's structure is the US Army Munitions Production Base Modernization Agency (MPBMA). The Agency is responsible for project management of the Munitions Production Base Modernization Program. The Agency exercises centralized management authority over the planning, direction, control and execution of the Program at all US Army Ammunition Plants and arsenals. A significant amount of interface between the MPBMA, ARRCOM, ARRADCOM, Air Force and Navy is necessary to assure integration of the MMT Program into related modernization plans.
ARMAMENT R&D COMMAND
ARMAMENT MATERIEL READINESS COMMAND
(ARRADCOM, ARRCOM)
(AMMUNITION)
<table>
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Bridging the technology gap, particularly in those areas that have no civilian counterpart, is a challenging task for the Ammunition MMT Program. In many respects, the Ammunition program presents unique problems which require innovative solutions. Practically all current operations involve a great many hand operations, and methods must be found to efficiently mechanize these. Batch processes must be converted to continuous processes in order to take advantage of new materials handling techniques and to improve the safety of operations.

The primary objective of the Ammunitions Manufacturing Technology Program is to improve existing manufacturing processes, techniques and equipment. The second objective is to bridge the gap between development and full-scale production. The third objective is to solve technological problems identified in the program.

The Manufacturing Methods and Technology effort in the Load, Assemble and Pack area is guided by four major program goals; improved economy of operation, improved safety conditions for operating personnel, establishment of a rapid response production capability, and improvements in the quality of the end product produced. All of these goals must be accomplished within the standards and criteria established for pollution abatement and energy conservation.

Recent changes in policy and guidance have required Process Technology Projects to be cost effective within the timeframe and procurement quantities of the Five Year Defense Plan (FYDP). The challenge of introducing new technology within this guidance is being met by developing systems with the flexibility to produce many items, establishing an optimum balance between system simplicity and process operational requirements, and providing equipment designs capable of high efficiency operation to achieve cost effective system operations.

Due to the inherently hazardous nature of munitions production, an extensive program has been undertaken to upgrade the safety of explosive preparation equipment, loading equipment, and assembly systems. The MMT Program relating to the upgrading of the operational safety of loading lines is a continuation of current efforts. This program will define and investigate specific operational safety hazards, and will develop equipment and systems to reduce operator exposures and risks.
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COMPONENT -- DECONTAMINATION

**0913** TITLE - SPIN COATING LF DECON AGENT CONTAINERS

**PROBLEM** - CURRENT METALLIC DECON AGENT CONTAINERS CORRODE BEFORE THE REQUIRED SHELF LIFE OF THE AGENTS IS REACHED. ALTERNATIVE CONTAINERS ARE NOT AVAILABLE, BUT PLASTIC LINERS HAVE BEEN SHOWN TO EXTEND THE LIFE OF CURRENT CONTAINERS SIGNIFICANTLY.

**SOLUTION** - ESTABLISH THE SPIN COATING OR ROTATIONAL MOLDING TECHNIQUE FOR COATING THE INSIDE OF CURRENT METALLIC CONTAINERS WITH CHEMICALLY RESISTANT POLYMERS FOR THE PRODUCTION ENVIRONMENT.

COMPONENT -- DETECTION/WARNING

**0904** TITLE - CHEMICAL REMOTE SENSING SYSTEMS

**PROBLEM** - FIRST GENERATION CHEMICAL REMOTE SENSING SYSTEMS HAVE HIGH PRIORITY. THEY REQUIRE COMPLEX, UNIQUE, SOPHISTICATED COMPONENTS WHICH IS NOT AVAILABLE TO MEET PRODUCTION REQUIREMENTS. COMPONENTS WILL BE HAND FABRICATED FOR INITIAL DEVELOPMENT.

**SOLUTION** - IN ORDER FOR PRODUCTION TO BEGIN AS SOON AS POSSIBLE IT IS NECESSARY THAT APPROPRIATE MANUFACTURING TECHNOLOGY START BEING DEVELOPED NOW. CONTRACTORS WITH NECESSARY EXPERIENCE WILL BE UTILIZED TO ESTABLISH PROCEDURES, ETC. FOR QUANTITY MANUFACTURING.

**0957** TITLE - MFG TECH FOR AML AGENT ALARM, XM22.

**PROBLEM** - PRODUCTION PROCESS ENGINEERING PROBLEMS MUST BE IDENTIFIED DURING DEVELOPMENT, UTILIZING PEP EFFORT AND FUNDS. PROCESS TECHNOLOGY REQUIRED UNDER PRODUCTION CONDITIONS FOR COMPLEX AREAS WILL HAVE TO BE ACCOMPLISHED.

**SOLUTION** - AS A RESULT OF PEP, ESTABLISH MINIMUM PILOT FACILITIES AND PROVE OUT THE MASS PRODUCTION FEASIBILITY OF COMPLEX PROCESSES AND FABRICATION. PROVIDE DESCRIPTION OF MANUFACTURE AND IN-PROCESS TESTS TOOLING DESIGN DATA.

**0959** TITLE - MFG TECH, AUTOMATIC LIQUID AGENT DETECTOR

**PROBLEM** - PRODUCTION PROCESS ENGINEERING PROBLEMS MUST BE IDENTIFIED DURING DEVELOPMENT, UTILIZING PEP FUNDS. THERE IS A NEED FOR A TECHNIQUE TO COAT THE CIRCULAR GROOVE DISC WITH SILVER FLAKE METALLIC PAINT AND STILL OBTAIN THE RESPONSE TIME REQUIRED.

**SOLUTION** - AS A RESULT OF PEP, ESTABLISH MINIMUM PILOT FACILITIES AND PROVE OUT THE MASS PRODUCTION FEASIBILITY OF COMPLEX PROCESSES AND/or FABRICATION. PROVIDE DESCRIPTION OF MANUFACTURE AND IN-HOUSE TEST TOOLING DESIGN DATA.
COMPONENT -- DETECTION/WARNING

(2961) TITLE - MFG TECH FOR NBC RECON VEHICLE III

PROBLEM - PROCESS TECHNOLOGY REQUIRED UNDER PRODUCTION CONDITIONS FOR COMPLEX AND CRITICAL COMPONENTS WILL HAVE TO BE ESTABLISHED. TWO CRITICAL COMPONENTS ARE THE MICROPROCESSOR AND MASS SPECTROMETER.

SOLUTION - MASS PRODUCTION PROCESSES AND TECHNIQUES MUST BE PROVEN OUT. DESCRIPTIONS OF MANUFACTURE WILL BE PREPARED AND IN-PROCESS TOOLING DATA ESTABLISHED.

COMPONENT -- FILTERS

(0900) TITLE - AUTOMATED MULTIPLE FILTER LIFE TESTER

PROBLEM - THERE IS A LOW TEST RATE CAPACITY AND AN INCREASING VOLUME OF TESTING FOR THE CURRENT FILTER LIFE TEST EQUIPMENT.

SOLUTION - REDUCE MANPOWER NEEDS BY DEVELOPING A MULTIPLE TEST CHAMBER TESTER WHICH WILL PERMIT FIVE ITEMS TO BE TESTED SIMULTANEOUSLY.

(0905) TITLE - MANUFACTURE OF IMPREGNATED CHARCOAL (WHETLERITE)

PROBLEM - ONLY ONE COMPANY (CALGON, INC.) SUPPLIES WHETLERIZED CHARCOAL AND CONSIDERS ITS PROCESS PROPRIETARY. THIS MATERIAL IS VITAL FOR NEW PROTECTIVE MASKS. A PROCESS MUST BE DEVELOPED TO DISCOVER PRODUCTION BASE AND REDUCE COST THROUGH COMPETITION.

SOLUTION - MMT PROJECT 5 76 1296 DEMONSTRATED THAT, USING DILUTE SOLUTIONS OF IMPREGNANTS AND MULTI-STAGE SOAKING AND DRYING OF CHARCOAL, SEVERAL CARBONS SHOWED DRAMATIC PROTECTION IMPROVEMENT. THIS PROJECT WILL USE THESE RESULTS TO ESTABLISH A PROCESS DESIGN.

(0918) TITLE - MODERNIZATION OF FILTER PENETRATION EQUIPMENT

PROBLEM - CURRENTLY, ALL PROTECTIVE PARTICULATE FILTERS ARE TESTED WITH THREE TYPES OF EQUIPMENT. THIS EQUIPMENT IS OBSOLETE, INEFFICIENT, AND UNRELIABLE.

SOLUTION - DEVELOP PROTOTYPE TESTERS WITH SOLID STATE COMPONENTS UTILIZING STATE OF ART TECHNOLOGY.

(0919) TITLE - POLLUTION ABATEMENT FOR WHETLERITE CHARCOAL

PROBLEM - THERE IS NO PROVEN PROCESS FOR THE TREATMENT AND DISPOSAL OF THE EFFLUENTS FROM THE MANUFACTURE OF WHETLERIZED CHARCOAL.

SOLUTION - PROVIDE A PROVEN PROCESS TO TREAT AND DISPOSE OF ALL THE WASTES AND EFFLUENTS OF THE MANUFACTURING PROCESS.
COMPONENT -- FILTERS

(1295) TITLE -- MOD OF CHARCOAL FILTER TEST EQUIPMENT

PROBLEM -- CHARCOAL FILTER TESTING EQUIPMENT NEEDED TO PROVIDE TESTING CAPABILITY FOR VARIOUS CHEMICAL AGENTS DOES NOT EXIST.

SOLUTION -- DESIGN A MODULAR TESTING SYSTEM FOR VARIOUS FILTER SYSTEMS.

COMPONENT -- PROCESSES

(1348) TITLE -- SUPER TROPICAL BLEACH

PROBLEM -- THERE IS A MAJOR SHORTFALL BETWEEN THE FY78 REQUIREMENTS FOR THIS ITEM AND THE QUANTITY OF IMPORTED CHLORINATED LIME KNOWN TO BE AVAILABLE.

SOLUTION -- THIS PROJECT WILL PROVIDE THE BASIC DESIGN OF A SUPER TROPICAL BLEACH FACILITY. STUDIES WILL INCLUDE POLLUTION ABATEMENT AND CONTROL EQUIPMENT TO ASSURE COMPLIANCE WITH OSHA AND EPA STANDARDS.

(2724) TITLE -- TECHNOLOGY DATA BASE FOR C6

PROBLEM -- C6 (PHOSGINE OXIME) IS NOT AVAILABLE COMMERCIALLY OR AT GOCC PLANTS TO SUPPORT DERivation FOR IT'S USE IN THE BINARY IVA MUNITION PROGRAM. THE TECH DATA BASE IS RESTRICTED TO LABORATORY TECHNOLOGY.

SOLUTION -- ESTABLISH OPTIMUM PROCESSES AND OPERATIONAL MODES FOR SCALE-UP TO COMMERCIAL OR GOVERNMENT PRODUCTION FACILITIES.

(2725) TITLE -- TECHNOLOGY DATA BASE FOR EA4923

PROBLEM -- THE DATA BASE FOR EA4923 IS RESTRICTED TO LABORATORY DATA. PILOTING DATA IS LACKING AND INFORMATION FOR DESIGNING PRODUCTION FACILITIES DOES NOT EXIST AT THIS TIME.

SOLUTION -- TO CONDUCT PROCESS STUDIES IN THE PILOT PLANT TO DETERMINE OPTIMUM OPERATING PARAMETERS AND GENERATE DATA TO SUPPORT THE DESIGN OF A PRODUCTION FACILITY.

(4491) TITLE -- TECHNOLOGY DATA BASE FOR PINACOLYL ALCOHOL

PROBLEM -- PINACOLYL ALCOHOL IS NOT CURRENTLY AVAILABLE COMMERCIALLY IN PRODUCTION QUANTITIES AND THEREFORE, THE ARMY HAS NO AVAILBLE SUPPLY TO SUPPORT PRODUCTION OF HIGH PRIORITY BINARY IVA CHEMICAL MUNITIONS.

SOLUTION -- THIS PROJECT WILL ESTABLISH THE OPTIMUM CHEMICAL PROCESSES AND OPERATIONAL MODES FOR PRODUCTION OF PINACOLYL ALCOHOL AND DEVELOP A TECHNICAL DATA BASE FOR SCALE-UP TO COMMERCIAL OR GOVERNMENT PRODUCTION FACILITIES.

(4547) TITLE -- PROCESS TECHNOLOGY FOR 1R XM76 GRENADE

PROBLEM -- NEW IR SMOKE SCREENING TECHNOLOGY NEEDED.

SOLUTION -- DEVELOP PROCESS TECHNOLOGY FOR FUTURE 1PF.
COMPONENT -- PROTECTIVE GEAR

(0909) TITLE - AUTOMATED AGENT PERMEATION TESTER

PROBLEM - MMT PROJECT 5 75 1314 DEVELOPED INSTRUMENTATION FOR AN IMPROVED PERMEATION TESTER. HOWEVER, BECAUSE OF COST ($5,000 PER TEST UNIT) AN ANTIQUATED METHOD USING FRUIT FLIES IS STILL USED FOR MOST OF THESE TESTS.

SOLUTION - A SYSTEM WILL BE DEVELOPED TO SEQUENTIALLY SAMPLE DATA FROM 10 TESTS AND FEED IT TO ONE TEST UNIT. SAMPLES OF ONE MINUTE EVERY TEN MINUTES WILL BE SUFFICIENT BECAUSE OF LONG TEST PERIODS (8 HOURS OR MORE). FLOW CONTROLS INCLUDE SOLENOID VALVES.

(0912) TITLE - PRODUCTION PROCESS FOR PROTECTIVE MASK CANISTER BODIES

PROBLEM - THE CURRENT FIVE-STEP DEEP-DRAW PROCESS IS TIME CONSUMING, THE PROCESS HARDENS THE MATERIAL AND MAKES IT SUBJECT TO CRACKING.

SOLUTION - ESTABLISH A PROCESS WHEREBY THE CANISTERS WILL BE FORMED ON A PROGRESSIVE DIE MACHINE.

(0914) TITLE - AUTOMATIC FINISHING OF MASK COMPONENTS

PROBLEM - DURING MASK MOLDING OPERATIONS, AN EXCESS OF MATERIAL (FLASH) REMAINS ON THE MOLDED PARTS.

SOLUTION - DEVELOP TUMBLING IN A CRYOGENIC ENVIRONMENT AS AN AUTOMATED PROCESS TO REMOVE FLASH.

(1335) TITLE - MFG TECH FOR NEW PROTECTIVE MASK

PROBLEM - FABRICATION OF ONE-PIECE PLASTIC MASKS WITH ADEQUATE OPTICAL CHARACTERISTICS IS DIFFICULT. VISION REDUCTION AND DISTORTION ARE CRITICAL.

SOLUTION - DEVELOP MANUFACTURING PROCESS TO ALLEVIATE PRODUCTION PROBLEMS DEFINED BY PEP EFFORT.

COMPONENT -- PYROTECHNICS

(1709) TITLE - IMPR PROCESSING OF STARTER MIX FOR PYROTECHNIC MUNITIONS

PROBLEM - ACCIDENTAL INVITATION OF MIXTURES DURING PROCESSING IS A SERIOUS PERSONNEL SAFETY PROBLEM DUE TO EXPOSURE TO FIRE AND EXPLOSIVE HAZARDS.

SOLUTION - EVALUATE NEW MIXING AND HANDLING TECHNOLOGY THAT WILL MINIMIZE EXPOSURE TO SAFE AND TOXIC MATERIALS.
COMPONENT -- PYROTECHNICS

(3710) TITLE - DEVELOP MANUFACTURING TECHNOLOGY FOR 40MM AND CS MUNITIONS.

PROBLEM - CURRENT PRODUCTION FACILITIES EXIST ONLY IN PRIVATE INDUSTRY. THIS MUNITION WILL NOW BE PRODUCED IN GOO FACILITY FOR MOD PURPOSES. CURRENT PROCESSRequires IMPROVEMENTS FOR OSHA/EPa STANDARDS.

SOLUTION - THERE IS CURRENTLY A FACILITY FOR PRODUCTION OF THE 40MM RED, YELLOW, AND GREEN COLORED SMOKE MARKER. THE TECHNOLOGY NEEDED TO CONVERT AND MODIFY THIS FACILITY TO INCLUDE PRODUCTION OF THE 40MM, CS, M651 CARTRIDGE IS TO BE DEVELOPED.

(3726) TITLE - MMT FOR LAP OF MINIATURE TORCH

(4161) TITLE - PROC TECH FOR PDN OF 81 MM IMPRV SMOKE MUN

PROBLEM - A REQUIREMENT EXISTS FOR APPLYING THE IMPROVED SMOKE CONCEPT TO FILLING THE WARHEAD FOR THE 81 MM MORTAR.

SOLUTION - CONDUCT PROCESSING TECHNIQUE STUDIES FOR PREMIX, FILL, CLOSE AND LAP MINITIONS PRODUCTION PROCESS DATA.

(4548) TITLE - SAFETY IMPROVEMENTS OF PYROTECHNIC MIXING

PROBLEM - PYROTECHNIC MIXING Requires INCREASED PERSONNEL SAFETY FEATURES.

SOLUTION - EVALUATE CURRENT PROCESS AND INCREASE OPERATOR SAFETY THROUGH ADOPTION OF PROCESS CHANGES.

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* C A T E G O R Y *

*ENERGY CONSERVATION*

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COMPONENT -- GENERAL

(2716) TITLE - USE OF HEAT FROM NITRIC ACID RECOVERY

PROBLEM - NITRIC ACID IS SEPARATED FROM SULFURIC ACID AND REMOVED AS A VAPOR TO THE DENITRATOR. THIS RESULTS IN A LOSS OF AVAIL ENERGY.

SOLUTION - THIS PROJECT INCLUDES THE PROCUREMENT, INSTALLATION AND EVAL OF APPROPRIATE HEAT TRANSFER EQUIP TO USE THE HEAT FROM NITRIC ACID VAPOR TO PREHEAT THE SPENT ACID FEED TO DENITRATOR, PRESENTLY ACCOMP BY THE USE OF STEAM.
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<thead>
<tr>
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<tr>
<td>(2717) TITLE - USE OF HEAT DISSIPATED IN ACID STEAM CONDENSER</td>
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<tr>
<td>PROBLEM - PART OF DENITRATOR OPR INCLUDES TRANS OF EXCESS DENITRATION STEAM TO ACID STEAM CONDENSER WHERE CONDENSED COOLED BEFORE FED TO NITRIC ACID ABSORPTION TOWER CONDENS COOL OF NITRIC ACID SOLUTION IS ACCOMP BY COOL WATER RESULTING IN LOSS OF AVAIL ENERGY</td>
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<tr>
<td>SOLUTION - PROJ COVERS PROCUREMENT, INSTALL &amp; EVAL OF HEAT TRANSFER EQUIP TO USE AVAIL HEAT IN WHEW NITRIC ACID VAPOR TO PREHEAT THE MIXED ACID FEED TO DENITRATOR &amp; REDUCE NEED FOR STEAM PRESENTLY BEING USED FOR THIS PURPOSE.</td>
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<tr>
<td>(2718) TITLE - UTILIZATION OF HEAT GENERATED IN TNT MANUFACTURE</td>
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<td>PROBLEM - NO EFFECTIVE USE IS BEING MADE OF THE HEAT REMOVED BY COOLING WATER DURING THE NITRATION STAGES IN THE MANUFACTURE OF TNT.</td>
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<tr>
<td>SOLUTION - INSTALL HEAT TRANSFER EQUIPMENT TO RECOVER THE HEAT GENERATED BY THE NITRATION REACTIONS FOR USE IN THE TNT PURIFICATION OPERATIONS.</td>
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<tr>
<td>(2720) TITLE - USE OF HEAT FROM SULFURIC ACID RECOVERY</td>
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<tr>
<td>PROBLEM - SPENT ACID FROM TNT PLANT IS HEATED BY STEAM &amp; FED TO DENITRATOR WHERE NITRIC ACID IS SEP FROM SULFURIC ACID LEAVING SYS AT A TEMP OF APPROX 310F COOLING WATER IS USED TO REDUCE TEMP OF SULFURIC ACID TO 120F, RESULTING IN LOSS OF AVAIL ENERGY.</td>
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<tr>
<td>SOLUTION - PROJ INCLUDES THE PROCUREMENT, INSTALLATION &amp; EVAL OF HEAT TRANSFER EQUIP TO PREHEAT SPENT ACID W/HEAT FROM THE SULFURIC ACID &amp; MINIMIZE THE NEED FOR STEAM FOR THIS PURPOSE.</td>
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<td>(2722) TITLE - HEAT RECOVERY FROM CYCLOHEXANONE VAPOR</td>
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<td>PROBLEM - CRUDE RDX OR HMX IS DISSOLVED IN WATER/CYCLHEXANONE SOLUTION W/AID OF STEAM HEAT, IT IS THEN RECRYSTALL TO OBTAIN DESIRRE CRYSSTALLINE SIZE + CONFIG BY EVAP CYCLHEXANONE-CYCLHEXANONE VAPOR CONDENSED BY COOLING WATER PROCESS IS ENERGY INTENSIVE.</td>
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<td>SOLUTION - THIS PROJ INVOLVES USE OF HEAT AVAIL FROM THE CYCLOHEXANONE VAPOR TO ACHIEVE DISSOLUTION OF THE RDX/HMX CRYSTALS &amp; THEREBY REDUCE THE REQUIREMENT FOR STEAM.</td>
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<td>(2740) TITLE - CAD OF AAP'S BASED ON ENERGY CONSIDERATIONS</td>
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<tr>
<td>PROBLEM - ADAPT NECAP (NASA ENERGY COST ANALYSIS PROGRAM) TO ACCOUNT FOR THE UNIQUE DESIGN FEATURES OF AAP'S.</td>
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<tr>
<td>SOLUTION - NECAP IS A PROGRAM FOR DETERMINING BUILDING DESIGN COST EFFECTIVENESS BASED ON ENERGY CONSIDERATIONS. MUST BE ADAPTED TO THE UNIQUE DESIGN FEATURES FOUND IN AAP'S.</td>
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MMT FIVE YEAR PLAN
RCS DRCMT 126

FUNDING ($000)

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COMPONENT — GENERAL (CONT'D)

(3714) TITLE — ALTERNATIVE AZEOTROPIC SOLVENT FOR ACETIC ACID CONCENTRATION
PROBLEM — CURRENT ACETIC ACID CONCENTRATION PROCESS AT HSAAP USES N-PROPYL ACETATE AS AN EXTRACTION AGENT TO REMOVE WATER FROM THE ACETIC ACID. THE CURRENT PROCESS USES VERY LARGE QUANTITY OF ENERGY FOR THIS PROCESS.
SOLUTION — REPLACE THE N-PROPYL ACETATE WITH N-BUTYL ACETATE. N-BUTYL ACETATE IS A MUCH MORE EFFICIENT AZEOTROPIC AGENT THAN N-PROPYL ACETATE.

(4281) TITLE — CONSERVATION OF ENERGY AT AAP'S
PROBLEM — PETROLEUM MAY NOT BE AVAILABLE IN FUTURE TO MEET PRODUCTION REQUIREMENTS.
SOLUTION — DEVELOP ENERGY SAVING TECHNOLOGY TO APPLY TO AAP MANUFACTURING FUNCTIONS TO REDUCE QUANTITY OF ENERGY USED AT ALL LEVELS OF PRODUCTION.

(4481) TITLE — PYROLYSIS OF AAP WASTE
PROBLEM — WASTE IS DESTROYED WITHOUT RECOVERY OF ENERGY.
SOLUTION — RECOVER ENERGY FROM WASTE.

COMPONENT — COMP B

(4037) TITLE — PROCESS IMPROVEMENT FOR PLASTIC-BOND EXPLOSIVES
PROBLEM — PRESENT METHODS OF PRODUCING PBX COMPOSITIONS ARE JOB-SHOP ORIENTED AND UNECONOMICAL FOR LARGE SCALE PRODUCTION PROJECTED IN THE FUTURE.
SOLUTION — DEVELOP NEW TECHNIQUES OF COATING, DRYING, AND PACKAGING PBX COMPOSITIONS. FIRST ATTEMPT WILL BE TO EVALUATE EQUIPMENT SELECTED FOR COMPOSITION C4 UNDER Proj 4449.

(4267) TITLE — CONTINUOUS PROCESS FOR GRANULAR COMPOSITION B
PROBLEM — THE BATCHWISE COOLING PROCESS OF RDX/TNT/WAX SLURRY ALLOWS ONLY A LIMITED CONTROL OF GRANULATION.
SOLUTION — DEVELOP AND USE A CONTINUOUS PROCESS TO PRODUCE GRANULAR COMPOSITION B.

COMPONENT — HMX/RDX

(3715) TITLE — AUTOMATE HMX NITROLYSIS OPERATIONS
COMPONENT -- HMX/RDX

(4406) TITLE - IMPROVE YIELD OF HMX DURING RDX NITROLYSIS

PROBLEM - THE CURRENT MANUFACTURING PROCESS FOR HMX IS INEFFICIENT IN THAT YIELDS OBTAINED ARE STILL LESS THAN THEORETICAL.

SOLUTION - THE CURRENT BACHMANN PROCESS WILL BE MODIFIED TO INCREASE THE HMX YIELD BEYOND 3D PERCENT.

(4423) TITLE - ON-LINE MOISTURE ANALYZER FOR RDX/HMX MFG

(4449) TITLE - PROCESS IMPROVEMENT FOR COMPOSITION C-4

PROBLEM - THE EXISTING FACILITIES WHICH ARE COMMON TO THE MANUFACTURE OF COMP B AND THE OTHER RDX COMPOSITION WOULD LIMIT THE AVAILABILITY OF THESE ITEMS BELOW THEIR MOD REQUIREMENTS.

SOLUTION - ESTABLISH NEW PROCESSES AND METHODS FOR THE MANUFACTURE OF THESE ITEMS TO MINIMIZE THE IMPACT OF COMMON OPERATIONS ON CAPACITY.

(4515) TITLE - HEXAMINE MANUFACTURING AND SOLUTION PREPARATION

PROBLEM - THERE IS INSUFFICIENT SUPPLY OF HEXAMINE TO PRODUCE RDX AND HMX MOBILIZATION REQUIREMENTS. MUCH OF THE TECHNOLOGY IS AVAILABLE TO PERMIT MANUFACTURE ON-SITE. THE PREPARATION OF AN ACETIC ACID-HEXAMINE SOLUTION FROM AQUEOUS HEXAMINE REQUIRES STUDY.

SOLUTION - VERIFY DISTILLATION ASSUMPTIONS ON BENCH SCALE PRIOR TO PROCEEDING WITH FULL-SCALE DESIGN.

COMPONENT -- IHEP

(1500) TITLE - EVAL INDUST CAPABILITY F/LOAD COMMERCIAL EXPL-HIGH USE MUNIT

PROBLEM - DURING MOBILIZATION THERE CAN BE A SHORT FALL IN AVAILABILITY OF MILITARY EXPLOSIVES: INDUSTRY HAS MANY SAFE EXPLOSIVE FORMULATIONS. THEIR APPLICABILITY TO MILITARY USAGE IS UNKNOWN. INDUSTRIAL CAPABILITY FOR MILITARY FILLING THESE EXPL IS UNKNOWN.

SOLUTION - CONDUCT A PROGRAM TO IDENTIFY THE QUANTITIES AND TYPES OF COMMERCIALLY AVAILABLE EXPLOSIVES THAT COULD BE USED TO SUPPLEMENT THE ARMY'S PRODUCT PRODUCTION CAPABILITIES DURING EMERGENCY PRODUCTION PERIODS. EVALUATE THE PERFORMANCE OF MUNITIONS PRODUCED THIS WAY

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<td>(4449)</td>
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**COMPONENT — NITROCELLULOSE**

**(4571) TITLE — INCREASED COTTON LINTERS NITRATING CAPACITY**

PROBLEM — NITROCELLULOSE, MADE FROM BALED COTTON LINTERS, HAS APPROXIMATELY ONE FOURTH THE THROUGHPUT THAT IT DOES WHEN MADE FROM SHEETED WOOD PULP. THIS PROBLEM SEEMS TO BE ASSOCIATED WITH THE INABILITY TO DROWN OR COMPLETELY WET AND RENETRATE THE COTTON.

SOLUTION — INCREASE AND EVALUATE THE AGITATION IN THE FIRST NITRATOR.

**COMPONENT — PROCESS CONTROL**

**(1906) TITLE — ADAPTIVE CONTROL OF EXPLOSIVES LINES**

PROBLEM — TAKE ADVANTAGE OF THE ADVANCED PROCESS CONTROL TECHNOLOGY FOR APPLICATION TO EXPLOSIVE PROCESSES TO REDUCE MANPOWER COSTS AND PERSONNEL EXPOSURE AND INCREASE PROCESS PRODUCTIVITY.

SOLUTION — ADAPT MINI-PROCESS CONTROLS D-D-D S O PROPELLANT PROCESSES WITH REDUCTION IN COSTS, ENHANCED REAL TIME CONTROL, REDUCED PERSONNEL EXPOSURE AND IMPROVED OVERALL EFFICIENCY.

**(1913) TITLE — PBX CONT CAST FOR BOMB LOADING**

PROBLEM — ADDUSED USE OF CASTABLE PLASTIC BONDED EXPLOSIVES WILL CREATE PRODUCTION SHORTFALLS. MOST PBX CAN NOT BE USED IN PRESENT MELT / CAST EQUIPMENT. PBX PRODUCTION IS NOW DONE AT 2 NAVY PLANTS WHICH COULD NOT HANDLE LOADING OF CASTABLE PBX IN BOMBS.

SOLUTION — ESTABLISH HIGH PRODUCTION RATE CONTINUOUS PROCESSES FOR MIX AND CAST OF VARIOUS PBX FORMULATIONS. IDENTIFY + EVALUATE EQUIPMENT + PROCESSES, SELECT + TEST EQUIPMENT + INTEGRATE ACCEPTABLE ITEMS INTO AN OPERATING PBX PROCESSING PILOT PLANT.

**(3708) TITLE — PROCESS FOR MANUFACTURE OF ETHYLENE DIAMINE DINITRATE (EDAN)**

PROBLEM — NO PROBLEM PROVIDED.

SOLUTION — NO SOLUTION PROVIDED.

**COMPONENT — TNT**

**(3729) TITLE — MFG PROCESSES F/SPEC CONCRETE STRUCTURE DEMOLITION CHARGES**
COMPONENT -- TNT
(Continued)

(4452) TITLE - REPROCESSING DEMILLED EXPLOSIVES

PROBLEM - LARGE QUANTITIES OF EXPLOSIVES FROM DEMILITARIZATION ARE DESTROYED ANNUALLY, PRIMARILY BY BURNING BECAUSE NO ESTABLISHED METHOD IS AVAILABLE FOR REPROCESSING THE MATERIAL FOR REUSE IN MUNITIONS LOADING.

SOLUTION - DEVELOP PROTOTYPE EQUIPMENT FOR REPROCESSING/REFINING RECLAIMED EXPLOSIVES, ANALYZE THE QUALITY, ENERGY POTENTIAL, AND LOADING RESULTS OF RECLAIMED EXPLOSIVES USED ALONE OR AS A MIXTURE WITH VIRGIN MATERIAL.

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* CATEGORY *
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#FUZES

COMPONENT -- ELECTRONICS

(1222) TITLE - BORESIGHTING W/ SFF W/ IR SENSOR

PROBLEM - NO PRODUCTION PROCESS EXISTS TO BORE SIGHT STORM WARHEAD W/ IR SENSOR. PRESENT HAND PROCESS REQUIRE SEVERAL HOURS AND IS UNRELIABLE.

SOLUTION - DEVELOP EQUIPMENT TO AUTOMATE PROCESS.

(2704) TITLE - TEST AND PROCESSES FOR GUN RUGGED CRYSTAL OSCILLATOR

PROBLEM - THERE IS A NEED FOR PRODUCTION TEST EQUIPMENT AND PROCESSES THAT CAN TEST AND SCREEN QUARTZ CRYSTALS TO INSURE SURVIVABILITY IN THE BALLISTIC ENVIRONMENT.

SOLUTION - THE GOAL OF THIS PROJECT IS TO DEVELOP APPROACHES AND DESIGN EQUIPMENT WHICH CAN PROVIDE PRODUCTION SCREENING OF QUARTZ CRYSTALS TO INSURE SURVIVABILITY IN THE BALLISTIC ENVIRONMENT.

(3716) TITLE - SENSOR TECHNOLOGY

PROBLEM - REPLACE CONVENTIONAL (AND COMPLEX) FUZES WITH OPTICAL SENSING DEVICES.

SOLUTION - THIS TECHNOLOGY (SENSOR) WILL BE HIGHLY AUTOMATED IN PRODUCTION AND HIGHLY ACCURATE IN USE (COMMERCIAL APPLICATIONS WILL BE NUMEROUS IN THIS TIME SPAN).

(13731) TITLE - MFG PROCESSES F/XM742 AND XM762 ELECTRICAL TIMER

(13742) TITLE - MFG PROCESSES F/MILLIMETER WAVE TECH FUZES/SEEKER SYSTEMS
MHS FIVE YEAR PLAN
RCS DRCM 126

FUNDING ($000)

PRIO 02 03 04 05 06

COMPONENT ---- ELECTRONICS

COMPONENT ---- METAL PARTS

(2736) TITLE - CHEMICAL MACHINING OF PRECISION COMPONENTS

PROBLEM - HOLDING TOLERANCES AND HIGH SCRAP RATES ARE COMMON PROBLEMS WHEN SMALL THIN FUZE PARTS ARE STAMPED IN A PRESS. STAMPING IS CAPITAL INTENSIVE AND IS ONLY GOOD FOR HIGH VOLUME QUANTITIES.

SOLUTION - CHEMICAL MACHINING OF COMPONENTS REQUIRES LESS CAPITAL EQUIPMENT AND PRODUCES A MUCH SMALLER QUANTITY OF SCRAP.

(4401) TITLE - HOT FORMING & COLD HEADING LARGE FUZE COMPONENTS

PROBLEM - MULTISPINDEL BAR MACHINES DATE FROM 1950'S. THEY HAVE LOW PRODUCTIVITY, DO NOT MEET OSHA, CAN'T USE CARBIDE TOOLS, NO SPARE PARTS.

SOLUTION - APPLY MOD TECH SUCH AS HOT FORGE AND COLD HEADING TO OBTAIN SHAPE & REDUCE MACHINING AND SCRAP. THIS ALLOWS HIGH SPEED CHUCKERS FOR FINISH MACHINING.

COMPONENT ---- QA/TESTING

(2739) TITLE - TEST EQPT AND PROCESSES FOR XM762 ELECTRONIC FUZE

PROBLEM - THERE IS A NEED FOR THE EQUIPMENT AND PROCESSES THAT CAN PROVIDE PRODUCTION TESTING OF FUZE ASSEMBLIES AT THE MOBILIZATION PRODUCTION RATE.

SOLUTION - THE GOAL OF THIS PROJECT IS TO DEVELOP TESTING APPROACHES AND DESIGN EQUIPMENT WHICH CAN PROVIDE ADDITIONAL TESTING OF FUZE COMPONENTS AND ASSEMBLIES AT THE MOBILIZATION PRODUCTION RATE.

COMPONENT ---- THICK FILM

(1800) TITLE - PROCESSING FOR METAL-BASED SUBSTRATES

PROBLEM - PROJECT WILL DEMONSTRATE FEASIBILITY OF USING THICK FILM NON-NOBLE METALS IN LIEU OF GOLD AS THE CONDUCTIVE MEDIUM ON PORCELAIN-COATED STEEL SUBSTRATES. PROBLEMS INVOLVE PRINTING, FIRING, TRIMMING AND WIRE BENDING.

SOLUTION - TECHNIQUES FOR WIRE BONDING AND CONDUCTOR PASTE ADHESION WILL BE ESTABLISHED. LASER TRIM PARAMETER CHANGES WILL BE DOCUMENTED. NON-OXIDIZING FURNACE FIRING WILL BE USED FOR THE NON-NOBLE CONDUCTIVE MEDIUM.
MINT FIVE YEAR PLAN
RCS ORCMT 124

FUNDING ($000)

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<th>82</th>
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<td>PRIOR</td>
<td>150</td>
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<tr>
<td>(3730) TITLE - MFG PROCESSES F/SENSOR OFF-ROUTE MINE SYSTEM (STORMS)</td>
<td>4500</td>
<td>2960</td>
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COMPONENT -- MISCELLANEOUS

(2742) TITLE - LASER APPLIED DURABLE COATINGS

PROBLEM - PRODUCTIVITY IS A FUNCTION OF RAM TO INCREASE RELIABILITY AND REDUCE MAINTENANCE DOWN TIME AND COST IN THE MUNITIONS PLANT ENVIRONMENT IS VERY DIFFICULT.

SOLUTION - UTILIZE LASER APPLIED DURABLE COATINGS ON MACHINE AND TOOL WEAR SURFACES AND IN CORROSIVE ENVIRONMENTS.

(4309) TITLE - PROCESS DEVEL F/120MM AMMO

PROBLEM - MASS PRODUCTION IN THE US OF W. GERMAN 120MM TANK AMMUNITION POSES PROBLEMS IN FOUR FUNCTIONAL AREAS - METAL PARTS, PROPELLANT, FUSE, AND LAP.

SOLUTION - THIS IS A MULTI-YEAR EFFORT IN FOUR FUNCTIONAL AREAS. A SEPARATE TASK ADDRESSES EACH UNIQUE PROBLEM. THIS MINT SUPPORTS FACILITY PROJECTS IN FY83-84 AND IS ESSENTIAL TO FIELDING THE 120MM GUN SYSTEM ON THE X111 TANK IN FY85.

COMPONENT -- ASSEMBLY

(030) TITLE - LAP OF SENSE AND DESTROY ARMOR (SADARM)

PROBLEM - SADARM COMPONENTS ARE COSTLY TO LAP. NO ECONOMICAL PRODUCTION SYSTEM EXISTS.

SOLUTION - DEVELOP ECONOMICAL METHODS FOR LAP OF SADARM COMPONENTS.

(2706) TITLE - AUTOMATIC PROCESSING OF PARACHUTE ASSEMBLIES

PROBLEM - PARACHUTE ASSEMBLY AT PRESENT IS AN OPERATOR CONTROLLED PROCESS DEVELOPED FROM HAND FOLDING OF MANNED PARACHUTES. THIS IS A TIME CONSUMING AND COSTLY PROCESS REQUIRING EXPERIENCE AND DEXTEROUS PERSONNEL.

SOLUTION - UTILIZING FavorABLE RESULTS OF PRIOR YEAR FEASIBILITY STUDIES, BUILD AND TEST A FULL SCALE PROTOTYPE SYSTEM FOR ECONOMICAL, RELIABLE, HIGH-RATE, SEMI-AUTOMATIC ASSEMBLY OF PARACHUTE COMPONENTS FOR AMMUNITION ITEMS.
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>ASSEMBLY</th>
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<tbody>
<tr>
<td><strong>(4062)</strong> TITLE - AUTO MFG SUPPORT FOR MORTAR INCREMENT CONTAINERS</td>
<td></td>
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<tr>
<td>PROBLEM - THE MANUFACTURE AND ASSEMBLY OF THE 60/81MM PROP CHARGE INCREMENT CONTAINER IS LABOR INTENSIVE AND DOES NOT MEET PRODUCTION REQUIREMENTS.</td>
<td></td>
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<tr>
<td>SOLUTION - DEVELOP PROCESS AND EQUIPMENT TO REDUCE COSTS, INCREASE PRODUCTION RATES, AND IMPROVE QUALITY.</td>
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<tr>
<td><strong>(4198)</strong> TITLE - AUTOMATED LAP' OF STICK-PROPELLANT CHARGES</td>
<td>1007</td>
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<tr>
<td>PROBLEM - STICK PROPELLANT CHARGES HAVE NO LAP PROCESSING PRECEDENT. CURRENT MANUAL METHODS OF PRODUCTION ARE INEFFECTIVE IN ACHIEVING SATISFACTORY LEVELS OF QUALITY, COST, SAFETY AND PRODUCTION READINESS.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION - EFFICIENT HIGH SPEED AUTO LAP EQUIPMENT WILL BRING PRODUCTION OF STICK PROPELLANT CHARGES TO A LEVEL CONSISTENT WITH MODERN TECHNOLOGY. AN INITIAL ENGINEERING STUDY TO DEFINE CONCEPTS AND PARAMETERS TO BE FOLLOWED BY PROTOTYPE EQUIPMENT IS PROPOSED.</td>
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<tr>
<td><strong>(4368)</strong> TITLE - DEV AUTOMATED EQPT FOR SEALING M55 DETONATORS</td>
<td></td>
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<tr>
<td>PROBLEM - CURR M55 DETS ARE BEING LACQUERED. 2 APPROACHES TO SEALING ARE BEING INVEST: I USED FOIL PRECOATED W/ADHESIVE + THE OTHER WELDS THE DET CUP TO FOIL. BOTH CAN BE PERF ON A LOADER. LESS HANDLING WILL REDUCE COST OF DET.</td>
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<tr>
<td>SOLUTION - DEVELOP EQUIPMENT BASED ON EITHER THE HOT MELT ADHESIVE OR ULTRA SONIC WELDING TECHNIQUE CURRENTLY BEING INVESTIGATED. RETROFIT BOTH SINGLE-TOOL AND MULTI-TOOL DETONATOR LOADERS WITH EQUIPMENT TO SEAL THE M55 DETONATOR.</td>
<td>569 226</td>
</tr>
<tr>
<td><strong>(4523)</strong> TITLE - RAPID MOISTURE ANALYSIS OF EXPLOSIVE MIXES</td>
<td>202</td>
</tr>
<tr>
<td>PROBLEM - PRESENT MOISTURE ANALYSIS TECHNIQUE REQUIRES SOME 3 3/4 HOURS PER SAMPLE. IN AN AUTOMATED BACKLINE, THIS IS TOO LONG A PERIOD TO WAIT RELATIVE TO AN ACCEPTANCE/REJECTION DECISION FOR THE BATCH.</td>
<td></td>
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<tr>
<td>SOLUTION - INVESTIGATE THREE KNOWN TECHNIQUES FOR RAPID MOISTURE ANALYSIS AND PROCEED WITH THE O/P TO THE PROTOTYPE STAGE.</td>
<td></td>
</tr>
<tr>
<td><strong>(4595)</strong> TITLE - AUTOMATED ASSEMBLY OF M21 FLASH SIMULATOR</td>
<td></td>
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<tr>
<td>PROBLEM - THE LONGHORN AAP PRODUCTION LINE IS BASICALLY A HAND LINE OPERATION WHICH IS LABOR INTENSIVE AND EXPOSES THE LINE OPERATORS TO POTENTIALLY HAZARDOUS OPERATIONS.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION - DEVELOP SEMI-AUTOMATED OR MECHANIZED ASSEMBLY EQUIPMENT WHICH WOULD SIGNIFICANTLY REDUCE THE PRODUCTION MANPOWER REQUIREMENTS AND REDUCE THE EXPOSURE OF PERSONNEL TO POTENTIALLY HAZARDOUS OPERATIONS.</td>
<td>550 870</td>
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</tbody>
</table>
COMPONENT -- GENERAL

(0003) TITLE -- APPLICATION OF NEW INDUSTRIAL PROCESSES TO LAP TECHNOLOGY

PROBLEM -- THERE ARE NUMEROUS REQUIREMENTS IN THE LAP AREA THAT COULD TAKE ADVANTAGE OF THE LATEST TECHNOLOGY DEVELOPMENT IN INDUSTRY. WE MUST PROVIDE FOR THE APPLICATION OF THIS TECHNOLOGY TO OUR LINES THROUGH ENGINEERING PROJECTS.

SOLUTION -- THIS TECHNOLOGY THREATENS THE APPLICATION OF NEW TECHNOLOGY DEVELOPMENTS IN INDUSTRY TO LAP PROCESSES. THESE MAY INVOLVE WEIGHING, MATERIAL HANDLING, MATERIAL DEVELOPMENT, AND EQUIPMENT APPLICATION.

(0015) TITLE -- DEVELOP TECHNOLOGY FOR MFG OF DELAY TRAINS

PROBLEM -- DELAY TRAIN PRODUCTION CONTRACTED OUT. DISRUPTIVE OF PRODUCTION. D EFFECTIVE COMPONENTS.

SOLUTION -- PROVIDE DELAY TRAIN MFG IN-HOUSE. PROVIDE INTEGRAL CONCEPT FOR ITEMS. PROVIDE INTEGRATED FACILITY.

(2703) TITLE -- THREAD CLEANING/INSPECTION OF HE LOADED MUNITIONS

PROBLEM -- THE THREADS OF HE LOADED MUNITIONS ARE CLEANED INDIVIDUALLY BY HAND. THE OPERATION IS LABOR INTENSIVE AND HAZARDOUS TO THE OPERATOR.

SOLUTION -- UTILIZING CURRENT TECHNOLOGY DESIGN + BUILD PROTOTYPE EQUIP THAT WILL CLEAN, INSPECT & TRANSFER THE MUNITION THROUGH ENTIRE OPERATION CYCLE AUTOMATICALLY.

(2712) TITLE -- MOISTURE MEASUREMENT INSTRUMENTATION

PROBLEM -- MEASUREMENT OF MOISTURE CONTENT IN POWDERED EXPLOSIVES USED IN REGULAR PROD IS CURRENTLY DONE ON A DAILY SAMPLING BASIS USING TIME CONSUMING + EXPENSIVE LABORATORY TECHNIQUES.

SOLUTION -- SECURE + INSTALL RAPID' MOISTURE MEASUR INSTRUMENTATION ON PROD LINE. EQUIP WILL PROVIDE QUICK + ACCURATE READOUTS OF PERCENT MOISTURE CONTENT. PRECISE DESIGN & SELEC OF APPROPRIATE INSTRUMENT COMPONENTS WILL BE ACCOMP OVER EXECUTION OF PROJ.

(4251) TITLE -- AUTO MANU OF DELAY FOR M549 AND XM650 PROJECTILES

PROBLEM -- CURRENT OPERATION ARE LABOR INTENSIVE. COST OF ITEM IS HIGH.

SOLUTION -- DEV AUTO LAP EQUIP.

(4522) TITLE -- AUTO CARRIER CLEANING STATION FOR DET FAC

PROBLEM -- CARRIERS USED IN PRODUCTION MAY HAVE CONSIDERABLE POWDER ON THEM WHICH MUST BE REMOVED IN A SAFE MANNER. THE CURRENT MANUAL OPERATION IS POTENTIALLY HAZARDOUS.

SOLUTION -- DEVELOP AN AUTOMATED POWDER REMOVAL AND CLEANING STATION FOR THE AUTOMATED CONVEYOR SYSTEM AT THE LSAAP MODERNIZED DETONATOR FACILITY.
COMPONENT -- GENERAL

(4550) TITLE - AUTO ASSY OF M22 FLASH SIMULATOR

PROBLEM - ITEM MANUFACTURED IN TEST QUANTITIES ONLY. PLANS ARE TO PROCURE FROM LONGHORN A&P ON HAND LINE WHICH IS EXPECTED TO RESULT IN A LABOR INTENSIVE OPERATION.

SOLUTION - THE MMT WILL DEVELOP AUTOMATED EQUIPMENT AND REDUCE LABOR FOR MANUFACTURE.

COMPONENT -- LOAD

(6001) TITLE - 60MM SMOKE PDM TECH/F/IMPROVED SMOKE MUNITION

PROBLEM - A FAMILY OF NEW IMPROVED RP OR WP SMOKE ROUNDS INCLUDING 60MM MORTAR IS BEING DEVELOPED. FUTURE PRODUCTION IS DEPENDENT ON THE AVAILABILITY OF NEW TECHNOLOGY AND PRODUCTION EQUIPMENT.

SOLUTION - DEVELOP TECHNOLOGY REQUIRED TO DESIGN PILOT EQUIPMENT FOR FILLING IMPROVED SMOKE 60MM MUNITION INCORPORATION RP WICK MATERIAL WITH WP.

(3301) TITLE - PRESS/INJECTION LOADING OF INSENSITIVE HE

PROBLEM - NO PROBLEM PROVIDED.

SOLUTION - NO SOLUTION PROVIDED.

(6010) TITLE - DEVELOP IMPROVED FILLING METHOD FOR M74 ROCKET

PROBLEM - TPA FILLING METHOD IS SLOW AND CAUSES INEFFICIENT OPERATION.

SOLUTION - EVALUATE AND SELECT OPTIMUM FILL EQUIPMENT TO REDUCE FILLING TIME.

(2441) TITLE - MODERNIZATION OF TRACER LOADING

PROBLEM - CURRENT TRACER LOADING TECHNOLOGY UTILIZES CONSIDERABLE LABOR, SLOW/SINGULAR OPERATING TYPE PRESSING MACHINES.

SOLUTION - DEVELOP MODERN AUTOMATED MULTIPLE ITEM LOADING EQUIPMENT. HIGH PRODUCTION, LOW MAINTAINABILITY, ECONOMICAL AND RELIABLE EQUIPMENT ADAPTABLE TO NUMEROUS TRACER ITEMS WILL RESULT.

(1367) TITLE - DEVELOP MFG TECHNOLOGY FOR XM96 CS ROCKET

PROBLEM - NEVER PRODUCED AT PBA. MOBILIZATION REQUIREMENT.

SOLUTION - PROVIDE MFG TECHNOLOGY. PROVIDE DESIGN CRITERIA FOR IPF.
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>LOAD</th>
<th>(CONTINUED)</th>
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<tbody>
<tr>
<td>(1701) TITLE - BULK TRANSFER OF CHEMICAL MATERIALS</td>
<td></td>
<td>221 207</td>
</tr>
<tr>
<td>PROBLEM - CURRENT TECHNIQUE FOR RETRIEVAL WEIGHING AND TRANSPORTING PYROTECHNIC CHEMICAL CONSTITUENTS ARE ACCOMPLISHED BY LABOR INTENSIVE OPERATION AND ARE UNSAFE.</td>
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<tr>
<td>SOLUTION - AN EFFICIENT MATERIALS HANDLING SYSTEM WILL BE SURVEYED AND DEVELOPED SO THAT EPA/OSHA STANDARDS WILL BE MET.</td>
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<tr>
<td>(2016) TITLE - COLD PRESSING OF EXPLOSIVES</td>
<td></td>
<td>750</td>
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<tr>
<td>PROBLEM - LOAD OF HMX EXPLOSIVES INTO SHAPED CHARGES + PRESS AMMO + PRESSING PELLETS IS SLOW + COSTLY DUE TO HEAT; VACUUM + NOT PRESSING REQUIRES OF EXPLOSIVE TO OVERCOME POTENTIAL EXUDATION + LOW DENSITY CHARGE PROBLEMS W/CAST CHARGES CANNOT BE REALIZED.</td>
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<tr>
<td>SOLUTION - NEW EXPLOSIVE HAS BEEN DEV WHICH HAS HMX AS ITS BASE; PROPERTIES SIM TO OCTOL + LX14 EXPLOSIVES + CAN BE CGLD PRESSED, AUTOMATING CGLD PRESSING OF HMX WILL ENHANCE ITS USE, WILL REDUCE COST DRASTICALLY + ELIM PENTIAL FOR EXPLOSION.</td>
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<tr>
<td>(2018) TITLE - INJECTION MOLDING TECHNIQUES FOR ACM/CMS</td>
<td></td>
<td>285</td>
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<tr>
<td>PROBLEM - CURRENT EXPLOSIVE LOADING TECHNOLOGIES FOR SMALL MUNITIONS USE GRAVITY POURING WHICH REQUIRES PERSONNEL EXPOSURE TO EXPLOSIVES AND RESULTS IN LARGE AMOUNTS OF RISSION SCRAP.</td>
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<tr>
<td>SOLUTION - DEVELOP AUTOMATIC PRODUCTION INJECTION MOLDING EQUIPMENT TO LOAD ACM AND CMS ITEMS WHICH WILL VIRTUALLY ELIMINATE EXPLOSIVE RISSION SCRAP AND DRASTICALLY REDUCE PERSONNEL EXPOSURE.</td>
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<tr>
<td>(2707) TITLE - IMPROVED PROCESS FOR HE CAVITY FORMING</td>
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<td>650</td>
</tr>
<tr>
<td>PROBLEM - CURRENT GDCW PROCESSES REQUIRE MACHINING OF EXPLOSIVE CAVITIES. THIS IS VERY HAZARDOUS AND MUST BE PERFORMED BEHIND A BARRICADE AND IS VERY COSTLY.</td>
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<tr>
<td>SOLUTION - REDESIGN THE POURING FUNEAL TO ELIM MACHINING. THIS WILL DRARCTLLY REDUCE COST AS NO BARRICADE IS REQUIRED, EXPENSIVE MACHINERY/MAINT IS ELIMINATED AND SUPPORTING LABOR IS REDUCED.</td>
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<tr>
<td>(3706) TITLE - MFG/LOG TECH E/NORWEGIAN BASED PROJECTILES</td>
<td></td>
<td>700</td>
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<tr>
<td>PROBLEM - DEVELOP AND DEMONSTRATE A PROTOTYPE LAP LINE FOR RAFOSS-TYPE PROJECTILE CAPABLE OF APPROXIMATING US HIGH VOLUME TECHNIQUES WITHOUT DEGRADING PERFORMANCE.</td>
<td></td>
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<tr>
<td>SOLUTION - DEVELOP A HIGH VOLUME LAP LINE FOR THE RAFOSS-TYPE ROUND STARTING WITH DEVELOPMENT OF HANDLING INSPECTION AND PRESS LOADING FOR DIFFERENT HIGH EXPLOSIVES AND INCREDIBLE MIXES AND PROGRESSING TO HIGH VOLUME DEMONSTRATION.</td>
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<tr>
<td>COMPONENT -- LOAD</td>
<td>(CONTINUED)</td>
<td>FUNDING ($000)</td>
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<tr>
<td>(3720) TITLE - MFG PROCESSES F/LAP OF UNDERWATER MINE SYS (UMS)</td>
<td></td>
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<tr>
<td>(3721) TITLE - MFG PROCESS F/LAP OF IMPROVED MINE SYSTEM</td>
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<td>500</td>
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<tr>
<td>(3722) TITLE - MFG PROCESSES F/LAP OF OFF-ROUTE ANTITANK MINE SYSTEM</td>
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<td>700</td>
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<tr>
<td>(3723) TITLE - MFG PROCESS F/LAP OF THE GUIDED ANTIARMOR MORTAR PROJECTILE</td>
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<tr>
<td>(3728) TITLE - MFG PROCESSES F/WIDE AREA SPRAY SYSTEM (SPRAY FAE)</td>
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<td>(3733) TITLE - MFG PROCESSES F/ADV DET DESIGNS</td>
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<tr>
<td>(3735) TITLE - MFG PROCESS F/WALL BREAKING CHARGE</td>
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<tr>
<td>(4078) TITLE - UPGRADE SAFETY READINESS AND PRODUCTIVITY OF EXIST MELT POUR</td>
<td></td>
<td>300 600 900</td>
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<tr>
<td>PROBLEM - SIGNIFICANT IMPROVEMENT OF MELT POUR FACILITIES IS NOT BEING REALIZED BECAUSE DESIGN APPROACHES FOR COST-EFFECTIVE INTERMEDIATE UPGRAADING ARE NOT AVAILABLE.</td>
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<tr>
<td>SOLUTION - DEVELOP A SERIES OF PROCESS DESIGN CONCEPTS TO IMPROVE SAFETY, REDUCE EXPLOSIVE QUANTITIES, REMOVE PERSONNEL FROM HAZARDOUS AREAS, INCREASE EFFICIENCY AND REDUCE PRODUCTION COSTS. PROVIDE MODULAR DESIGN PKGS F/VARIOUS PROCESSES AND UPGRAADING LEVELS.</td>
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</tr>
<tr>
<td>(4086) TITLE - REPROCESSING EXPLOSIVE FINES AND DRILL SCRAP</td>
<td></td>
<td>621</td>
</tr>
<tr>
<td>PROBLEM - FINELY DIVIDED EXPLOSIVE SCRAP GENERATED IN CAVITY DRILLING AND RISER CRUSHING OPERATIONS IS CURRENTLY BURNT AS WASTE. IT CANNOT BE REPROCESSED IN ITS GENERATED STATE DUE TO HANDLING PROBLEMS AND AGGLOMERATION WHEN INTRODUCED INTO MELT SYSTEMS.</td>
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<tr>
<td>SOLUTION - DEVELOP A SYSTEM TO SCREEN, INSPECT AND REPROCESS THE FINE EXPLOSIVE INTO FLAKE EXPLOSIVE THAT CAN BE EASILY TRANSPORTED AND DIRECTLY INTRODUCED INTO MELT POUR SYSTEMS.</td>
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<tr>
<td>COMPONENT --- LOAD</td>
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(4373) TITLE - SILK SCREEN DEPOSITION OF PRIMARY EXPLOSIVES

**Problem:** Current non-electric detonator facilities, equipment and methods lack versatility, present problems in quality and uniformity of product and are costly in operation and maintenance.

**Solution:** Eval new improved or modified equipment and techniques for the mass production of detonators using silk-screen techniques with the ultimate goal of modernizing production facilities.

(4497) TITLE - HANDLING EQUIPMENT FOR ADAM OVERLAYS

**Problem:** The ADAM propellant overlay is manually conveyed between six modules. The manual conveyance is slow and exposes personnel to hazardous operations.

**Solution:** Develop a material handling system to automatically load and unload each station and to convey parts between stations during the welding and filling operation.

(4520) TITLE - DEV PROCESS FJPRESS LOADING IDSMM HEAT-MP-T, XM815 PROJ

**Problem:** The IDSMM XM815 will be the first tank round to use a pressed shaped charge. A production process for press loading must be established evaluating several candidate explosives and establishing tooling design and pressing parameters.

**Solution:** Processing procedures will be established for candidate explosives and a limited number of units loaded, tested, evaluated, process equipment will be identified so that proper press loading procedures may be implemented into production.

(4524) TITLE - LOW VOLUME AUTO MELT-POUR EQUIP FOR LOADING SMALL AP MINES

**Problem:** Current explosive loading of small AP mines is achieved by highly labor intensive operations. Large volume techniques are not applicable because of low planned production quantities.

**Solution:** Develop a low cost, low volume automated injection molding system for melt loading of FASCAM mines.

(4561) TITLE - FILL/CLOSE + LAP TECHNOLOGY FOR BINARY IVA MUNITIONS

**Problem:** New IVA binary munitions will require process baseline for design of production facilities to fill/close and lap the items.

**Solution:** Manufacturing processes will be established and prototype equipment acquired to produce the IVA munitions.
COMPONENT -- PACK

(4568) TITLE -- AUTO WEIGHING SYSTEM FOR PROPELLANTS

PROBLEM -- ELECTRONIC CONTROLS FOR WEIGHING SYSTEMS DO NOT MEET THE NATIONAL ELECTRICAL CODE STANDARDS AND OPERATE PRESENTLY UNDER EXEMPTIONS TO THE CODE, PROCUREMENT 16 CURRENTLY FROM A SOLE SOURCE.

SOLUTION -- TO MODIFY AND SYNTHESIZE COMMERCIAL COMPONENTS INTO A LESS EXPENSIVE AND MORE RELIABLE SYSTEM WHICH CAN BE PURCHASED ON A COMPETITIVE BASIS AND NOT REQUIRE SAFETY WAIVERS.

COMPONENT -- SUPPORT

(2002) TITLE -- IMPROVED AUTOMATED LAP MATERIAL HANDLING TECH

PROBLEM -- MATERIAL HANDLING EQUIPMENT USED IN LINES AT LAP PLANTS IS GENERALLY OLD AND COSTLY TO OPERATE, MAINTAIN, AND SUPPORT.

SOLUTION -- THIS PROJECT WILL EXPLORE STATE OF THE ART EQUIPMENT WITH EMPHASIS ON ADAPTATIONS REQUIRED FOR OPERATION IN AN EXPLOSIVE ENVIRONMENT.

COMPONENT -- TNT

(4202) TITLE -- TNT CRYSTALLIZER FOR LARGE CALIBER

PROBLEM -- TNT MELT LOADING REQUIRES AN OPTIMUM RATIO OF MOLTEN AND SOLID TNT IN THE EXPLOSIVE MIX AT THE TIME OF POUR. THE RATIO IS OBTAINED BY THE ADDITION OF FLAKE TNT TO A QUANTITY OF MOLTEN TNT BASED ON OPERATOR JUDGEMENT.

SOLUTION -- DEV A DEVICE WHICH UTILIZES MOLTEN TNT TO GEN A SLURRY CONSISTENCY THROUGH PARTIAL CONTROLLED, STEADY-STATE CRYSTALLIZATION. BY close control of TNT FLOW RATE AND THERMAL PARAMETERS, A CONTINUOUS FINE GRAINED SLURRY MIX OF PROPER RATIO WOULD RESULT.

(4399) TITLE -- INSTRU IN-PROCESS MEASUREMENTS OF SOLID LIQUID TNT

PROBLEM -- no accurate real time capability exists to measure the solid/liquid ratio of TNT slurries critical for TNT loading of medium and large caliber projectiles. This results in marginal process control with a potential for defective casts and rework.

SOLUTION -- develop remotely operated highly sensitive instrumentation to measure slurry solid/liquid proportion during TNT loading operations. This will permit close control of the TNT physical characteristics and result in the highest uniform quality possible.

*****

* CATEGORY *

* METAL PARTS *
COMPONENT — CARTRIDGE CASES

(4542) TITLE - ULTRASONIC DEEP DRAWING OF CANNON STEEL CARTRIDGE CASES

PROBLEM - DEEP DRAWN STEEL CASES REQUIRE MULTIPLE DRAWS AND REQUIRE EXCESSIVE PROCESSING AND ENERGY VS BRASS.

SOLUTION - ULTRASONIC ACTIVATION OF FORMING DIES HAS POTENTIAL FOR REDUCING DRAWING FORCES AND ELIMINATING STEPS IN THE DRAWING PROCESS.

COMPONENT — FORMING/MACHINING

(2726) TITLE - LASER CUTTING SLOTS IN HARDENED STEEL STRUCTURES

PROBLEM - CURRENT TECHNOLOGY EMPLOYED TO FORM SLOTS IN HARDENED STEEL STRUCTURE OF VARYING THICKNESS IS SLOW AND COSTLY. A MORE COST EFFECTIVE TECHNIQUE IS REQUIRED.

SOLUTION - ADAPT STATE-OF-THE-ART MICROPROCESSOR CONTROLLED LASER CUTTING EQUIPMENT TO PRODUCE CLOSE TOLERANCED ORDNANCE CONFIGURATIONS IN HARDENED STRUCTURES.

(2731) TITLE - ULTRASONIC ASSISTED MACHINING

PROBLEM - DIFFICULT TO MACHINE MATERIALS REQUIRE REDUCED FEEDS AND SPEEDS AND INCREASED TOOL WEAR AND BREAKAGE ALL OF WHICH CONTRIBUTES TO INCREASED MACHINING COSTS.

SOLUTION - STUDIES SHOW THAT ULTRASONIC ACTIVATION OF CUTTING TOOLS RESULTED IN REDUCED LOADS AND WEAR WHEN CUTTING DIFFICULT TO MACHINE MATERIALS. ECONOMIC BENEFITS WILL BE ESTABLISHED BY APPLYING THE LAB METHODS TO REAL WORLD MACHINING SITUATIONS.

(3015) TITLE - IUD FOR DU COMES

PROBLEM - ACCELERATED CORROSION TESTING OF STABALLOY CORES HAS INDICATED A POTENTIAL CORROSION PROBLEM WITH UNCOATED STABALLOY CORES IN LONG TERM STORAGE. CONVENTIONAL COATING PROCESSES SUCH AS PAINTING AND ELECTROLESS PLATING ARE NOT SATISFACTORY.

SOLUTION - INVESTIGATE ION VAPOUR DEPOSITED COATINGS. DETERMINE EQUIPMENT REQUIREMENTS, INSPECTION AND TEST PROCEDURES, PRODUCE A PIECE OF PRODUCTION EQUIPMENT, AND ESTABLISH PROCESS PARAMETERS.

(3703) TITLE - WASP SHAPED CHARGE LINER

PROBLEM - THE WARHEAD (WASP) SHAPED CHARGE LINER IS PROJECTED TO HAVE A DOUBLE CONTOUR WITH VARIABLE THICKNESS WALLS. MACHINING COSTS FOR THIS LINER COULD BE AS MUCH AS $250 IN 'THEN-YEAR' DOLLARS.

SOLUTION - NO SOLUTION PROVIDED.
COMPONENT — FORMING/MACHINING (CONTINUED)

(3712) TITLE — PRODUCTION BASE FOR NOVEL SHAPED CHARGE LINERS

PROBLEM — NEW SHAPED CHARGE MATERIALS BEING INVESTIGATED TO COMBINE HIGH MASS AND PYROPHORICITY WILL HAVE NO PRODUCTION BASE BECAUSE OF THE NATURE OF THE MATERIALS.

SOLUTION — A COMBINATION OF RHEOCASTING THE COMPOSITE AND PRESSURE CASTING TO REMOVE EXCESS LOW DENSITY MATERIAL CAN PRODUCE SHAPED STOCK FOR FURTHER WARM WORKING.

(3713) TITLE — EQUIPMENT / ASSESSMENT TO MAINTAIN A QUICK RESPONSIVE PDN

(4369) TITLE — IMPROVED PROJECTILE CAVITY SURFACE

PROBLEM — THE FORGING PROCESSES AND TECHNIQUES CURRENTLY USED CAN CAUSE DEFECTS AND IMPERFECTIONS ON THE CAVITY SURFACE. THIS CONDITION NEEDS CORRECTION TO PREVENT SENSITIVITY PROBLEM THAT CAN OCCUR WITH THE COMP EXPLOSIVE TO BE USED IN HE ROUNDS.

SOLUTION — INVESTIGATE THE VARIOUS OPERATIONS SUCH AS NICK AND BREAK BILLET SEPARATION, SCALE, TOOL WEAR OF FORGE, AND FOREIGN MATTER BUILD-UP. DETERMINE BEST PROCESS CHANGES.

(4380) TITLE — ABRASIVE MACHINING IN PROJECTILE MANUFACTURING

PROBLEM — NEW GENERATION OF PROJECTILES HAVE HIGH HARDNESS AND ARE MADE FROM ALLOY AND HIGH FRAGMENTATION STEELS. CONVENTIONAL MACHINING THESE ALLOYS REQUIRE SURFACE SPEEDS LOWER THAN NORMALLY EXPECTED WITH CARBON STEELS AND ARE CONSEQUENTLY HIGHER IN COST.

SOLUTION — ABRASIVE MACHINING TECHNIQUES CAN BE USED TO INCREASE THE METAL REMOVAL RATES WHEN MACHINING THE NEW GENERATION PROJECTILES MADE WITH HARD STEEL ALLOYS. THIS PROGRAM WILL INVESTIGATE BOTH RIGID AND FLEXIBLE SURFACE ABRASIVE MACHINING TECHNIQUES.

(4397) TITLE — FABRICATION OF ADVANCED WARHEADS

PROBLEM — MANUFACTURING PROCEDURES FOR ADVANCED WARHEADS NEED TO BE ESTABLISHED.

SOLUTION — STUDIES TO ESTABLISH AND OPTIMIZE THE MANUFACTURING PROCESS FOR ADVANCED WARHEADS.

(4519) TITLE — OUTLINE AUTOMATIC DETECTION OF TOOL WEAR

PROBLEM — TOOL WEAR ON SEMIAUTOMATIC METAL MACHINES CAUSE DEFECTIVE PARTS IF UNDETECTED.

SOLUTION — PROVIDE AN AUTOMATIC MEASURING DEVICE ON THE TRANSPORTER OF THE LOAD/UNLOAD SYSTEM.
COMPONENT — FORMING/MACHINING
(continues)

(4528) TITLE - ROTARY FORGING OF DU PENETRATORS

PROBLEM - CURRENT FABRICATION TECHNIQUES FOR THE PRODUCTION OF DU PENETRATORS INVOLVE CONSIDERABLE MACHINING WITH ASSOCIATED HIGH COST AND WITH ACCOMPANYING PROBLEMS OF DISPOSAL OF THE RESULTANT MATERIAL SCRAP.

SOLUTION - APPLICATION OF ROTARY FORGING TECHNOLOGY TO THE FABRICATION OF NEAR NET SHAPE DU PENETRATORS RESULTING IN CONSIDERABLY LESS FINISH MACHINING AND SCRAP.

(4529) TITLE - MFG OF PRECISION CONES FOR HEAT PROJECTILES

PROBLEM - THE HEAT PROJECTILE LINER MUST BE HELD TO .003' IN ANY TRANSVERSE PLANE AND WITHIN .006' ALONG ITS LENGTH. THE TOLERANCES ARE AT THE EXTREME LIMIT OF ACCURACY. THE XM815 LINER REQUIRES PRECISION AN ORDER OF MAGNITUDE GREATER (1,0005').

SOLUTION - PHASE ONE WOULD EXAMINE TWO CANDIDATE PROCESSES - SHEAR FORMING AND DRAIAL/ANNEAL. FIFTY ROUNDS WOULD BE TESTED BY EACH PROCESS. ONE CANDIDATE PROCESS WILL BE CHOSEN FOR FURTHER DEVELOPMENT DURING THE SECOND PHASE.

COMPONENT — PROJECTILES

(3209) TITLE - POWDERED METAL (PM) FOR LOW DRAG 20-40MM PROJECTILES

PROBLEM - LOW DRAG PROJECTILES REQUIRE SIGNIFICANT AMOUNT OF MACHINING AND INSPECTION. CONSEQUENTLY, EACH PROJECTILE IS EXPENSIVE AND THE PROCESS SEVERELY LIMITS PRODUCTION RATES.

SOLUTION - PM MANUFACTURING TECHNIQUES MAY INCREASE PRODUCTION RATES WHILE REDUCING COST. A SECONDARY COINING OPERATION MAY OR MAY NOT BE REQUIRED; HOWEVER, THE TOTAL MACHINING OPERATIONS IS REDUCED TO, AT MOST, TWO.

(3736) TITLE - MFG PROCESSES F/SMART TARGET FIRE AND FORGET PROJ (STAFF)

(3741) TITLE - MFG PROCESSES F/ADV DESIGN ARTILLERY TRAINING AMMUNITION

(3745) TITLE - IMPROVED TECH F/MKG OF 8' FIN STABILIZED ART PROJ (CHAMP)

(3747) TITLE - TECHNOLOGY F/MKG OF ADVANCED 75MM AMMUNITION
COMPONENT -- PROJECTILES

(4189) TITLE -- HIGH FRAGMENTATION STEEL PRODUCTION PROCESS

PROBLEM -- THE CURRENT PRODUCTION PROCESS FOR MANUFACTURING HF1 PROJECTILES IS EXTREMELY EXPENSIVE; PROPRIETARY PRODUCTION PROCESSES DEVELOPED BY PRIVATE INDUSTRY ARE NOT AVAILABLE.

SOLUTION -- EXAMINE NEW AND IMPROVED PRODUCTION PROCESSES FOR REDUCTION OF STARTING MULTI-METAL, MACHINING TECHNIQUES, ANNEALING FORGINGS, ONE-HIT HOT NOSING, HEAT TREATING AND FRACTURE TOUGHNESS. WILL COMPLETE A TOP FOR COMPETITIVE PROCUREMENT.

(4517) TITLE -- PROCESS FOR RECYCLING STABALLOY MACHINING CHIPS

PROBLEM -- STABALLOY CHIPS ARE PYROPHORIC AND MUST BE DISPERSED IN AN INERT MATERIAL TO BE DISPOSED OF BY BURIAL AS A RADIOACTIVE MATERIAL. RECYCLING INTO USABLE METAL WOULD SOLVE DISPOSAL PROBLEMS.

SOLUTION -- CONTINUE EFFORT INITIATED IN FY80 W/REDIRECTED FY79 FUNDS. VARIOUS APPROACHES TO CHIP RECYCLING ARE BEING EXPLORED. ONE APPROACH SHOWING MOST ADVANTAGES WILL BE SELECTED FOR FURTHER OPTIMIZATION IN FY83.

(4553) TITLE -- PROCESS PARAMETERS FOR COLD DRAWING ALLOY STEELS

PROBLEM -- THE USE OF MORE HIGHLY ALLOYED STEELS TO MEET PROPERTY REQUIREMENTS MAY NAGATE USE OF COLD DRAW PROCESS, WITH RESULTANT COST INCREASES.

SOLUTION -- DEVELOP THE NECESSARY PROCESSING PARAMETERS TO ENABLE CONTINUED USE OF COLD DRAW PROCESS ON HIGH PERFORMANCE STEELS.

(4597) TITLE -- MFG PROC F/CANNON CALIBER DU PENETRATOR (20MM, 25MM, 30MM)

PROBLEM -- CURRENT FABRICATION TECHNIQUES FOR SMALL CALIBER DEPLETED URANIUM PENETRATORS RESULT IN EXCESSIVE SCRAP OF RADIOACTIVE CONTAMINANTS AND ARE HIGHLY LABOR INTENSIVE.

SOLUTION -- DEFINE A FULL PRODUCTION PROCESS AND EQUIPMENT FOR THE MANUFACTURE OF DU PENETRATORS DIRECT FROM ROLLED BAR BY SKewed AXIS ROLL FORMING TECHNIQUES.

COMPONENT -- TOOLING

(3707) TITLE -- WELDING TECHNOLOGY ADVANCEMENTS (AF83-7)

PROBLEM -- FAB AND MAINT COSTS OF TOOLING FIXTURES; TOOLING AND PART SAFETY FOR RESISTANCE AND TIG WELDING; EXTENSIVE WELDING SCHEDULES, TESTING, AND STRIP REQUIREMENTS FOR TAPERED MATERIALS ARE COST DRIVERS OF COMPONENTS FOR MISSILE AND ROCKET MOTOR.

SOLUTION -- EVALUATE THE DESIGN AND MATERIALS OF CONSTRUCTION OF SHORT BARS, DEVELOP NEW TECHNIQUE UTILIZING LOW HEAD PRESSURES. THE DEVELOPMENT OF A WELDING MACHINE AND/OR PROCESS TO PERMIT VARIABLE SCHEDULES AND WELD SAMPLES WHILE IN OPERATION.
COMPONENT -- TOOLING

(4164) TITLE - ANALYSIS FOR PREDICTING FAILURE OF MFG TOOLING

PROBLEM - THE ABILITY TO PREDICT FAILURE OF MACHINE OR COMPONENTS IS NON-EXISTANT. FAILURES ARE COSTLY AND REDUCE PRODUCTION OUTPUT.

SOLUTION - FREQUENCY ANALYSIS WILL IDENTIFY MACHINE PARTS WHICH ARE DEFECTIVE, OVERLOADED, OR NOT OPERATING PROPERLY.

***************
* CATEGORY *
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POLLUTION ABATEMENT

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COMPONENT -- CHEMICAL

(4208) TITLE - EVALUATION OF DMN DISPOSAL ON HSAAP B-LINE

PROBLEM - EFFLUENT FROM AMONIA RECOVERY COLUMN CONTAINS SIGNIFICANT AMOUNTS OF DMN. DMN IS ONE OF THE EPA CONSENT DEGREE COMPOUNDS FOR WHICH WASTE QUALITY CRITERIA MUST BE PROVIDED. EPA INSISTS ON LEVELS BELOW 0.3 PPB.

SOLUTION - EVALUATE UV PHOTOLYSIS CATALYTIC HYDROGENATION, CARBON ADSORPTION OR OTHER TECHNIQUES FOR ABATING OR DESTROYING DMN.

COMPONENT -- GENERAL

(4226) TITLE - ON-LINE MONITORS FOR WATER POLLUTANTS

PROBLEM - IDENTIFICATION AND MONITORING OF INDIVIDUAL MILITARY UNIQUE EFFLUENT POLLUTANTS REQUIRED BY WATER POLLUTION CONTROL ACT.

SOLUTION - DEMONSTRATE PROTOTYPE CONTINUOUS MONITORS DEVELOPED UNDER R&D PROGRAM BY FIELD TESTS ON AAP WASTEWATER EFFLUENT DISCHARGE STREAMS.

(4231) TITLE - IN-PLANT REUSE OF POLLUTION ABATED WATERS

PROBLEM - MORE STRINGENT STANDARDS FOR MILITARY UNIQUE POLLUTANTS. 1985 GOAL OF ZERO DISCHARGE. EXPENSE OF TREATING POLLUTION CONTINUE THIS REUSE OF TREATED WATER IN OTHER PROCESSES.

SOLUTION - THIS PROJECT CONCENTRATES EFFORT IN RECYCLING OF TREATED WASTE WATER WITH THE ULTIMATE GOAL OF COMPLYING WITH THE ZERO DISCHARGE GUIDELINE.

(4248) TITLE - NOISE POLLUTION ABATEMENT F/SCAMP IN LCAAP

PROBLEM - NOISE LEVEL EXCEEDS 85 DBS IN BLDG 1 AT LAKE CITY AAP.

SOLUTION - INSTALL RECOMMENDED ONE SUBMODULE NOISE SUPPRESSION SYSTEM AND EVALUATE ALL OTHER SUBMODULES.
COMPONENT — GENERAL

(4364) TITLE - ON-LINE BID SENSORS TO MONITOR MIXED WASTE STREAMS

PROBLEM - PL92-509 Requires that WASTE DISCHARGES BE MONITORED TO ASSURE THAT AQUATIC LIFE ARE PROTECTED FROM TOXIC/HAZARDOUS SUBSTANCES. IN ADDITION, BIOLOGICAL MONITORING WILL SOON BE REQUIRED IN SOME NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM PERMITS.

SOLUTION - USE A BIOLOGICAL MONITORING SYSTEM TO EVALUATE TOXIC EFFECTS. FROM CORRELATIONS BETWEEN CHEMICAL CONSTITUENTS IN THE WASTE WATER AND BIOLOGICAL RESPONSES, EXPENSIVE CHEMICAL MONITORING MIGHT BE ELIMINATED.

COMPONENT — PROPELLANTS/EXPLOSIVES

(4229) TITLE - ADVANCED PINK WATER TREATMENT

PROBLEM - CURRENT PINK WATER DISPOSAL TECHNOLOGY THROUGH CARBON ADSORPTION IS HIGH IN COST EVEN WHEN REGENERATION TECHNIQUE IS UTILIZED.

SOLUTION - ALTERNATIVE TECHNOLOGIES ARE AVAILABLE WHICH CAN REDUCE THIS TREATMENT BY 50 PERCENT. IT IS LIKELY THAT A HYBRID SYSTEM WILL BE DEVELOPED THAT CAN BE RETOOFITTED TO THE CURRENT SYSTEMS.

(4295) TITLE - TERTIARY TREATMENT OF HOLSTON WASTE WATER

PROBLEM - FACILITY PROJECT AT HOLSTON Requires TERTIARY TREATMENT TO MEET DISCHARGE STANDARDS FOR NITROBODIES. CARBON ADSORPTION OR A HYBRID TREATMENT SYSTEM IS NEEDED.

SOLUTION - THIS PROJECT WILL COMPLETE PILOT WORK TO ESTABLISH DESIGN CRITERIA AND OBTAIN DATA FOR THE TERTIARY TREATMENT SYSTEM.

(4489) TITLE - ADVANCED POLLUTION ABATEMENT FOR DARCOM FACILITIES

PROBLEM - MUCH WORK HAS BEEN DONE IN THE PROPELLANTS AND EXPLOSIVES PLANTS TO MEET THE POLLUTION ABATEMENT STANDARDS. HOWEVER, ALL OF THE GOALS HAVE NOT YET BEEN MET.

SOLUTION - DEVELOP TECHNOLOGY TO DISPOSE OF WASTEWATER TREATMENT SLUDGE, TO PROVIDE TERTIARY TREATMENT OF HAAP WASTEWATER, TO TREAT PINK WATER, AIR EMISSION AND DETONATOR WASTE, AND TO PROVIDE ENVIRONMENTAL IMPROVEMENTS FOR NITRATE ESTERS.

(4511) TITLE - DISPOSAL OF FINAL SLUDGE FROM ACID RECOVERY OPERATIONS

PROBLEM - RECOVERY OF NITRIC NITRATE AFTER HMX/RDX PROD AT HSAP IS COSTLY AND CAUSES POLLUTION. NITRO NITRATE RESULTS BECAUSE NITRIC ACID IS USED IN THE ACID PLANT TO NEUTRALIZE RESIDUAL NITRIC ACID AND EXPLOSIVES IN THE SPENT ACID.

SOLUTION - USE AMMONIA IN THE FORM OF AMMONIUM ACETATE TO NEUTRALIZE EXCESS NITRIC ACID. AMMONIUM NITRATE SLUDGE WILL BE CATALYTICALLY HYDROGENATED TO DESTROY OTHER RESIDUES. FINAL SOLUTION IS NH4NO3 IN WATER AND HAS A VALUE 4 TO 5 TIMES THAT OF NITRIC NITRATE.
COMPONENT -- RECYCLE

(4344) TITLE - ETS WASTE DISPOSAL TECH FOR M687 BINARY PROJ FAC

PROBLEM - LARGE QUANTITIES OF SOLID WASTES ARE GENERATED DURING MFGR. THERE
IS NO ACCEPTABLE DISPOSAL METHOD. DRUM STORAGE IS NOT FEASIBLE AND LANDFILL
MAY REQUIRE SPECIAL PREPARATION.

SOLUTION - DEVELOP PROCEDURES FOR DECREASING THE AMOUNT OF SOLID WASTE
GENERATED. RECOVER WASTES IN THE FORM OF LIQUID HCL WHICH CAN BE USED IN THE
CENTRAL LWT FACILITY AND RECYCLE STILL BOTTOMS WHICH WILL REDUCE SOLID
WASTES BY 80 PERCENT.

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* CATE G ORY *
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*PROPELLANTS *
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COMPONENT -- BALL

(4540) TITLE - CALCIUM CARBONATE COATING OF 7.62MM BALL PROPELLANTS

PROBLEM - A SAFE AND EFFICIENT PROCESS IS NOT CURRENTLY AVAILABLE FOR THE
COATING OF 7.62MM BALL PROPELLANT WITH CALCIUM CARBONATE.

SOLUTION - UTILIZE AN EXISTING TWO-STAGE CONTINUOUS PILOT SCALE COATER AT
QLT'S ST. MARKS, FL FACILITY TO DEVELOP A SAFE AND EFFICIENT PROCESS TO
COAT 7.62MM BALL PROPELLANT WITH CALCIUM CARBONATE.

(4588) TITLE - SMALL CAL AUTOMATED NON-DESTRUCTIVE TEST - SCANT

PROBLEM -.50 CALIBER BALL, TRACER, ARMOR PIERCING INCENDIARY(API) AND ARMOR
PIERCING INCENDIARY TRACER(APIT) AMMUNITION IS INSPECTED USING 1/1000 GAGE
AND WEIGH MACH AND VISUAL EXAM. THIS PROCESS IS SLOW, INACCURATE AND
EXPENSIVE

SOLUTION - AUTOMATE THE GAGE + WEIGH PROCESS USING THE TECHNOLOGY DEVELOPED
FOR 5.56MM. THE TECHNOLOGIES FOR THIS AUTOMATED PROCESS INCLUDE-
OPTICS/ELECTRONICS, LASER SCATTERING, EDDY CURRENT, AND X-RAY. THE PROCESS
WILL BE COMPUTER CONTROLLED.

COMPONENT -- GENERAL

(4145) TITLE - CONTROL DRYING IN AUTO SB AND BALL PROP MFGR

PROBLEM - OFF-LINE ANALYSIS FOR MOISTURE AND VOLATILES MAKES IT DIFFICULT TO
CONTROL A CONTINUOUS DRYING OPERATION SINCE THE TIME REQUIRED FOR ANALYSIS
IS LONG COMPARED TO THE RESIDENCE TIME FOR THE PROPELLANT IN A CONTINUOUS
DRYER.

SOLUTION - USE PRODUCT TEMPERATURE AND/OR ON-LINE ANALYZERS AND FLOW METERS AS
A BASIS FOR IMPROVED CONTROL OF A CONTINUOUS DRYING OPERATION AND REDUCE THE
AMOUNT OF OFF-LINE ANALYSIS REQUIRED.
**COMPONENT — GENERAL**

**TITLE — AUTO PRODUCTION OF STICK PROPELLANT**

**PROBLEM** — Present batch techniques for stick propellant MFG involve much hand labor thereby resulting in limited production capacity, high cost, and hazard exposure.

**SOLUTION** — Install and evaluate prototype equipment to automatically produce racked solvent-type stick propellant, which will be cut by fluid jet cutter. This process will operate with existing 12 inch press and press bay.

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**TITLE — LOVA PROPELLANT PROCESSING**

**PROBLEM** — Vul of prop to var attack forces contrib major portion of probability of losing a firing vehicle. Vul of bulk propellant in complete round assembly, storage or transport is also a problem. This charac is inherent in current multibase formulation.

**SOLUTION** — Determine hazard classification of materials used to manufacture low vulnerability (LOVA) propellants and analyze their influence on facilities selection and need. Conduct bench scale investigations on pollution abatement and solvent recovery.

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**COMPONENT — MISCELLANEOUS**

**TITLE — CONVERSION OF SURPLUS PENTABORANE TO B10**

**PROBLEM** — The diborane (B2) used in the manufacture of decaborane (B10) is a cost driver.

**SOLUTION** — Develop a process to mix government owned pentaborane (B5) with B2 to reduce the cost of the product B10.

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**COMPONENT — MULTI-BASE**

**TITLE — CONTINUOUS PRODUCTION OF NEW PROPELLANTS ON CAMBL**

**PROBLEM** — Various high energy and LOVA granular and stick multi-base propellants are being developed. Batch facilities for multi-base propellants have a constrained capacity. A new CAMBL hasn't been proven acceptable on the newer propellants.

**SOLUTION** — Adapt recently developed CAMBL process to demonstrate the mass producibility of the new propellants. This will insure a production base for the new formulations and prevent having to use and/or build inefficient batch facilities.

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(4544) TITLE - DEVELOP A THIRD GENERATION DYNAGUN TO SIMULATE TANK GUNS

PROBLEM - STANDARD BALLISTIC EVALUATION TESTS ARE THE ONLY MEANS AVAILABLE FOR ASSESSING PROPELLANTS FOR HIGH PRESSURE/HIGH VELOCITY SYSTEMS SUCH AS THE 105MM AND 120MM TANK GUNS. THESE PROCEDURES ARE VERY EXPENSIVE AND TIME CONSUMING.

SOLUTION - DEVELOP A THIRD GENERATION DYNAGUN WHICH CAN BE USED IN LIEU OF STANDARD BALLISTIC TESTS AS A MORE RAPID AND LESS COSTLY MEANS OF ASSESSING PROPELLANTS FOR THE 105MM AND 120MM TANK GUNS.

(4572) TITLE - IMPROVED BATCH PROCESSING OF MULTI-BASE PROPELLANTS

PROBLEM - BATCH MANUFACTURE OF MULTI-BASE PROPELLANTS REQUIRES MANY OPERATIONS WHICH ARE LABOR INTENSIVE DIFFICULT TO CONTROL AND HAZARDOUS TO THE OPERATORS.

SOLUTION - PROVIDE PROTOTYPE EQUIPMENT TO IMPROVE, SIMPLIFY, AND COMBINE OPERATIONS IN BATCH PROCESSING OF MULTI-BASE PROPELLANTS BOTH GRANULAR AND STICK TO REDUCE COST AND OPERATOR HAZARD.

(4061) TITLE - NITROGUANIDINE PROCESS OPTIMIZATION

PROBLEM - A NITROGUANIDINE FACILITY IS UNDER CONSTRUCTION AT SAAP TO BE OPERATIONAL IN FY80. IT UTILIZES PROCESSES NOT PREVIOUSLY USED COMMERCIAL AND IT CONTAINS MANY RECIRCULATION AND SUPPORT LOOPS, THE OPERATION OF WHICH ARE STRONGLY INTERDEPENDENT.

SOLUTION - CONDUCT PROCESS IMPROVEMENT PROCEDURES USING NITROGUANIDINE SUPPORT EQUIPMENT (NSE) INSTALLED UNDER PROJECT 5752632, AND APPLY EVOLUTIONARY OPERATION (EVUP) TO THE NITROGUANIDINE FACILITY BEING CONSTRUCTED AT SUNFLOWER APP.

(4427) TITLE - ON-LINE ANALYZERS FOR NITROGUANIDINE PLANT

PROBLEM - A NITROGUANIDINE MFG FACILITY IS BEING CONSTRUCTED AT SUNFLOWER APP. MMT 5 78 4447 INDICATED THE FEASIBILITY OF AUTOMATED ON-LINE INSTRUMENTATION FOR PROCESS STREAM CHEMICAL ANALYSIS. HOWEVER THE RELIABILITY HAS NOT BEEN DEMONSTRATED.

SOLUTION - INSTALL AND EVALUATE AN ON-LINE ION CHROMATOGRAPH, A GAS CHROMATOGRAPH, AND A SPECTROPHOTOMETER IN THE NQ SUPPORT EQUIPMENT WHICH IS TO BE OPERATED DURING FY82 UNDER MMT 5 8X 4061, NQ PROCESS OPTIMIZATION.
**COMPONENT -- SINGLE BASE**

(4027) TITLE - SOLVENT RECOVERY/DRYING OF SINGLE BASE PROPELLANTS

**PROBLEM** - PRESENTLY SOLVENT RECOVERY, WATER DRY, AND AIR DRY OPERATIONS ARE ACCOMPLISHED IN 3 SEPARATE TANKS, ONE TANK IS USED FOR EACH OPERATION. THESE OPERATIONS ARE BOTH LABOR AND ENERGY INTENSIVE AND GENERALLY INEFFICIENT.

**SOLUTION** - COMBINE THE 3 SEPARATE OPERATIONS INTO ONE COMBINED OPERATION TO TAKE PLACE IN ONE MODIFIED SOLVENT RECOVERY TANK. THIS APPROACH WILL RESULT IN A SIGNIFICANT SAVINGS IN BOTH LABOR AND ENERGY.

(4573) TITLE - COMBINED CPD, MIX AND EXTRUSION FOR S.B. PROPS

**PROBLEM** - BATCH MANUFACTURE OF SINGLE BASE PROPELLANTS Requires OPERATIONS WHICH ARE LABOR INTENSIVE, DIFFICULT TO CONTROL AND HAZARDOUS TO THE OPERATORS.

**SOLUTION** - THIS PROJECT WILL PROVIDE PROTOTYPE EQUIPMENT TO IMPROVE, SIMPLIFY AND COMBINE OPERATIONS IN BATCH PROCESSING OF SINGLE BASE PROPELLANTS TO REDUCE COST AND OPERATOR HAZARDS.

**COMPONENT -- SOLVENTLESS**

**CATEGORY**

**QUALITY CONTROL/TESTING**

**COMPONENT -- INSPECTION**

(3717) TITLE - APPLICATION OF RAPID X-RAY TECHNIQUE

**PROBLEM** - IN HIGH G SHELL IT IS IMPORTANT THAT THERE ARE NO RESIDUAL STRESSES AFTER MANUFACTURE TO INSURE NO MALFUNCTIONS DURING FIRING OVER FRIENDLY FORCES.

**SOLUTION** - COUPLE APPLICABLE ELECTRONICS AND A COMPUTER TO A CONVENTIONAL X-RAY GENERATOR TO PRODUCE ACCURATE STRESS DETERMINATION ON A CONTINUOUS PRODUCTION LINE.
COMPONENT -- INSPECTION

(3718) TITLE - CONTINUOUS EVALUATION OF THE PROTECTIVE COATINGS

PROBLEM - ARTILLERY SHELLS ARE GIVEN PROTECTIVE COATINGS AND SAMPLES FROM EACH LOT ARE EVALUATED DURING PRODUCTION IN THE STANDARD ASTM B117 SALT SPRAY TEST (REQUIRES 2-4 DAYS).

SOLUTION - CONTINUOUS SCANNING PROBE IMPEDANCE TECHNIQUES WILL PERFORM 100 PCT PROTECTIVE COATING CHECKS.

(4357) TITLE - FLUX LEAKAGE INSPECTION SYSTEM FOR M483

PROBLEM - THERE IS NO NONDESTRUCT INSPECT MENT WITH FLOW DETECTION RELIABILITY ESTABF/M483. A MAGNETIC FLUX LEAKAGE DEVICE PURCHASED F/Louisiana AAP DEMONSTRATED FEAS BUT COST OF OPERATION MUST BE DETERMINED.

SOLUTION - DESIGN DEVELOP AND FABRICATE A PROTOTYPE MFL INSPECT SYS + EVALUATE RELIABILITY + OPERATING COST COMPARED TO ULTRASONIC INSPECTION SYSTEMS.

(4358) TITLE - AUTO LINE - PROCESS INSPECTION OF NEW EED'S (ALPINE)

PROBLEM - INSPECTION OF BRIDGE WIRE ON ELECTRIC DETONATORS.

SOLUTION - AUTOMATE THE TESTING TECHNOLOGY DEVELOPED BY TIT ARRACOM 12-78, 'ELECTROTHERMAL ANALOG RESPONSE INSPECTION OF EED'S' FOR FINAL END ITEM NONDESTRUCTIVE ACCEPTANCE INSPECTION.

(4359) TITLE - IMPROVE PROCESS TECHNOLOGY F/INSPECTION OF CLOTH

PROBLEM - REDUCE TIME AND COST OF VISUAL INSPECTION OF CLOTH USED IN PROPELLANT BAGS, FLASH REDUCERS, ADDITIVE LINERS AND IGNITER PADS.

SOLUTION - IMPLEMENT EQUIP PROVEN FEASIBLE, PURCHASE INSTALLATION OF MOD STATE-OF-ART SENSORS THAT WILL MARK LOCATION OF CLOTH DEFECTS DURING SLITTING OPERATION. CLOTH WILL BE REMOVED + DISCARDED PRIOR TO SUBSEQUENT SEWING OPERATIONS.

(4471) TITLE - CONICAL SURFACE INSPECTION

PROBLEM - NO SATISFACTORY AUTOMATED INSPECTION EQUIPMENT IS KNOWN TO ACCOMPLISH THE VARIOUS CONICAL SURFACE INSPECTIONS FOR CONVENTIONAL AND ADVANCED SHAPED CHARGE LINERS.

SOLUTION - PROVIDE AN AUTOMATED INSPECTION SYSTEM COMPATIBLE WITH PROPOSED CONVENTIONAL AND SHAPED CHARGE TECHNOLOGY PROGRAMS, SPECIFICALLY FOR CONICAL SURFACE MEASUREMENTS.
COMPONENT -- NON-DESTRUCTIVE TESTING

(3719) TITLE - APPLICATION OF X-RAY SYSTEM SCANNER 100 PCT

PROBLEM - IN THE CURRENT METHOD OF TESTING THE METALLURGICAL PROPERTIES OF SHELL, DESTRUCTIVE SAMPLES MUST BE TAKEN CONTINUOUSLY IN PRODUCTION

SOLUTION - DEVELOP A RAPID AND EFFECTIVE NDT METHOD TO CONTINUOUSLY VERIFY THE TENSILE AND HARDNESS PROPERTIES OF EACH SHELL PRODUCED.

(4473) TITLE - AUTO LEAK DETECTION OF WP MUNITIONS

PROBLEM - THE CURRENT METHOD OF HEATING THE WHITE PHOSPHOROUS MUNITIONS TO CHECK FOR LEAKS IS LABOR INTENSIVE AND IS NOT UNIFORM FOR ALL ROUNDS.

SOLUTION - PROVIDE A PROTOTYPE AUTOMATED IN-LINE LEAK DETECTION SYSTEM BASED ON QUANTITATIVE FLAME PHOTOMETRY. THE SYSTEM WILL CONSIST OF TWO HEATING STAGES, A SAMPLING WHEEL, LEAK DETECTOR AND HANDLING SYSTEM.

(4546) TITLE - NOT FOR BONDED AREAS OF 60/60M MORTAR INCREMENT CONTAINERS

PROBLEM - LACK OF NONDESTRUCTIVE TEST OR INSPECTION OF THE BONDING OF THE CONTAINER HALVES AND THE CLOSURE OF FILLING HOLE.

SOLUTION - DEVELOP NDT AND EQUIPMENT FOR AUTOMATIC 100 PERCENT INSPECTION OF THE INCREMENT CONTAINER BONDED AREA. THE FEASIBILITY OF OPTICS TECHNOLOGY WILL BE INVESTIGATED FOR PRACTICALITY WHICH WILL BE FOLLOWED BY EQUIPMENT DESIGN AND FABRICATION.

COMPONENT -- SIMULATION

(2856) TITLE - SHOCK IMPULSE HYDROSTATIC TESTING

PROBLEM - BALLISTIC ACCEPT TEST OF METALLIC CARTRIDGE CASES UTILIZES 100 SAMPLE ITEMS LOADED INTO COMPLETE ROUNDS + FIRED AT A PG. THIS TEST CONSTITUTES APPROX 50 PERCENT OF ALL BALLISTIC ACCEPT TEST DONE ON ENTIRE ROUND REQUIRED TO PRODUCT ROUND.

SOLUTION - A SHOCK IMPULSE HYDROSTATIC PRESSURE TESTER QEW TO TEST COMPONENT CARTRIDGE CASE IN-PLANT W/D NEED OF ASSEMBLING INTO A FULL-UP ROUND WHILE STILL SIMULATING INTERIOR BALLISTIC PULSE WILL MINIMIZE EXPENSE OF TESTING BALLISTICALLY.

COMPONENT -- X-RAY

(4434) TITLE - AUTOMATIC INSPECTION DEVICE EXPLOSIVE CAST IN SHELL

PROBLEM - THE PRESENT METHOD OF INSPECTION LOADED PROJECTILE UTILIZES A STANDARD RADIOGRAPHIC FILM METHOD. LABOR AND MATERIAL (FILM) ARE COSTLY. DETERMINATION OF CRITICAL DEFECT IS SUBJECT TO HUMAN JUDGEMENT, FATIGUE, AND ERROR.

SOLUTION - DEVELOP PROTOTYPE SYSTEM USING A MINI-COMPUTER TO ANALYZE X-RAY IMAGES TO AUTOMATICALLY ACCEPT OR REJECT GROUPS OF HE FILLED PROJECTILES. DEVELOP A PROTOTYPE FILMLESS REAL-TIME AUTOMATED INSPECTION SYSTEM.
COMPONENT — X-RAY

(4545) TITLE — DIGITAL IMAGE AMPLIFICATION X-RAY SYSTEM

PROBLEM — EXISTING IMAGE AMPLIFICATION X-RAY DOES NOT MEET THE IMAGE QUALITY CRITERIA TO BE USED AS AN INSPECTION TOOL FOR HE MORTAR PROJECTS. FILM RADIOGRAPHY, AS CURRENTLY USED, IS LABOR INTENSIVE, TIME CONSUMING, AND SUBJECT TO HUMAN INTERPRETIVE JUDGEMENT.

SOLUTION — REPLACE WITH AN IMPROVED REAL-TIME IMAGE AMPLIFICATION SYSTEM. TECHNIQUES FOR DIGITAL IMAGE ENHANCEMENT AND ANALYSIS DEVELOPED UNDER THE AX0S PROJECT WILL BE ADAPTED.

* CATEGORY *

*SAFETY *

COMPONENT — GENERAL

(2741) TITLE — LIGHTNING WARNING SYSTEM FOR MUNITION PLANT SAFETY

PROBLEM — AS THE ELECTRONICS ADAPTED IN THE DESIGN OF AAF'S BECOMES MORE SOPHISTICATED AND COSTLY, THE NEED FOR QUICK AND RELIABLE LIGHTNING PROTECTION INCREASES.

SOLUTION — IMMEDIATE EVALUATION OF AUSTRALIAN (E.F. AUSTRALASIA) LIGHTNING PROTECTION SYSTEM AND SUBSEQUENT STATE OF THE ART ADVANCEMENT.

(4071) TITLE — EXPLOS PREVENTION IN DRY DUST COLLECTION SYSTEMS

PROBLEM — POTENTIALLY HAZARDOUS CONDITIONS EXIST IN DRY DUST COLLECTION SYSTEMS THROUGHOUT THE MUNITIONS PRODUCTION BASE. PRESENT DATA ON DETONATION CHARACTERISTICS OF EXPLOSIVE, PROPPELLANT OR PYROTECHNIC DUST ARE INCOMPLETE/INADEQUATE TO IMPROVE SAFETY.

SOLUTION — DEVELOP DATA TO ESTABLISH SAFE OPERATING PARAMETERS FOR DUST COLLECTION SYSTEMS. UTILIZE THESE DATA TO DEVELOP SAFE COLLECTION SYSTEM DESIGNS WHICH PREVENT DUST EXPLOSIONS BY EMPLOYMENT OF PROPER VENTING, LIMITING IGNITION ENERGY, ETC.

(4291) TITLE — BLAST EFFECTS IN THE MUNITIONS PLANT ENVIRONMENT

PROBLEM — MOST OF THE DESIGN EFFORT IS IN THE AREA OF LACE REINFORCED STRUCTURES FOR CLOSED IN AREAS TO AN EXPLOSION. WE MUST ATTEMPT TO UTILIZE COM CONSTRUCTION MATERIAL.

SOLUTION — TO STUDY CHARACTERISTICS OF THE BLAST ENVIRONMENT AND DETERMINE THE RESPONSE OF THE VARIOUS STRUCTURAL MATERIALS AND ELEMENTS SUBJECTED TO THESE LOADING.
COMPONENT -- LAP

(4374) TITLE -- EXPLOSIVE SAFETY SHIELDS

PROBLEM -- ACRYLIC MAT IS USED AS A PROTECTIVE SHIELD ON LOADING LINES WHERE LOADING OF SMALL QUANT OF HIGHLY SENSITIVE EXPLOSIVE OCCURS--NO DATA ON BLAST CAP OF THE MAT IS AVAL + WORK MUST BE DONE ON A CASE-BY-CASE BASIS.

SOLUTION -- DETERMINE BLAST CAP OF ACRYLIC MATS + PREP DESIGN GUIDANCE F/FUTURE USE. TECH REPORTS FOR DESIGN GUIDANCE OF THIS TYPE OF PROTECTIVE SHIELDS WILL BE DEV TO PRECLUE CASE-BY-CASE METHOD NOW USED.

COMPONENT -- PROPELLANTS/EXPLOSIVES

(4285) TITLE -- TNT EQUIV TESTING FOR SAFETY ENGINEERING

PROBLEM -- PRESENT CRITERIA FOR BLAST RESISTANT STRUCTURES IS IN TERMS OF SURFACE BURST OF HEMISPHERICAL TNT. IN STRUCTURAL DESIGN, TO PROTECT FROM THE OUTPUT OF OTHER ENERGETICS, THE DESIGNERS MUST HAVE DATA PERTINENT TO THE MATERIAL IN QUESTION.

SOLUTION -- BY TESTING TO GENERATE PEAK PRESSURE AND PDS IMPULSE DATA FROM BLAST MEASUREMENTS OF HIGH ENERGY MATERIALS IS GENERATED. THESE RESULTS ARE COMPARRED WITH THE BLAST OUTPUT OF HEMISPHERICAL TNT TO DETERMINE THE TNT EQUIVALENCY OF THE MATERIAL.

(4318) TITLE -- OCCUPATIONAL EXPOSURE TO NITRATE ESTERS IN MUNITION MFG

PROBLEM -- THE THRESHOLD LIMIT VALUE FOR NITROGLYCERIN AND OTHER NITRATE ESTERS MAY BE REDUCED FROM 0.2 PPM TO 0.02 PPM. THIS COULD INVOLVE EXTENSIVE REDESIGN ON ALL FACILITY PROJECTS INVOLVING NG OR NITRATE ESTERS.

SOLUTION -- UTILIZE MORE EFFECTIVE VENTILATION OR CHEMICAL ENTRAPMENT, REMOTE AUTOMATIVE OPERATIONS, DEVELOP PROTECTIVE CLOTHING AND AIR RESPIRATORS.

(4453) TITLE -- PROPAGATION DISTANCE FOR ENERGETIC MATERIALS

PROBLEM -- THE EXISTING SAFETY MANUAL (MACR 385-10D) HAS BECOME ANTIQUATED BY RECENT ADVANCES IN WEAPONS TECHNOLOGY. THERE IS A NEED TO UPGRADE ACCIDENTAL DETONATION SUPPRESSION CRITERIA.

SOLUTION -- A SERIES OF PROPAGATION SUPPRESSION CRITERIA TESTS ON VARIOUS ENERGETIC MATERIALS WILL BE CONDUCTED. THE SAMPLE CONFIGURATIONS WILL SIMULATE STAGES OF END ITEM MANUFACTURE AND ASSEMBLY.
COMPONENT -- PROPELLANTS/EXPLOSIVES (CONTINUED)

(4558) TITLE - THERMAL DEHYDRATION PROCESS SAFETY AND OPERATIONAL REDESIGN

PROBLEM - THERMAL DEHYDROWS WERE EVALUATED UNDER 2 MMT PROGRAMS, ONE FOR CASBL AND ONE FOR CAMPL. A THIRD THERMAL DEHYD WAS CONSTRUCTED FOR C-LINE, AND DURING PROVE-OUT, AN INCIDENT OCCURRED. THE EXACT SOURCE OF INITIATION WAS NOT DETERMINED BY INVESTIGATION BOARD.

SOLUTION - OBTAIN OPERATIONAL AND SAFETY DATA USING THE CAMPL PILOT LINE THERMAL DEHYD TO DETERMINE ELECTROSTATIC AND OPERATIONAL PARAMETERS LEADING TO IN-PROCESS MATERIAL IGNITION AND ITS ELIMINATION IN ORDER TO ASSURE THE THERMAL DEHYD TO BE A SAFE OPERATION.

(4565) TITLE - ULTRA HIGH SPEED FIRE PROTECTION SYSTEM

PROBLEM - SAFETY REG WACOM 385-100 REQUIRES CERTAIN HAZARDOUS OPERATIONS TO BE EQUIPPED WITH FIRE PROTECTION SYSTEMS THAT CAN PROVIDE SUPPRESSANT ON FIRES WITHIN 50 MSEC FROM THE TIME OF THEIR DETECTION.

SOLUTION - A COMPREHENSIVE INVESTIGATION (INCLUDING TESTS) WILL BE CONDUCTED TO DETERMINE IF 50 MSEC REQUIREMENT IS REASONABLY ACHIEVABLE (BOTH TECHNICALLY AND ECONOMICALLY) ON PRACTICAL SYSTEMS USING EXISTING FIRE SUPPRESSANT TECHNOLOGY.

COMPONENT -- GENERAL

(4351) TITLE - IMPROVED STORAGE TECHNOLOGY FOR PRODUCTION MACHINE

PROBLEM - NEED TO OVERCOME DEGRADATION OF ELECTRONIC COMPONENTS + MEET RAPID REACTIVATION OF AUTO PDN LINES F/MOB REQUIREMENTS.

SOLUTION - DEVELOP PACKAGING TECHNIQUE AND USE OF DRY NITROGEN FOR SCAMP EQUIPMENT.

(4464) TITLE - COMPUTER/GROUP TECHNOLOGY FOR SMALL CAL AMMO

PROBLEM - PRESENTLY THERE IS NO METHOD TO OPTIMIZE DESIGN OF TOOLING AND TO SELECT PROPER EQUIPMENT FOR SMALL CALIBER AMMO.

SOLUTION - INVESTIGATE POSSIBLE USE OF COMPUTER FOR OPTIMUM TOOL AND EQUIPMENT DESIGN, AND TO PREDICT PROCESS PARAMETERS AND COSTS.

(4539) TITLE - AUTOMATIC CARTRIDGE CASE HARDNESS MEASUREMENT

PROBLEM - MANUAL MEASUREMENTS BY SAMPLING METHODS ARE INADEQUATE AND COSTLY.

SOLUTION - DIRECT EDDY CURRENT TECHNIQUE WOULD PROVIDE CONTINUOUS AND 100% INSPECTION
COMPONENT — 5.56MM - .30 CAL

(2743) TITLE - IMPROVED TECH FOR SMALL CALIBER AMMUNITION
PROBLEM - THE SMALL ARMS AMMUNITION PRODUCTION BASE MUST KEEP ABEREAST OF THE RAPIDLY EMERGING NEW MANUFACTURING TECHNIQUES ON A COST/EFFECTIVENESS BASIS.
SOLUTION - CONTINUALLY MONITOR THE SMALL ARMS DEVELOPMENTS AND APPLICABLE EMERGING MANUFACTURING TECHNOLOGY.

(4177) TITLE - NEW METH OF 5M CAL TRACER CHARGE
PROBLEM - CURRENT FACILITIES AT LCAAP ARE 1942 VINTAGE CRANK TYPE CHARGING MACHINES AND ARE LABOR INTENSIVE.
SOLUTION - DEVELOP MODERNIZED TRACER CHARGING EQUIPMENT TO MEET REQUIREMENTS OF BULLET SUBMODULES AND TO IMPROVE PRODUCT UNIFORMITY AND INCREASED PERFORMANCE.

(4503) TITLE - NEW PROCESS FOR SAW TRACER AMMUNITION
PROBLEM - THERE IS NO U.S. CAPABILITY FOR MANUFACTURING THE PROPOSED NATO 5.56MM TRACER BULLET IN THE QUANTITIES REQUIRED FOR THE SAW SYSTEM.
SOLUTION - THE CONVENTIONAL SMALL CALIBER TRACER BULLET MANUFACTURING EQUIPMENT WILL BE MODIFIED TO PRODUCE THE NATO TRACER BULLET.

(4506) TITLE - 5.56MM CARTRIDGE LINKING SYSTEM
PROBLEM - THERE ARE CURRENTLY NO LINKING MACHINES AVAILABLE FOR LINKING PRODUCTION QUANTITIES OF 5.56MM AMMUNITION. THE MANUAL AND SEMI-MANUAL METHODS AVAILABLE ARE SLOW AND COSTLY.
SOLUTION - LINKING MACHINES FOR 7.62MM AMMUNITION DO EXIST. A MODIFICATION AND IMPROVEMENT SHOULD PROVIDE A SATISFACTORY SOLUTION. A PRODUCTION RATE OF 65.8 MILLION ROUNDS PER YEAR IS REQUIRED.

(4534) TITLE - MODERNIZED PROCESSES FOR MANUFACTURE OF NATO 5.56MM AMMUNITION
PROBLEM - AN AMERICANIZED VERSION OF BELGIUM S5-109 WILL BE USED IN THE SAW SYSTEM. THIS EFFORT IS DEDICATED TOWARD DEVELOPMENT OF CONVENTIONAL PROCESSES TO MASS PRODUCE SAW'S AMMUNITION ON SCAMP EQUIPMENT.
SOLUTION - THIS PROJECT WILL DEFINE PROCESSES AND EQUIPMENT/TURING CHANGES REQUIRED ON SCAMP LINE. INITIATION OF THESE EFFORTS THIS YEAR WILL PROVIDE PROCESS EQUIPMENT SPECIFICATIONS FOR IMPLEMENTATION IN SUFFICIENT TIME TO MEET FY87 AND ON REQUIREMENTS.
COMPONENT -- 5.56MM - .30 CAL

(4538) TITLE - 5.56MM SAWS LINK ORIENTOR AND FEED SYSTEM

PROBLEM - THE M27 LINKS ARE MANUALLY ORIENTED AND PACKED AT THE LINK MANUFACTURERS. AT THE LOADING PLANT, LINKS MUST BE MANUALLY UNPACKED AND FED INTO THE LINKING MACHINES, WHICH IS TIME CONSUMING AND COSTLY.

SOLUTION - BY DEVELOPING RANDOM ORIENTOR EQUIPMENT, THE LINK MANUFACTURERS WILL BE ABLE TO SHIP LINKS IN BULK TO THE LOADING PLANT; THUS, ELIMINATING MANUAL PACKING, UNPACKING, AND COST OF CARTONS.

(4541) TITLE - AUTO PRIMER INSERT LACQUER AND ANVIL PRESENCE INSPECT SYS

PROBLEM - LACQUER INSPECTION AT GAGE 7 WEIGH IS BEING ELIMINATED. THE PRIMER INSERT SUBMODULE CURRENTLY INSPECTS FOR PRIMER ANVIL WITH A PROBE. TO IMPROVE EFFICIENCY, A BACK-UP INSPECTION IS DESIRED CAPABLE OF BEING INSTALLED ON EXISTING EQUIPMENT.

SOLUTION - A FLUORESCENT DYE WILL BE ADDED TO THE PRIMER LACQUER TO BE DETECTED BY TWO DETECTORS. THE BACK-UP INSPECTION OF PRIMER ANVIL WILL BE EVALUATED BY USING A NONCONTACT EDDY CURRENT PROBE.

(4551) TITLE - MFG PROCESS PARAMETERS FOR XM855/856 AMMO

PROBLEM - THE ARMY IS DEVELOPING A PRODUCTION BASE FOR THE NATO 5.56MM AMMUNITION. HOWEVER, THERE IS NO PROCESS UNDER WHICH U.S. PRODUCED ROUNDS CAN BE PROVEN OUT FOR ACCEPTABILITY OF PERFORMANCE OR THE SUITABILITY OF THE MANUFACTURING TOOLING AND PROCESSES.

SOLUTION - PRODUCE QUANTITIES OF XM855/856 AMMUNITION FROM LCAA PRODUCED BY THE NEWLY DEVELOPED PROCESS AND TOP FOR TECHNICAL EVALUATION AND PRODUCT/TOLLING ACCEPTABILITY.

COMPONENT -- .50 CAL AND LARGER

(5021) TITLE - HOT FORMING OF P/M PROJ BODIES

PROBLEM - CURRENT METHODS OF FABRICATING CANNON CALIBER ROUNDS REQUIRES EXTENSIVE MACHINING TO REMOVE 60-70 PERCENT OF THE STARTING MATERIAL.

SOLUTION - FABRICATE PROJECTILE BODIES BY UTILIZING POWDER METALLURGY (P/M) HOT FORMING INTO THE DESIRED SHAPE.

(4583) TITLE - IMPROVED PROCESS F&C .50 CAL .50 CORE MANUFACTURE

PROBLEM - .50 BULLET CORES ARE MANUFACTURED ON SCREW MACHINES FROM STEEL ROD RESULTING IN A 33 PERCENT SCRAP RATE. THE SCRAP REPRESENTS 28 PERCENT OF EACH CORE UNIT COST.

SOLUTION - PRODUCE CORES TO NET SHAPE ON SKewed AXIS ROLL FORMING MACHINES REDUCING SCRAP TO ABOUT 2 PERCENT OF ROD FEEDSTOCK.
COMPONENT -- .50 CAL AND LARGER

(Continued)

(4584) Title - Loading Equipment for Cal .50 Ball/Blank Ammunition

Problem - The increased requirements for .50 cal ammunition is in excess of the capacities of current production equipment.

Solution - Investigate current and proposed equipment to determine the most cost effective, produce a prototype system that will meet the anticipated production rates.

(4585) Title - Sabot Launched Armor Penetrator (SLAP) Amn Mfg Processes

Problem - The Mfg of SLAP ammunition requires the development of prototype equipment and tooling to provide the most cost effective production.

Solution - Processes and equipment will be demonstrated to cold form the area multiplier, to automate area multiplier feeding and sabot molding, to fabricate penetrators from powder metal and to assemble the sabot/penetrator/cartridge.

(4596) Title - Production Processes for Caliber .50 Plastic Blank Amn

Problem - There is currently no production equipment to produce the plastic cased cal .50 blank round in large quantities, this is a new configuration requiring new priming and lap techniques.

Solution - The production requirements will be met either by modifying a SCAMP MGD B Loading Machine or a Commercial Shot Shell Priming and Loading Machine, either option is sufficient to meet requirements.
ARMAMENT R&D COMMAND
ARMAMENT MATERIAL READINESS COMMAND
(ARRADCOM, ARRCOM)
(WEAPONS)
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WEAPONS PROGRAM

The US Army Armament Materiel Readiness Command (ARRCOM), headquartered at Rock Island, IL, has responsibility for MMT projects on weapons in full scale production. ARRADCOM is responsible for MMT projects for weapons in development or initial production. Most of the weapons projects are performed through Watervliet Arsenal (WVA) and Rock Island Arsenal (RIA). The main emphasis of the weapons MMT program is the modernization and upgrading of operations through the REARM program. The purpose is to reduce costs and improve product quality by taking advantage of the advances in metalworking technology.

Many of the projects planned for FY82-86 at Watervliet Arsenal are related, in whole or in part, to the handling and fixturing of cannon tubes and their components. Since many items produced at Watervliet are large, complex and/or require close tolerances, the setup and movement time are important cost drivers.

A major cost driver at WVA is metal removal. Since the alloys used in weapons are expensive and difficult to work, producing components close to final shape will reduce the cost and time required for finishing. Methods being explored include hot isostatic pressing (HIP) and powder metallurgy (PM). Projects are also proposed to improve the metal removal process. High speed metal removal is addressed in several projects as are efforts proposed to perform multiple operations at one time. Some of the other areas in the Watervliet submission include group technology, computer-aided manufacturing, non-traditional surface hardening methods, chromium plating, and finding substitutes for critical materials.

Cost reductions and productivity increases in manufacturing continue to be the prime objectives of MMT at Rock Island Arsenal. Because RIA is a job-shop organization, administration and planning overhead is a significant cost driver. By developing an integrated computer-aided manufacturing/managment information system the Arsenal will be able to efficiently control all operations from receipt of an order to delivery of the product. Some of the management areas addressed include process modeling, performance measurement, computer-aided work measurement system, and online production information system. Cost benefits are also expected from improved material handling and in-process control projects which are tied into the overall CAM/MIS effort at RIA. Efforts in this area include robot loading of machines, and automated process control.

Since RIA's task is primarily metalworking, there are several projects included in this area. While all efforts will in themselves reduce costs, coupling with the Arsenal's overall CAM/MIS will further increase the benefits. Some of the areas covered include casting, welding, and electro-chemical grinding.
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</table>
COMPONENT — ASSEMBLIES

(8321) TITLE - ADHESIVE BONDING FC SYSTEMS
PROBLEM - CURRENT ASSEMBLY METHODS DO NOT TAKE FULL ADVANTAGE OF THE MANY ADVANCED ADHESIVE SYSTEMS AVAILABLE. MANY OPERATIONS COULD BE CONVERTED WITH SIGNIFICANT SAVINGS IN BOTH TIME AND MONEY AND WITH INCREASED RELIABILITY.
SOLUTION - SELECT A SERIES OF ASSEMBLY OPERATIONS AS CANDIDATES FOR ADHESIVE BONDING, DESIGN BONDING SYSTEMS, APPLY, TEST AND EVALUATE. PREPARE PROCESS SPECIFICATIONS FOR THE SUCCESSFUL SYSTEMS.

COMPONENT — GENERAL

(7966) TITLE - MANUFACTURE OF TRITIUM POWERED RADILUMINOUS LAMPS
PROBLEM - CURRENT METHODS OF CONTROLLING MOISTURE CONTENT, SEALING AND ALUMINIZING TRITIUM LAMPS ARE BELIEVED RESPONSIBLE FOR THE PRESENT LACK OF DEPENDABILITY.
SOLUTION - DETERMINE THE PRODUCTION CONDITION THAT WILL RESULT IN OPTIMUM HALF-BRIGHT LIFE AND MODIFY CURRENT PRODUCTION METHODS ACCORDINGLY.

(8263) TITLE - PROD. IN-PROCESS INSPECT EQIP FOR LASER RANGE FINDER (CAM)
PROBLEM - CURRENT PRODUCTION/IN-PROCESS INSPECT TECHNIQUES ARE REJECTING GOOD LASER RANGE FINDERS. THE REJECTION OF GOOD LRF IS ATTRIBUTED TO INACCURACIES OF RADIIETERS AND INCANDESCENT LIGHT SOURCES USED TO MEASURE THE LASER POWER OUTPUT AND SENSITIVITY.
SOLUTION - ADVANCES IN ELECTRO-OPTICAL TECHNOLOGY, DIGITAL RADIIETERS AND CALIBRATED SOLID STATE LIGHT SOURCES WILL BE USED TO CORRECT CURRENT INSPECT.INACCURACIES.

(8327) TITLE - COMPUTER INTEGRATED MFG (CIM F/FC MATERIAL) (CAM)
PROBLEM - MANUFACTURING METHODOLOGIES AND THE APPLICATION OF CAD AND CAM TO FC MANUFACTURING HAS ONLY PRODUCED ISOLATED IMPROVEMENTS AND MANY OF THE MAJOR PRODUCTION PROBLEMS STILL PREVAIL.
SOLUTION - A SYSTEMS APPROACH WITH COMPUTER INTEGRATED MANUFACTURING METHODOLOGIES TO ESTABLISH A CLOSE-LOOP SYSTEM FOR THE DESIGN-THROUGH MANUFACTURING PROCESS FOR FC, INCLUDING PLANNING ENGINEERING, QA, AND DECISION MAKING.

COMPONENT — OPTICS

(8080) TITLE - HIGH SPEED FABRICATION OF ASPHERIC OPTICAL SURFACES
PROBLEM - THE BULK OF THE COST OF OPTICS FOR FIRE CONTROL SYSTEMS LIES IN THE FIGURING AND POLISHING STAGE.
SOLUTION - USE THE TUBULAR TOOL GRINDING PROCESS TO PRODUCE ASPHERIC SURFACES DIRECTLY DURING THE GRINDING PROCESS.
COMPONENT — OPTICS

(8108) TITLE — THERMOGRAPHIC EVALUATION OF OPTIC BANDS

PROBLEM — THE BOND BETWEEN OPTICAL ELEMENTS AND THEIR STRUCTURAL SUPPORTS MUST BE FREE OF VOIDS, OF UNIFORM THICKNESS AND OF SUFFICIENT STRENGTH TO HOLD FAST AND MAINTAIN ALIGNMENT UNDER SEVERE SHOCK.

SOLUTION — INTRODUCE THERMOGRAPHIC PROCEDURES TO THE INSPECTION OF OPTIC BANDS.

(8165) TITLE — STANDARDS FOR DIAMOND TURNED OPTICAL PARTS

PROBLEM — EXISTING SURFACE FINISH STANDARDS AND TESTING EQUIPMENT AND TECHNIQUES DO NOT COVER THE RANGE OF DIAMOND TURNED OPTICAL SURFACES FOR A PRODUCTION ENVIRONMENT (1/2 TO 1 MICRINCH).

SOLUTION — CORRELATE LASER SCATTEROMETRY AND INTERFERENCE CONTRAST MICROSCOPY WITH FUNCTIONAL OPTICAL TESTING TO OPTIMIZE THE SPECIFICATION OF THE SURFACE WITH A MEASUREMENT TECHNIQUE FOR A PRODUCTION ENVIRONMENT.

(8209) TITLE — PILOT PRODUCTION OF GRADIENT INDEX OPTICS

PROBLEM — GRADIENT OPTICS, WHERE IN THE INDEX OF THE GLASS IS SEQUENTIALLY VARIED TO OBTAIN DESIGNED OPTICAL CHARACTERISTICS IS FAR MORE DESIRABLE THAN CURRENT USED, I.E., FORMING A CURVE ON THE GLASS SURFACE.

SOLUTION — ESTABLISH, SUBSEQUENT TO THE INTRODUCTION AND DEVELOPMENT OF GRADIENT OPTICS TO MILITARY USE, A PILOT PRODUCTION FACILITY TO MANUFACTURE GRADIENT OPTICS AT A REQUIRED RATE.

(8211) TITLE — NET SHAPE OPTICAL PROCESSING

PROBLEM — CONSIDERABLE TIME AND EFFORT IS REQUIRED TO PROCESS AN OPTIC FROM A RAW PRESSING TO ITS FINAL SHAPE.

SOLUTION — IMPROVE OPTICAL PRESSING TECHNIQUE TO ACHIEVE NEAR NET SHAPES IN THE INPUT BLANK.

(8262) TITLE — PRODUCTION METHODS FOR OPTICAL WAVE GUIDES

PROBLEM — MANUFACTURE OF INTEGRATED WAVEGUIDES IS COMPLICATED AND TIME CONSUMING INVOLVING PROCESSES RELATED TO METHODS USED TO MAKE SEMICONDUCTOR INTEGRATED CIRCUITS.

SOLUTION — USE ION IMPLANTATION TO ALTER OPTICAL PROPERTIES OF GALLIUM ARSENIDE AND PHOSPHIDE SUBSTRATES TO DIRECTLY FORM OPTICAL WAVEGUIDES IN A ONE-STEP PROCESS.
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<td><strong>PROBLEM</strong> — PRODUCTION DELAYS AND COST OF REMOVAL OF A GREAT LOGISTICS SHORTFALL IN PRODUCTION CAPABILITY.</td>
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<td><strong>SOLUTION</strong> — ASSESSMENT OF NEW PROCESS TECHNOLOGY, UPDATED EQUIPMENT AND OPTIMIZED PROCESSES IS NECESSARY FOR THE ASSEMBLY OF A PILOT PRODUCTION LINE CAPABLE OF DEMONSTRATING HIGH SPEED PRODUCTION AND IMPROVED INSPECTION TECHNIQUES.</td>
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<td><strong>(0467) TITLE — DIAMOND POINT TURNING OF GLASS OPTICS</strong></td>
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<td><strong>PROBLEM</strong> — THE GENERATION OF UNCONVENTIONAL AND EXTREMELY ASYMMETRICAL-OPTICAL SURFACES HAVE BEEN DIFFICULT AND EXPENSIVE TO MAKE BY CONVENTIONAL TECHNIQUES. RECENT DEVELOPMENTS HAVE ESTABLISHED A BASIS FOR DIAMOND TURNING OF GLASS OPTICS.</td>
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<tr>
<td><strong>SOLUTION</strong> — INVESTIGATE AND APPLY N/C PRECISION MACHINING AND POSITIONAL MEASUREMENT FEEDBACK SYSTEMS FOR DIAMOND TURNING SMOOTH WELL DAMAGE FREE GLASS SURFACES AND APPLY THE ADVANCES IN THE METROLOGY FOR THESE SURFACES.</td>
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</tbody>
</table>

***COMPONENT — EQUIPMENT***

| **(0154) TITLE — COMPUTER INTEGRATION MHG (CIM), DMC** | 442 650 450 |
| **PROBLEM** — NUMERICAL CONTROL MACHINE TOOLS OFFER MANY ADVANTAGES OVER CONVENTIONAL MACHINE TOOLS BUT HAVE CERTAIN DISADVANTAGES. ONE PROBLEM AREA IS GETTING MACHINE INSTRUCTIONS TO THE MACHINE TOOL AND COLLECTING MANAGEMENT INFORMATION. | |
| **SOLUTION** — INTERFACE IN-HOUSE COMPUTER FACILITIES WITH CURRENT AND FUTURE NC MACHINE TOOLS TO FORM AN ADVANCED COMPUTER INTEGRATED MHG SYSTEM. UTILIZE DMC TECHNOLOGY. | |
| **(0424) TITLE — AUTOMATIC/ROBOTIC WELDING OF WEAPON COMPONENTS (ICAM)** | 291 438 |
| **PROBLEM** — THE REPAIR OF DEFECTIVE WELDS ARE FREQUENTLY EXPERIENCED. REPAIR REQUIREMENTS ARE OFTEN TRACED TO THE SKILL LEVEL OF THE WELDING OPERATORS. | |
| **SOLUTION** — ADAPTIVE CONTROLS ARE BEING USED IN AN INCREASING NUMBER OF WELDING APPLICATIONS TO DEEMPHASIZE OPERATOR'S SKILL IN MAKING CONSISTENT PRODUCT. SUCH FEEDBACK CONTROL ROBOTS SHOULD BE USED ALSO IN WEAPONS FABRICATION. | |
COMPONENT --- EQUIPMENT

(8532) TITLE - ARM & CAM FOR FUTURE CAM ACTIVITIES

PROBLEM - IN CONDUCTING SEPARATE EFFORTS ON CAM, IT CAN BE EXPECTED THAT PURCHASED EQUIPMENT MAY NOT BE FULLY UTILIZED OR SOFTWARE MAY NOT BE COMPATIBLE WITHIN VARIOUS CAM SYSTEMS USED BY DIFFERENT ARMY INSTALLATIONS AND SUPPLIERS.

SOLUTION - DEVELOP A MASTER PLAN FOR ARMY CAM ACTIVITIES. IT WILL OUTLINE MEDIUM TO LONG-RANGE GOALS FOR FURTHER CAM APPLICATION AND DETERMINE WHAT MFG AREAS REQUIRE MORE EMPHASIS.

(8608) TITLE - STATE-OF-THE-ART LADLE/FURNACE REFINING

PROBLEM - THERE ARE NO PROVISIONS IN PROJECT 6838251, IMPROVED MELTING PRACTICES, TO IMPLEMENT TECHNIQUES THAT REQUIRE PURCHASE OF MAJOR ITEMS SUCH AS AN ARGON OXYGEN DECARBURIZATION FURNACE.

SOLUTION - THIS PROJECT WILL BE USED TO INSTALL NEW LADLE/FURNACE EQUIPMENT. THE BEST PROCESS PARAMETERS WILL BE DETERMINED AND CONTROLS WILL BE EVALUATED.

COMPONENT --- INFORMATION SYSTEMS

(8132) TITLE - PERFORMANCE MEASUREMENT PARAMETERS FOR GOGO MFG.

PROBLEM - MEASURING THE PERFORMANCE OF A GOVERNMENT MANUFACTURING OPERATION IS DIFFICULT. GOOG OPERATIONS, ALTHOUGH PARTIALLY COMPETITIVE, ARE NOT IN A FULLY COMPETITIVE MARKETPLACE. ACCOUNTING DATA BY ITSELF IS NOT SUFFICIENT TO MEASURE PERFORMANCE.

SOLUTION - DEVELOP A SERIES OF MEASUREMENTS THAT COMBINE ACCOUNTING DATA AND PRODUCTION DATA TO ADEQUATELY ASSESS PERFORMANCE. INCLUDE DATA ON TECHNOLOGICAL IMPROVEMENTS, INFLATION, PRODUCT COST, ETC. MEASUREMENTS WILL BE USEFUL IN LONG RANGE PLANNING.

(8305) TITLE - INTEGRATED MANUFACTURING SYSTEM (ICAM)

PROBLEM - MIS?S ARE APPLIED LOCALLY BUT THERE IS NO DATA MANAGEMENT SYSTEM FOR THE ENTIRE MANUFACTURING ACTIVITY. THIS INCREASES COST DUE TO LONG LEAD TIMES, SCHEDULE INTERRUPTIONS AND SHORTAGES OF MACHINE AVAILABILITY, LABOR AND MATERIALS.

SOLUTION - DEVELOP AN MIS WHICH ADDRESSES ACTIVITIES OF ALL DIRECTORATES SUPPORTIVE TO MANUFACTURING AT RIA. THE SYSTEM WILL USE STATE-OF-THE-ART TECHNOLOGY TO DELINEATE OPTIMUM SCHEDULING AND PINPOINT POTENTIAL PROBLEM AREAS FOR EASIER RESOLUTION.
### COMPONENT -- INFORMATION SYSTEMS (CONTINUED)

**(8306) TITLE -- ON-LINE PRODUCTION INFORMATION SYSTEM (CAM)**

**PROBLEM** -- THE MANUFACTURING DATA BASE CANNOT BE ACCESSED THROUGH AN ON-LINE DATA BASE SYSTEM, MAKING INTEGRATION OF AUTOMATED SYSTEMS FOR PROCESS PLANNING, TIME STANDARDS GENERATION, FACILITIES/PRODUCTION PLANNING AND PRODUCTION CONTROL SIMULATION DIFFICULT.

**SOLUTION** -- DEVELOP THE MANUFACTURING DATA BASE FROM ITS PRESENT BATCH ORIENTED ENVIRONMENT TO AN ON-LINE SYSTEM.

<table>
<thead>
<tr>
<th>COMPONENT -- MISCELLANEOUS</th>
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<tr>
<td><strong>(8030) TITLE -- MANUFACTURING GUIDE FOR ELASTOMERIC SEALS</strong></td>
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**PROBLEM** -- CONSTANT PROBLEMS IN THE PROCUREMENT OF SATISFACTORY SEALS FOR WEAPONS SYSTEMS, I.E., M140, M127, ETC., ARE EXPERIENCED WITH RESULTANT SOLE SOURCE PURCHASES.

**SOLUTION** -- ELIMINATE SOLE SOURCE PROCUREMENT BY DOCUMENTING PROCESSES, TECHNIQUES AND FORMULAS VARIATIONS FOR A VARIETY OF MILITARY SEALS FOR PUBLICATION IN A GUIDE FOR USE BY INDUSTRY.

| **(8252) TITLE -- INDUCTION HEATING OF VARYING DIAMETER PREFORMS** | 241 |

**PROBLEM** -- TO FORGE A PREFORM REQUIRES HEATING IN THE INDUCTION SYSTEM. THE PRESENT SYS HAS 4 LINES WHICH OSCILLATE THE PREFORM THRU THE INDUCTION COIL CONTROLLED BY A NONVARYING POWER SUPPLY WHICH PRECLUDES PRECISE HEATING OF A VARYING DIAMETER PREFORM.

**SOLUTION** -- DESIGN A DEVICE THAT WILL AUTOMATICALLY ADJUST THE POWER TO THE COILS BASED ON PREFORM DIAMETER. IT WOULD SENSE PREFORM DIAMETER AS IT ENTERS THE COIL AND ADJUST POWER ACCORDINGLY.

| **(8464) TITLE -- PROCESSES FOR PLASTIC/POLYMERIC COMPONENTS/INSTRUMENTS** | 250 | 750 |

**PROBLEM** -- LACK OF OPTICAL PERFORMANCE, THERMAL STABILITY, ENVIRONMENTAL RESISTANCE HAS PREVENTED USE OF THESE MATERIALS FOR ARMY APPLICATION. USE OF PLASTICS FOR FIRE CONTROL OPTICAL SYSTEMS OFFERS SIGNIFICANT POTENTIAL FOR COST AND WEIGHT REDUCTIONS.

**SOLUTION** -- THIS PROJECT WILL IDENTIFY THE MFG PROCEDURES AND CONTROLS AND THE PLASTIC MATERIALS WHICH MUST BE MODIFIED TO UPGRADE THE MANUFACTURED ITEM TO MILITARY QUALITY. A PILOT PRODUCTION LINE WILL BE ESTABLISHED.
**COMPONENT -- MISCELLANEOUS**

(8535) **TITLE** - DETERMINATION OF AREAS WITHIN MANTECH FOR FUTURE R&D

**PROBLEM** - WITH THE ADVENT OF THE NEW ARMY BATTLE PLAN, FIELD CAPABILITY FOR MANUFACTURING REPLACEMENT PARTS AND REPAIRS WILL BE NEEDED. THE ECONOMICS, FUTURE DEVELOPMENTS, SIGNIFICANT PROCESSES AND COMPONENTS REQUIRING NEW TECHNIQUES NEED IDENTIFICATION.

**SOLUTION** - BY COMPILING INFO ON MFG OF MILITARY HARDWARE FROM DOMESTIC AND FOREIGN SOURCES, DETERMINE THOSE ITEMS WHICH ARE DIFFICULT/EXPENSIVE TO MFG AND SUGGEST POSSIBLE PRODUCTION TECHNIQUES FOR CONUS OR BATTLEFIELD USES.

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<tr>
<th>COMPONENT -- PROCESSES</th>
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<tr>
<td><strong>(7707) TITLE</strong> - AUTOMATED PROGRESS CONTROL FOR MACHINING (CAM)</td>
</tr>
<tr>
<td><strong>PROBLEM</strong> - MACHINING OPERATIONS ARE SELECTED, PARAMETERS ARE SET, AND STANDARDS ARE ESTABLISHED EMPIRICALLY WITH LITTLE OR NO ENGINEERING ANALYSES, CONTROL OR FEEDBACK.</td>
</tr>
<tr>
<td><strong>SOLUTION</strong> - APPLY COMPUTERIZED CONTROLS FOR OVERALL SELECTION OF PROCESSES, OPERATIONS, PARAMETERS, FEEDBACK AND OPTIMIZATION, WITH AUTOMATED ESTIMATING AND DETERMINATION OF REAL TIME AND COSTS.</td>
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<tr>
<td><strong>(7940) TITLE</strong> - SYNERGISTIC PLATINGS WITH INFUSED LUBRICANTS</td>
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<tr>
<td><strong>PROBLEM</strong> - LOW FRICTION, WEAR RESISTANT SURFACES ARE NEEDED FOR COMPONENTS IN SLIDING CONTACT.</td>
</tr>
<tr>
<td><strong>SOLUTION</strong> - USE OF TWO-SYSTEM COATINGS INCORPORATING SOLID LUBRICANT INTERLOCKED WITH METAL PLATING.</td>
</tr>
<tr>
<td><strong>(8006) TITLE</strong> - ESTABLISHMENT OF ALLOY PLATING PROCESS</td>
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<tr>
<td><strong>PROBLEM</strong> - SEVERAL COATING MATERIALS SUCH AS CHROMIUM ARE IN SHORT SUPPLY.</td>
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<tr>
<td><strong>SOLUTION</strong> - REPLACE OR REDUCE THE AMOUNT OF CRITICAL ELEMENTS IN THE COATING BY ALLOY PLATING.</td>
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<tr>
<td><strong>(8113) TITLE</strong> - ESTABLISHMENT OF ION PLATING PROCESS FOR ARMAMENT PARTS</td>
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<tr>
<td><strong>PROBLEM</strong> - DOD IS REPLACING TOXIC CADMIUM WHEREVER POSSIBLE. CURRENTLY, CADMIUM PLATING IS SPECIFIED FOR APPROXIMATELY 3000 ARMAMENT COMPONENTS. EQUALLY IMPORTANT IS THE ELIMINATION OF THE HYDROGEN EMBSRITLEMENT OF STEEL CAUSED BY ALL ELECTROPLATING PROCESSES.</td>
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| **SOLUTION** - ION PLATING ALUMINUM COATINGS TO STEEL ARMAMENT SUBSTRATES WILL PROVIDE CORROSION RESISTANCE SUPERIOR TO THAT OF ZINC OR CADMIUM PLATING. ION PLATING AND ELECTROPLATING COSTS ARE SIMILAR. PROCESS NEEDS TO BE ESTABLISHED FOR ARMAMENT ITEMS. 

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<td>165 180</td>
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<td>150 142</td>
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</table>
COMPONENT — PROCESSES

(8120) TITLE — ADAPTIVE CONTROL TECHNOLOGY (CAM)

PROBLEM — CURRENT GRINDING PROCESSES DO NOT TAKE ADVANTAGE OF THE GRINDING WHEEL CUTTING EFFICIENCY. PRECISION TOLERANCES ARE DIFFICULT TO HOLD DUE TO PART HEATING. WHEEL WEAR RATES INCREASE EXPONENTIALLY WITH FEED RATES AND LIMIT PRODUCTIVITY.

SOLUTION — USE A PROCESS CALLED ENERGY GRINDING. IT USES AN ADAPTIVE CONTROL FITTED TO A CYLINDRICAL GRINDER. WHEEL SPEED, WHICH DETERMINES WHEEL SHARPNESS WHICH EFFECTS METAL REMOVAL RATES AND EFFICIENCY, IS CONTROLLED.

(8135) TITLE — INPROCESS CONTROL OF MACHINING

PROBLEM — DURING MFG. OF RECOIL CONTROL ORIFICES, ERRORS ARE INTRODUCED WHICH REQUIRE REWORK. CORRECTIVE ACTIONS INVOLVE COSTLY DETAILED INSPECTION AND REANALYSIS WITH COMPUTERIZED DESIGN PROGRAMS TO DEFINE POSSIBLE REWORK ALTERNATIVES.

SOLUTION — AN IMPROVED MANUFACTURING METHOD UTILIZING ADAPTIVE CONTROLS AND AUTOMATED INSPECTION EQUIPMENT WILL BE ESTABLISHED. MACHINE TOOLS WILL BE RETROFITTED.

(8206) TITLE — APPLICATION OF HIGH-RATE ABRASIVE MACHINING

PROBLEM — CONVENTIONAL GRINDING IS SLOW AND COSTLY. LONG, MULTIPLE PASSES AND INFEEDS ARE REQUIRED TO SIZE AND FINISH WEAPON COMPONENTS.

SOLUTION — APPLY HIGH-SPEED ABRASIVE-BELT MACHINING.

(8225) TITLE — ELECTROCHEMICAL GRINDING OF WEAPON COMPONENTS

PROBLEM — SIZING AND FINISHING OF LARGE, LONG WEAPON COMPONENTS BY CONVENTIONAL GRINDING IS SLOW AND COSTLY, OFTEN REQUIRING MULTIPLE OPERATIONS, SET UPS, WHEEL CHANGES, AND REPETITIVE MULTIPLE PASSES. FOR EXAMPLE— PLANNING / GRINDING HGWITTER MOUNT RAIL.

SOLUTION — RETROFIT EXISTING, SPECIAL LONG BED, HORIZONTAL, SURFACE GRINDER WITH ELECTROLYTIC SYSTEM TO PROVIDE FAST, SINGLE PASS ROUGH FINISHING OF LARGE COMPONENTS, ELIMINATE ROUGHING BY PLANNING OR MILLING BEFORE ELECTROLYTIC GRINDING.

(8231) TITLE — IMPROVED CASTING TECHNOLOGY (CAM)

PROBLEM — EXCESSIVE METAL MUST BE MELTED IN CASTING OPERATIONS. THE YIELD RATIO OF SOME CASTS IS TOO LOW AND THE GATES AND RISERS TOO DIFFICULT TO CUT OFF. MATERIAL PROPERTIES OFTEN VARY WITH CASTING PROCEDURES.

SOLUTION — USING COMPUTERIZED TECHNIQUES AND PRODUCTION CASTING FACILITIES, THE OPTIMUM SHAKE OUT TIMES, RISER SLEEVES AND GATING AND RISERING CONFIGURATIONS WOULD BE DETERMINED. PROPERTIES OF CAST MATERIALS WILL BE EVALUATED FOR DIFFERENT CAST DESIGNS.
COMPONENT -- PROCESSES

(8254) TITLE - AUTOMATED SURFACE COATING OF CANNON (CAM)

PROBLEM - IT REQUIRES APPROXIMATELY 2 1/2 HOURS PER TUBE TO APPLY ONE UNDER COAT AND TWO FINISH COATS OF PAINT BY MANUAL BRUSHING. CURRENT DRYING METHODS REQUIRE EXCESSIVE FLOOR SPACE AND OVERHEAD CRANE SUPPORT.

SOLUTION - DESIGN AN AUTOMATED SURFACE COATING SYSTEM THAT CONSISTS OF ELECTRONICALLY CONTROLLED, HYDRAULICALLY POWERED ELECTRO-STATIC SPRAYING MACHINES, INTEGRATED MATERIAL HANDLING, AND AUTOMATIC DRYING SYSTEMS, ALL UNDER COMPUTER CONTROL.

(8360) TITLE - ESTABLISHMENT OF ZINC ION VAPOR DEPOSITION PROCESS

PROBLEM - NO PROBLEM PROVIDED BY ARADCOM.

SOLUTION - NO SOLUTION PROVIDED BY ARADCOM.

(8402) TITLE - WARM FORGING OF WEAPON COMPONENTS (CAM)

PROBLEM - EXCESSIVE ENERGY IS CONSUMED IN CONVENTIONAL FORGING. ALSO DIE LIFE IS SHORTENED BY HIGH FORGING TEMPERATURES AND BY OXIDATION.

SOLUTION - BY USING CAD/CAM TECHNIQUES FOR DIE DESIGN, FORGING WILL BE DONE AT MUCH LOWER TEMPERATURE AND THE FINAL PARTS WILL HAVE BETTER MECHANICAL PROPERTIES

(8403) TITLE - DESIGN CRITERIA FOR HARDENING (CAM)

PROBLEM - SELECTION OF THE BEST HARDENING PROCESS. INCOMPLETE HARDENING THROUGHOUT THE COMPONENT AND COMPLICATIONS CAUSED DURING THE HEAT TREATMENT OF WELDMENTS ARE RECURRING PROBLEMS CURRENTLY ADDRESSED BY EMPIRICAL METHODS.

SOLUTION - THE RELATIONSHIPS OF DIFFERENT VARIABLES SUCH AS QUENCH RATES, COMPONENT SIZE, SHAPE, AND COMPOSITION WILL BE ESTABLISHED. A COMPUTER WILL BE PROGRAMMED TO FURNISH THE NECESSARY INFORMATION.

(8503) TITLE - ELECTRO-MECHANICAL JOINING TECHNIQUES

PROBLEM - PURELY MECHANICAL (FRICITION WELDING) OR MOSTLY ELECTRICAL (RESISTANCE) WELDING MACHINES OF VARIOUS TYPES WOULD HAVE TO BE LARGE AND WOULD TAKE EXCESSIVE TIME TO WELD JOINT AREAS 25 SQUARE INCHES OR MORE.

SOLUTION - COMBINE THE FEATURES OF BOTH METHODS TO DELIVER SUFFICIENTLY LARGE SPECIFIC ENERGY FOR WELDING OF LARGE PARTS.
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<th>COMPONENT — PROCESSES</th>
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<tr>
<td><strong>(0513) TITLE</strong> — MICROWAVE CURING OF FURAN BONDED SAND</td>
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<tr>
<td><strong>PROBLEM</strong> — CURE RATE OF FURAN BOND SANDS DEPENDS ON THE ACID CATALYST/RESIN RATIO AND THE SIZE AND TEMP OF THE MOLD. SINCE PDN RATES ARE HIGH, SOME RATIOS CANNOT BE USED WHILE USEABLE RATIOS ARE A COMPROMISE BETWEEN VALUES FOR LARGE AND SMALL MOLDS.</td>
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<tr>
<td><strong>SOLUTION</strong> — USE MICROWAVE HEATING TO CHANGE THE CURE CHARACTERISTICS OF SELECTED RESIN-CATALYST SYSTEMS TO COMPENSATE FOR DIFFERENT SIZES OF MOLDS. THIS WILL PERMIT A MORE UNIFORM PRODUCTION RATE.</td>
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<tr>
<td><strong>(0514) TITLE</strong> — OPTIMIZATION OF MACHINING PARAMETERS</td>
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<tr>
<td><strong>PROBLEM</strong> — CONTROL OF TIME, COST AND QUALITY DEPENDS ON EMPIRICAL ADJUSTMENTS TO THE PDN EQUIPMENT. APPLICATION OF FULLY AUTOMATED CONTROLS HAS BEEN DELAYED BY NONAVAILABILITY OF STATE-OF-THE-ART EQUIPMENT.</td>
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<tr>
<td><strong>SOLUTION</strong> — APPLY AVAILABLE COMPUTERS TO ANALYZE AND QUANTIFY THE EFFECTS OF BASIC OPERATION VARIABLES ON THE COST AND QUALITY OF THE WORKPIECE. DEVELOP SOFTWARE TO DETERMINE THE OPTIMUM OPERATION VARIABLES TO BE INCLUDED ON THE SHOP ORDER.</td>
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<td><strong>(0515) TITLE</strong> — APPLICATION OF WIDE AREA PLUNGE GRINDING</td>
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<tr>
<td><strong>PROBLEM</strong> — CONVENTIONAL MACHINING OF WORKPIECES WITH MULTIPLE DIAMETERS AND BLENDED TAPERS AND RADIUS REQUIRES MANY OPERATIONS AND IS SLOW AND COSTLY.</td>
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<tr>
<td><strong>SOLUTION</strong> — USE A WIDE GRINDING WHEEL WHOSE FACE IS DRESSED TO THE REQUIRED PROFILE AND PRODUCE THE FINISHED PIECE IN ONE OPERATION BY PLUNGE GRINDING TO SIZE.</td>
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<tr>
<td><strong>(0522) TITLE</strong> — LASER SURFACE ALLOYING PROCESS FOR IMPROVED WEAR RESISTANCE</td>
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<td><strong>PROBLEM</strong> — NO PROBLEM PROVIDED BY ARADCOM.</td>
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<td><strong>SOLUTION</strong> — NO SOLUTION PROVIDED BY ARADCOM.</td>
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<tr>
<td><strong>(0523) TITLE</strong> — ION IMPLANTATION OF WEAPON COMPONENTS</td>
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<td><strong>PROBLEM</strong> — NO PROBLEM PROVIDED BY ARADCOM.</td>
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<td><strong>SOLUTION</strong> — NO SOLUTION PROVIDED BY ARADCOM.</td>
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<tr>
<td><strong>(0534) TITLE</strong> — CONSERVATION OF ENERGY IN PROCESSING OF WEAPONS COMPONENTS</td>
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<td><strong>PROBLEM</strong> — PRESENT HEAT TREAT TECHNIQUE AND SELECTION OF HEAT TREAT EQUIPMENT RELIES ON PAST EXPERIENCE AND IS NOT BASED ON SCIENTIFIC CALCULATIONS.</td>
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<tr>
<td><strong>SOLUTION</strong> — EVALUATE PRESENT TECHNIQUES AND EQUIPMENT. DEVELOP COMPUTER-AIDED-MODULAR METHOD TO PREDICT MIN TIME REQD TO HEAT A PART. DEVELOP MODELS TO COMPARE COSTS TO HEAT A GIVEN PART BY VARIOUS MEANS (GAS, INDUCTION, RESISTANCE, ETC.).</td>
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</table>
COMPONENT -- PROCESSES

(0602) TITLE - LASER SURFACE HARDENING

PROBLEM - CURRENTLY AT RIA THE ENTIRE COMPONENT IS HEAT TREATED. THIS CAN
CAUSE DISTORTION AND DISTURBED SURFACES, AND CAN ELIMINATE THE BENEFITS OF
SELF QUENCHING AND CONTROLLED PENETRATION.

SOLUTION - LASER HEAT TREATING PERMITS THE TREATMENT OF SELECTED AREAS. FINE
PRECISION AND RAPID PRODUCTION CAN BE OBTAINED WITHOUT DISTORTION OR SURFACE
SCALE.

(0603) TITLE - ROBOTIC WELDING

(0605) TITLE - RING ROLLING OF WEAPON COMPONENTS

PROBLEM - COMPONENTS WITH RING LIKE SHAPE OFTEN REQUIRE EXTENSIVE METAL
REMOVAL OVER ALMOST THE ENTIRE SURFACE BECAUSE TUBING OF THE OPTIMUM SIZE
FOR RAW MATERIAL IS NOT AVAILABLE. THIS INCREASES PRODUCTION COSTS.

SOLUTION - SIMPLE SHAPED RINGS WITH LITTLE EXCESS MATERIAL WILL BE SHAPED ON
SPECIAL RING ROLLING EQUIPMENT TO NEAR NET SHAPE.

(0606) TITLE - IMPROVED CARBURIZING TECHNOLOGY

PROBLEM - CARBURIZING IS NOT DONE IN CYANIDE SALTS WITH PRESENTS SAFETY AND
DISPOSAL PROBLEMS. THE PROCESS REQUIRES CLOSE ATTENTION BY THE HEAT TREATERS
TO MEET QUALITY AND SAFETY REQUIREMENTS.

SOLUTION - USE A FLUIDIZED BED FURNACE WHICH CAN BE APPLIED TO CARBURIZING,
ANNALING IN NEUTRAL ATMOSPHERE, OR GENERAL HEAT TREAT IN AIR.

(0610) TITLE - PREPARATION OF COUPONS REPRESENTATIVE OF CASTINGS

PROBLEM - MANY SPECS REQUEST THE DESTRUCTIVE TEST OF A SEPARATELY PREPARED
COUPON RATHER THAN THE ACTUAL PART. THE MECHANICAL PROPERTIES OF THE
MATERIAL IN THE COUPON FREQUENTLY DIFFER FROM THOSE IN THE CASTINGS.

SOLUTION - THIS PROGRAM WILL ESTABLISH PROCEDURES FOR DESIGNING AND HEAT
TREATING COUPONS THAT ACCURATELY REPRESENT ACTUAL PARTS.

(0611) TITLE - AUTOMATED ANALYSIS AND CONTROL OF PLATING BATHS

PROBLEM - PERIODIC WET CHEMISTRY ANALYSIS OF PLATING BATHS IS REQD TO
MAINTAIN PROPER CHEMICAL BALANCE. THE TIME LAG BETWEEN ANALYSIS AND USE IS A
DETERRIMENTAL FACTOR.

SOLUTION - APPLY AUTOMATED ANALYTICAL EQUIPMENT FOR THE CONTINUOUS MONITORING
OF BATH COMPOSITIONS AND FOR THE AUTOMATIC ADDITION OF THE REQD INGREDIENTS.
THIS EQUIPMENT WILL IDENTIFY IMPURITIES IN THE BATH AND ALSO CHECK
WASTEWATER.
COMPONENT -- PROCESSES

(8613) TITLE - POWDERED METALS FOR NONFERROUS COMPONENTS

PROBLEM - ROCK ISLAND ARSENAL MUST CAST SMALL PARTS FROM AL OR CU ALLOYS THAT ARE NOT VERY CASTABLE. SHRINKAGE, HOT TEARING AND OXIDES CAUSE UNSOUND CASTINGS WITH ATTENDED LOW ACCEPTANCE RATES.

SOLUTION - IMPROVE ACCEPTANCE BY MAKING THE PROBLEM COMPONENTS FROM POWDERED METAL. COMPARE PROPERTIES OF PM PARTS WITH CAST PARTS. DETERMINE IF ADDITIONAL PROCESSING SUCH AS HIP IS NEEDED AND PERFORM AN ECONOMIC COMPARISON.

COMPONENT -- TOOLING

(8248) TITLE - APPLICATION OF HIGH-RATE CUTTING TOOLS

PROBLEM - APPLICATION OF NEW HIGH-RATE CUTTING TOOLS LAG DUE TO LACK OF TESTING, ANALYSES AND ENGINEERED APPLICATIONS. MANUFACTURERS PROVIDE INSUFFICIENT DATA FOR EFFICIENT APPLICATIONS OF CERAMICS, OXIDES, NITRIDES, BORIDES, AND DIAMONDS.

SOLUTION - HIGH-RATE CUTTING TOOLS WILL BE TESTED, ANALYSED, AND APPLIED WITH BOTH NEW AND EXISTING MACHINING TOOLS. ENGINEERING GUIDELINES WILL BE ESTABLISHED FOR BOTH PHYSICAL AND ECONOMIC MACHINING PARAMETERS AND LIMITS.

(8307) TITLE - CRYOGENIC TREATMENT OF TOOL STEELS

PROBLEM - MANY METAL CUTTING OPERATIONS REQUIRE TOOL STEEL CUTTERS OF FORMING TOOLS RATHER THAN CARBIDE OR CERAMIC MATERIALS. TOOL STEEL MATERIALS DO NOT HAVE AS LONG A USEFUL LIFE AS DO THE HARDER MATERIALS AND REQUIRE FREQUENT RESHARPENING.

SOLUTION - CRYOGENIC TREATMENT OF TOOL STEELS GREATLY IMPROVES THE WEAR CHARACTERISTICS OF THE TOOL AND GREATLY REDUCES THE FREQUENCY OF RESHARPENING.

(8400) TITLE - SPECIAL TOOLING FOR FLEXIBLE MANUFACTURING

PROBLEM - CONVENTIONAL, N/C, AND FLEXIBLE MANUFACTURING SYSTEMS USE SEPARATE TOOLING WHICH LACKS COMPLETE FLEXIBILITY FOR MULTIPLE-TOOL AND/OR MULTIPLE-SPINDLE CUTTING WITH INTERCHANGEABILITY.

SOLUTION - CLASSIFY TOOLING BY GROUPS, ESTABLISH INTERCHANGEABILITY, APPLY SPECIAL MULTIPLE TOOL AND/OR MULTIPLE-SPINDLE TOOLING IN FLEXIBLE MANUFACTURING OPERATIONS AND SYSTEMS.
## Component — Breach Mechanisms

### (7730) Title — Manufacture of Split Ring Breach Seals

**Problem** - Split rings require precise MFG. Present methods are outdated and costly requiring much hand finishing by highly skilled workers. Rejection rate high with much rework.

**Solution** - Automated and improved procedures will be adopted. New method of slitting ring requiring less stock removal, special equipment will be designed and purchased to minimize hand finishing by high skill operators.

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<th>PRIOR</th>
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### (7926) Title — Hot Isostatic Pressing (HIP) of Large Cannon Comp

**Problem** - Many hours are required to machine the breach block forging to the finished part. More than 25% of forging becomes chips. With high cost of alloy steel, this becomes a very costly waste of material.

**Solution** - Hot Isostatic Pressing (HIP) will form breach blocks to nearly final shape, greatly reducing machining costs.

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### (8062) Title — Rapid Internal Threading

**Problem** - Producing internal metric threads in breach rings is a serious production problem because of both the techniques and tooling required. Conventional thread hobbing presents a production bottleneck.

**Solution** - Current technology and recent tooling breakthroughs have expanded high speed threading considerably. Automated threading will be an efficient, economic replacement for the current milling-type thread hobbing processes.

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### (8102) Title — Applic. of Powder Metallurgy Forgings to Comp.

**Problem** - Forgings and castings are fabricated oversize and subsequently machined down to final dimensions. Final component configuration involves a large amount of material and machines to remove alloy steel as chips.

**Solution** - Recent advances have occurred in powder metallurgy forging. The advances will produce 'near net shape' components which reduces amount of machining required while keeping adequate mechanical properties. Utilize new technique.

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### (8117) Title — Shaped Casting of ESR Material

**Problem** - Components require forging plus extensive machining to achieve the final dimensions. The forging process has encountered some problems with the mechanical properties recurring in the steel.

**Solution** - A production process capable of producing a shaped casting.

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</table>
COMPONENT — BREECH MECHANISMS

(8236) TITLE — IMPROVED BURING TOOLS FOR BREECH RING LUGS

PROBLEM — PRESENT METHODS OF PRODUCING THE VARIOUS HOLES ON BREECH RINGS ARE TREPANNING, TWIST DRILLING, GUN DRILLING, AND FINISH BORING. PRODUCTION OF THESE HOLES IS A TIME CONSUMING AND COSTLY OPERATION.

SOLUTION — THE JOINT PROCESS OF EJECTOR DRILLING AND INDEXABLE CARBIDE INSERT HOLE DRILLING PROMISES TO REDUCE THE SEQUENCE STEPS NOW REQUIRED AND TO PROVIDE A FAIR MORE COST EFFECTIVE MEANS OF PRODUCING AN ACCEPTABLE HOLE.

(8339) TITLE — APPLIC OF NON-TRADITIONAL SURF. HARDENING METHODS

PROBLEM — PRESENT METHODS OF SURFACE HARDENING WEAPON COMPONENTS ARE COSTLY, TIME CONSUMING, AND MAY IMPART UNDESIREABLE RESIDUAL STRESSES.

SOLUTION — TO TRANSFORM THE SURFACE LAYER OF THE STEEL TO ALLOW MATERIAL TO BE UNIFORMALY QUENCHED. THE ADVANTAGES ARE LESS ENERGY USAGE, POLLUTION FREE, ALLOW HIGHER PRODUCTION RATES, AND MINIMAL POST-PROCESSING SUCH AS CLEANING AND STRAIGHTENING.

(8440) TITLE — CONTROLLED GRAIN SIZE CASTINGS, PRODUCTION AND HEAT TREAT

PROBLEM — FINE GRAIN CASTINGS HAVE DEMONSTRATED AN IMPROVEMENT IN LOW CYCLE FATIGUE LIFE BY A FACTOR OF TWO TO FOUR, IT IS EXPECTED THAT A HEAT TREATMENT WILL EXTEND THE LIFE STILL FURTHER.

SOLUTION — PROVIDE FOR CASTING A BREECH BLOCK BY ONE OF THE AVAILABLE TECHNIQUES THEN OPTIMIZE THE HEAT TREATMENT FOR THE CHOSEN ALLOY. LIFE IMPROVEMENTS WILL BE DEMONSTRATED.

COMPONENT — GENERAL

(7724) TITLE — GROUP TECHNOLOGY OF WEAPON SYSTEMS

PROBLEM — THERE IS A NEED TO REDUCE AND CONTROL THE PROLIFERATION OF PARTS AND DESIGNS FOR ITEMS MANUFACTURED AT WATERSLIEF ARSENAL.

SOLUTION — THE ARMY HAS PURCHASED A GROUP CLASSIFICATION AND CODING SOFTWARE PACKAGE. ONCE THIS SYSTEM IS IMPLEMENTED, IT SHOULD BE POSSIBLE TO REDUCE THE NUMBER OF DIFFERENT PARTS THRU STANDARDIZATION.

(8249) TITLE — SHORT-CYCLE HEAT TREATING OF WEAPON COMPONENTS

PROBLEM — HEAT TREATING SOAK TIMES ARE DETERMINED WITHOUT CONSIDERATION OF THE RELATIONSHIPS BETWEEN COMPOSITION, CONFIGURATION, THICKNESS, AND DETRIMENTAL EFFECTS OF AUSTENITIC GRAIN GROWTH. CONSEQUENTLY, CONSIDERABLE ENERGY IS WASTED.

SOLUTION — SUITABLE SYSTEMATIC PRODUCTION METHODS WILL BE USED TO DETERMINE THE PROPERTIES OBTAINED AT MINIMAL PROCESSING TIMES TO REDUCE ENERGY CONSUMPTION AND INCREASE PRODUCTION EFFICIENCY.
COMPONENT — GENERAL

(8323) TITLE — SPRAY- AND -FUSE PROCESSING OF ARMAMENT COMPONENTS

PROBLEM — MisMATCHED AND WORN WEAPON COMPONENTS ARE NOT ONLY COSTLY TO REPLACE BUT SHORTAGE OF STRATEGIC MATERIALS IMPACT ON THE SUPPLY AND FABRICATION OF NEW COMPONENTS.

SOLUTION — UTILIZE THE THERMAL SPARY AND FUSE COATING PROCESS TO SALVAGE OR RECLAIM OVERSIZED OR WORN WEAPON COMPONENTS (E.G., M140 RECOIL PISTONS).

(8326) TITLE — APPLICATION OF CORROSION RESISTANT GALVANIC COATINGS

PROBLEM — CURRENT METAL FINISHES DO NOT PROVIDE ADEQUATE CORROSION AND HEAT RESISTANCE. COMPONENTS ARE REPLACED OR RWORKED BEFORE THEIR INTENDED LIFE. FREQUENT MAINTENANCE IN THE FIELD AND DEPOTS ADD TO THE OVERALL COST OF THE COMPONENTS.

SOLUTION — A NEW PROCESS HAS EMERGED FOR APPLYING SUPERIOR CORROSION AND HEAT RESISTANT COATINGS. THE PROCESS, USING SERMIL-16, CONSISTS OF AN AUTOMATED SPRAY-BAKE PROCESS FOR A COATING OF ALUMINUM/ CERAMIC AND INORGANIC COATINGS.

(8426) TITLE — APPLICATION OF LASERS TO CANNON MANUFACTURE

PROBLEM — COMPONENT MARKINGS, TOOL MAINTENANCE, COMPONENT SURFACE HARDENING, CUT OFF OF INVESTMENT CAST COMPONENTS, WELDING AND BRAZING ARE DIFFICULT, COSTLY, TIME CONSUMING MANUFACTURING OPERATIONS.

SOLUTION — APPLY LASER TO THESE TRADITIONAL MANUFACTURING OPERATIONS TO TAKE ADVANTAGE OF THE RAPIDLY EMERGING TECHNOLOGY.

(8435) TITLE — SQUEEZE CASTING OF CANNON COMPONENTS

PROBLEM — PRESENT PROCESSES, SUCH AS HOT FORGING AND SAND CASTING REQUIRE CONSIDERABLE MACHING WITH ATTENDANT HIGH COSTS AND LOSS OF CRITICAL ALLOYS.

SOLUTION — INVESTIGATE THE APPLICATION OF SQUEEZE CASTING AS A CLOSE TO NET SHAPE TECHNOLOGY FOR MANUFACTURING BOTH MAJOR AND MINOR CANNON COMPONENTS.

(8437) TITLE — DENSIFICATION OF WEAPON CASTINGS (HIP)

PROBLEM — CASTINGS FOR WEAPONS COMPONENTS OFTEN CONTAIN EXCESSIVE SHRINKAGE CAVITIES AND VOIDS, RESULTING IN REJECTION OR COSTLY WELD REPAIR.

SOLUTION — INTERNAL Voids CAN BE MADE SMALLER OR ELIMINATED BY HOT ISOSTATIC PRESSING (HIP), THEREBY IMPROVING TOUGHNESS AND DUCTILITY.

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</table>
COMPONENT -- GUN MOUNTS

(8251) TITLE - IMPROVED MELTING AND POURING TECHNOLOGY

PROBLEM - THERE IS A HIGH REJECTION RATE FOR CASTING POURED AT RIA BECAUSE MODERN TECHNIQUES ARE NOT USED TO MEASURE AND CONTROL PROCESS PARAMETERS AND PURSITY.

SOLUTION - PROCEDURES TO MINIMIZE DISSOLVED GAS AND TO MORE ACCURATELY MEASURE GAS CONCENTRATIONS WILL BE ESTABLISHED. METHODS OF MEASURING TEMPERATURES AND COMPOSITIONS OF ATMOSPHERES IN FURNACES AT RIA WILL BE ESTABLISHED.

COMPONENT -- RECOIL MECHANISMS

(8239) TITLE - IMPROVED MACHINING PROCEDURES FOR RAILS

PROBLEM - CURRENTLY THE DOWETAL CONFIGURATION ON THE RAILS IS MILLED WITH A SERIES OF HIGH SPEED STEEL FORM MILLS. THESE MILLS REQUIRE A GREAT DEAL OF SHARPENING, AND THIS CHANGES THEIR SIZE THIS COMPOUNDING THE PROBLEM OF MAINTAINING ALIGNMENT.

SOLUTION - A 60 PERCENT REDUCTION IN MANUFACTURING TIME COULD BE REALIZED USING THE LATEST CONCEPTS IN MACHINE TOOLS. THESE INCLUDE CROSS AXIAL MOVEMENTS AND A METHOD OF HIGH SPEED MILLING USING INDEXABLE CARBIDE INSERTS.

(8250) TITLE - IMPROVED FABRICATION OF RECOIL WEAR SURFACES

PROBLEM - PRESENTLY GRINDING AND HONING OPERATIONS ON WEAR SURFACES RESULT IN PARTICLE INCLUSIONS WHICH COME IN CONTACT WITH HYDRAULIC AND PRODUCE HIGH WEAR RATES.

SOLUTION - USING ADVANCED METHODS REMOVE FOREIGN PARTICLES PRIOR TO THE FINAL GRINDING OR HONING OPERATIONS OR, IF MORE EFFECTIVE, AFTER FINAL GRINDING OR HONING.

(8422) TITLE - HONE FORMING OF RECOIL CYLINDERS

PROBLEM - REPLACEMENT OF SCARRED, WORN OR MISMACHINED RECOIL CYLINDERS ARE COSTLY AND TIME-CONSUMING IN TERMS OF LONG-LEAD TIMES FOR MATERIAL DELIVERY AND MACHINING. CYLINDER REPLACEMENT REQUIRES ADDITIONAL CONSUMPTION OF STRATEGIC MATERIALS.

SOLUTION - HONE FORMING IS A SIMULTANEOUS PROCESS WHERE HONING AND MATERIAL BUILDOUT BY ELECTROPLATING TAKE PLACE TO ACHIEVE THE DESIRED DIMENSION AND FINISH. COST SAVINGS CAN BE ACHIEVED WITH THE PROCESS FOR RECOIL CYLINDER MANUFACTURE AND RECLAMATION.
COMPONENT — RECOIL MECHANISMS

(8607) TITLE — AUTOMATED FLUSHING OF RECOIL SYSTEMS TO REDUCE CONTAMINATION

PROBLEM —INEFFECTIVE CLEANING OF MACHINED SURFACES CAUSES METALLIC CONTAMINATION OF THE HYDRAULIC FLUID AFTER THE RECOIL SYSTEM IS ASSEMBLED. SUCH CONTAMINANTS ARE DIFFICULT TO REMOVE WITH NORMAL FLUSHING PROCEDURES.

SOLUTION — ESTABLISH AN AUTOMATED FLUSHING SYSTEM INTEGRATING HIGH PRESSURE TO REMOVE METALLIC CONTAMINATION FROM THE HYDRAULIC FLUID. THIS WILL REDUCE THE NUMBER OF REJECTIONS OF ASSEMBLED RECOIL MECHANISMS AFTER MECHANICAL GYMNASIUM.

(8612) TITLE — ELECTROSLAG REMELTING FOR WEAPON COMPONENTS

PROBLEM — CYLINDRICAL STEEL CASTINGS USED IN RECOIL CYLINDERS ARE OFTEN REJECTED DURING MACHINING BECAUSE OF POROSITY OR INCLUSIONS. DURING QUENCH, FORGED CYLINDRICAL PARTS CRACK DUE TO THESE INTERNAL DEFECTS.

SOLUTION — CAST THESE COMPONENTS USING ESR TO ELIMINATE HOT TEARING AND SHRINKAGE AND REDUCE THE LIKELIHOOD OF CRACKING DURING QUENCHING. COMPONENTS MADE WITH THIS PROCESS WILL BE RELATIVELY INCLUSION-FREE.

COMPONENT — TUBES

(8024) TITLE — HIGH SPEED ABRASIVE BELT GRINDING

PROBLEM — SLIDE SURFACE DIAMETER AND FINISH IS PRESENTLY PRODUCED ON CYLINDRICAL GRINDING MACHINES USING ABRASIVE WHEELS. THE TIME IT TAKES FOR THIS OPERATION CAN BE SIGNIFICANTLY REDUCED.

SOLUTION — ABRASIVE BELT GRINDING DEPENDING ON ITS APPLICATION HAS METAL REMOVAL RATES WHICH CAN EXCEED MILLING OR GRINDING AT THE SAME TIME PRODUCING EXCELLENT TOLERANCES AND SURFACE FINISH.

(8050) TITLE — RECYCLING SPENT GUN TUBES BY ESR MELTING

PROBLEM — BECAUSE OF ANTICIPATED SHORTAGES IN THE AVAILABILITY OF CRITICAL ALLOYS, IT IS ADVANTAGEOUS TO UTILIZE SPENT GUN TUBES.

SOLUTION — TUBES WHICH CANNOT BE DIRECTLY ROTARY FORGED MIGHT BE REMELTED DIRECTLY BY ESR INTO INGOTS FOR USE ON THE ROTARY FORGE.

(8103) TITLE — HIGH VELOCITY MACHINING

PROBLEM — SPEED OF MACHINING CANNON TUBES IS LIMITED WITH CURRENT EQUIPMENT.

SOLUTION — EVALUATE HIGH SPEED METAL REMOVAL METHODS AND AVAILABLE EQUIPMENT. FUTURE YEARS FUNDING WILL PROVIDE FOR ACQUISITION AND TESTING OF NEW MACHINE AND PROCESS.
COMPONENT -- TUBES

(0106) TITLE -- LARGE CALIBER POWDER CHAMBER BORING

PROBLEM -- POWDER CHAMBERS PRODUCTION ON LARGE BORE CANNON, 6 IN M201, CURRENTLY REQUIRE 14 HOURS TO ACCOMPLISH BOTH ROUGH AND FINISH OPERATIONS.

SOLUTION -- PERFORM THE FINISHING OPERATION IN THE SAME SETUP AS THE ROUGHING OPERATION BUT USING AS A CUTTING MEDIA DIAMOND FINISHING TOOLS WHICH AT VERY HIGH SPEEDS PRODUCE EXCELLENT SURFACE FINISH. THIS PROCESS WOULD ELIMINATE ONE GRINDING OPERATION.

(0151) TITLE -- PORTABLE ENGRAVING SYSTEM

PROBLEM -- CURRENTLY THE COMPONENT IDENTIFICATION LEGEND IS STAMPED BY HAMMER AND INDIVIDUAL ALPHA-NUMERIC STAMPS. THIS IS A TIME CONSUMING PROCESS WITH NO DEPTH CONTROL AND CAN PRESENT A SAFETY HAZARD TO PERSONNEL.

SOLUTION -- PROVIDE A PROGRAMMABLE DATA ENGRAVING SYSTEM TO RELIEVE THE OPERATOR OF THE FATIGUE AND HAZARD OF HAND STAMPING. THIS WILL RESULT IN MORE UNIFORM SPACING AND DEPTH CONTROL AND REDUCE BOTH TIME AND COST.

(0241) TITLE -- COMPUTER APPLICATIONS TO BORE GUIDANCE

PROBLEM -- THE BORE GUIDANCE SYSTEM CONSISTS OF MANY INTERDEPENDENT ELEMENTS MAKING IT DIFFICULT AND TIME CONSUMING TO DIAGNOSE PROBLEMS. ALSO, TUBES WITH LARGE WALL VARIATIONS GREATLY INCREASE THE DIFFICULTY IN MAINTAINING CONTROL.

SOLUTION -- COMPUTER CONTROL WILL MAKE POSSIBLE FEATURES AS SELF TESTING, CHECKING, MONITORING, AND CALIBRATION IN CONTROL, TEST, AND MEASUREMENT SYSTEMS.

(0242) TITLE -- DUAL PRESS LOADING

PROBLEM -- ABOUT 20% PCF OF GUN TUBE FORGINGS REQUIRE STRAIGHTENING AT TEMPERATURES ABOVE 600° DEG F BECAUSE THE CRITERIA FOR 'COLD' STRAIGHTENING ARE RELATIVELY TIGHT. SINGLE LOADING INDUCES STRESSES THAT CREATE MACHINING PROBLEMS.

SOLUTION -- A TWO POINT LOADING DEVICE WILL BE DESIGNED WHICH WILL APPLY LOADS AT TWO POINTS, THUS REDUCING INDUCED STRESSES.

(0243) TITLE -- COMPUTER CONTROLLED CHROMIUM PLATING PROCESS

PROBLEM -- CHROMIUM PLATING OF CANNON BARRELS IS A COMPLICATED, MULTI-STAGE PROCESS WHICH IS MANUALLY CONTROLLED. MANUAL MANIPULATION OF VALVE STRESS, SWITCHES, ETC., IS SLOW, SOMETIMES HAZARDOUS, AND CAN RESULT IN DEGRADED DEPOSIT QUALITY DUE TO HUMAN ERROR.

SOLUTION -- THE CRITICAL STAGES OF THE CHROMIUM PLATING PROCESS WILL BE IDENTIFIED AND A PROGRAMMABLE CONTROLLER(S) DEVELOPED TO REDUCE TO NEAR ZERO THE MANIPULATION FUNCTIONS REQUIRED OF AN OPERATOR.
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<tr>
<th>COMPONENT — TUBES</th>
<th>TITLE — OPTIMIZATION OF HEAT TREAT</th>
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<tr>
<td>(8244)</td>
<td>PROBLEM - ROTARY FORGED TUBES ARE CURRENTLY HEAT TREATED BASED ON HISTORICAL DATA. IF THE INITIAL CYCLE DOES NOT RESULT IN ADEQUATE PROPERTIES ADDITIONAL CYCLES ARE PERFORMED UNTIL ACCEPTABLE PROPERTIES ARE ATTAINED.</td>
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<td>SOLUTION - INFORMATION ON EACH PREFORM TOGETHER WITH HISTORICAL DATA WILL BE USED TO DEVELOP A COMPUTER PROGRAM TO GENERATE HEAT TREAT PARAMETERS. THIS WILL GREATLY INCREASE THE PROBABILITY THAT THE REQUIRED PROPERTIES WILL BE OBTAINED ON THE FIRST CYCLE.</td>
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<td>(8245)</td>
<td>TITLE — LOW CONCENTRATION (LC) CHROMIUM PLATING</td>
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<td>PROBLEM - HIGH CONCENTRATION CHROMIUM COATING IS CURRENTLY USED TO RESIST EROSION IN GUN BORES. INHERENT PROPERTIES MAKE THE COATING SUSCEPTIBLE TO SHEARING AND FLAKING.</td>
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<td>SOLUTION - PLATING WITH LOW CONCENTRATION CHROMIUM WILL GIVE A MARKED INCREASE IN WEAR RESISTANCE DUE TO ITS SUPERIOR CHARACTERISTICS.</td>
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<td>(8246)</td>
<td>TITLE — IMPROVED FINISHING OF GAS CHECK SEATS</td>
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<td>PROBLEM - MACHINING OF GAS CHECK SEATS IS A PRECISION PROCESS INVOLVING GRINDING AND LAPPING OF A CRITICAL AREA OF THE CANNON WHICH RESULTS IN 3D TO 5D PERCENT REMARK TO PASS CONTACT GAGE REQUIREMENTS.</td>
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<td>SOLUTION - APPLY MORE PRECISE ALIGNMENT OF FINISHING EQUIPMENT AND ELIMINATE THE MACHINING FACILITY WHICH TENDS TO INDUCE ECCENTRICITY. THE GAUGING SYSTEM WILL ALSO BE REVIEWED.</td>
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<tr>
<td>(8259)</td>
<td>TITLE — MACH/MARKING OF FIRE CONTROL REGISTERS</td>
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<td>PROBLEM - DIFFICULTY IN MEASURING AND CORRECTLY MARKING THE FIRE CONTROL REGISTER, ON VARIOUS MID CALIBER WEAPON SYSTEMS, INDICATING COMPENSATION FOR MANUFACTURING VARIANCE DUE TO TOLERANCE ALLOWANCES.</td>
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<td>SOLUTION - PROVIDE AN ANALOG LEVELING MEASURING SYSTEM WHICH WILL PROVIDE INPUT DATA FOR A SERVOCONTROLLED JACKING SYSTEM TO POSITION LEVEL A TUBE AT THE MUZZLE END AND A MEASURING SYSTEM FOR THE VARIATIONS AT THE BREECH LEVELING SITE.</td>
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<td>(8341)</td>
<td>TITLE — HOLLOW CYLINDER CUT OFF MACHINE</td>
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<td>PROBLEM - ESTAB. CYL LENGTH IS DONE 1 OF 2 WAYS. PARTED OFF IN A LATHE AND FACED TO LENGTH OR SAWED OFF AND THEN SET UP IN A LATHE FOR FACING TO FINAL LENGTH DIMENSIONS. IN EITHER CASE, THE OPERATION REQUIRES DOUBLE HANDLING OR SLOW OPERATING PROCEDURES.</td>
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<td>SOLUTION - NEW TECHNOLOGY IS BEING DEVELOPED WHEREBY A SET OF ROTATING CUTTERS MILLS THE CYLINDER TO LENGTH PRODUCING A FACE SURFACE TO SATISFY OUR TUBE LENGTH REQUIREMENTS CURRENT MACH. DESIGN WILL NOT PERFORM THIS FUNCTION BUT THE TECHNOLOGY IS APPLICABLE.</td>
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COMPONENT -- TUBES

(0346) TITLE -- DEBURRING OF MERE EVACUATOR HOLES

PROBLEM -- AN INABILITY TO SUCCESSFULLY AND CONSISTENTLY PRODUCE A SMOOTH RADIUS TO THE INTERNAL OPENING OF THE MERE EVACUATOR HOLE OF THE 120MM HAS LED TO EARLY CHROMIUM FAILURE.

SOLUTION -- AN INTERNAL FIXTURE, ACTING AS A CARRIER FOR THE ANODE AND SOLUTION WILL BE DESIGNED AND FABRICATED. THE UNIT WILL BE CAPABLE OF DEBURRING THE INTERNAL AREA OF THE EVACUATOR HOLES BY USE OF ELECTRO-CHEMICAL POLISHING.

(0351) TITLE -- IMP MFG OF QUADRANT FLATS ? MUZZLE BRAKE

PROBLEM -- PRESENT METHODS OF MACHINING FLATS AND KEYWAYS REQUIRE TWO SET-UPS ON TWO SEPARATE MACHINE TOOLS WITH ATTENTUAL MATERIAL HANDLING REQUIREMENTS.

SOLUTION -- DESIGN A DUAL MACHINING SYSTEM CAPABLE OF MANUFACTURING BOTH THE KEYWAY AND THE LEVELING FLATS IN A SINGLE SET-UP, FABRICATE AND RETROFIT TO CURRENT EQUIPMENT.

(0352) TITLE -- SKIVING OF GUN TUBE BORES

PROBLEM -- INTERMEDIATE TUBE BORE HONING OPERATIONS FOR SURFACE FINISH AND SIZE CONTROL ARE A TIME CONSUMING, COSTLY METAL REMOVAL PROCESS. COUNTERBORING OPERATIONS PRIOR TO SWAGE AUTOPRETTAGE ARE ALSO SLOW, TIME CONSUMING, AND HIGH IN TOOLING COSTS.

SOLUTION -- THE APPLICATION OF RECENTLY DEVELOPED SKIVING TECHNOLOGY AND EQUIPMENT WILL ELIMINATE COSTLY ROUGH HONING COUNTERBORING OPERATIONS.

(0354) TITLE -- AUTO FLAME CUTTING OF HOT ROTARY FORGED TUBES

PROBLEM -- CUT OFF OF MUZZLE AND BREACH ENDS OF ROTARY FORGED FORGINGS IS A BOTTLE NECK OPERATION PRIOR TO HEAT TREATING.

SOLUTION -- AUTOMATIC FLAME CUTTING WILL ELIMINATE A BOTTLE NECK OPERATION AND REDUCE CUTTING TIME.

(0380) TITLE -- CARBON/CARBON COMPOSITE STIFFENED LARGE CALIBER GUN TUBES

PROBLEM -- REDUCED WEIGHT WITHOUT REDUCT OF ACCURACY. GRAPHITE FIBER REINFORCED COMPOSITES TUBE STIFFENERS CAN DECREASE WEIGHT AND IMPROVE ACCURACY, THE EPOXY MATRIX MATERIAL, CAN NOT SUSTAIN THE HIGH TEMPERATURE PRODUCED BY REPEATED RAPID FIRINGS.

SOLUTION -- CARBON/CARBON COMPOSITES ARE STABLE TO TEMPERATURE FAR IN EXCESS TO THAT OF STEEL. A NEW MATRIX PRECURSOR IMPPREGNATED REDUCES PROCESSING REQUIREMENTS SIGNIFICANTLY, thus MAKING CARBON/ CARBON COMPOSITES A COST COMPETITIVE MATERIAL.
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<td>TITLE -- AUTOMATED WELDING OF BORE EVACUATORS</td>
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<td>PROBLEM -- PRESENT PROCEDURE DOES NOT ENABLE WELDING BORE EVACUATORS INSIDE AND OUTSIDE SIMULTANEOUSLY. THUS ENERGY AND TIME ARE WASTED.</td>
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<td>SOLUTION -- EMPLOY SPECIAL EQUIPMENT AND PROCEDURES TO PERMIT COMBINING THESE OPERATIONS.</td>
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<td>TITLE -- IN PROCESS CONTROL OF SELAS HEAT TREAT SYSTEM (CAM)</td>
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<td>PROBLEM -- AS GUN TUBES ARE HEAT TREATED THE ACTUAL WORKPIECE TEMPERATURE IS NOT KNOWN UNTIL THE PIECE EXITS THE FURNACE. EXCESSIVE FORGING TEMPERATURES CAN DEGRADE MECHANICAL PROPERTIES.</td>
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<td>SOLUTION -- AUTOMATICALLY CONTROL FURNACE TEMPERATURES BY MONITORING THE ACTUAL WORKPIECE TEMPERATURE, AND FEEDING THIS DATA TO MICROPROCESSORS.</td>
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<td>TITLE -- IMPROVED RIFLING PROCEDURES</td>
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<td>PROBLEM -- RIFLING HEADS USED TO HOLD BROACH CUTTERS IN THE RIFLING OPERATION ARE SUBJECT TO EXCESSIVE WEAR, NECESSITATING SIGNIFICANT MAINTENANCE AND REPAIR EXPENDITURE.</td>
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<td>SOLUTION -- DESIGN A NEW RIFLING HEAD THAT IS NOT SUBJECT TO WEAR, THEREBY ELIMINATING MAINTENANCE AND REPAIR EXPENDITURE ASSOCIATED WITH WORN RIFLING HEADS.</td>
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<td>TITLE -- IMPROVED CUTTING OF CHARPY AND TENSILE BLANKS</td>
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<td>PROBLEM -- CANNON TUBE TEST SPECIMEN BLANKS ARE SAWED MANUALLY. THIS METHOD IS TIME CONSUMING AND OFTEN RESULTS IN BLANKS THAT ARE OVERTIZED AND REQUIRE ADDITIONAL MACHINING OPERATIONS.</td>
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<td>SOLUTION -- ADAPT HIGH SPEED CUTTING PROCEDURES AND AUTOMATED HANDLING TECHNIQUES IN ORDER TO DECREASE MACHINING TIME AND ELIMINATE SUBSEQUENT MACHINING OPERATIONS.</td>
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<td></td>
<td>TITLE -- OPTIMAL RIFLING CONFIGURATION FOR CHROME PLATING</td>
<td>228 180</td>
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<td>PROBLEM -- EARLY FAILURE OF CHROMIUM COATINGS IN GUN TUBES OCCURS AT THE SHARP CORNERS OF THE LAND RUN-UP. PRESENTLY NO EFFECTIVE METHOD OR TOOL IS AVAILABLE TO ELIMINATE THIS CONDITION.</td>
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<td>SOLUTION -- DEVELOP A METHOD AND APPROPRIATE TOOLING TO ALTER THE RIFLING PROFILE OF GUN TUBES.</td>
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</table>
(8473) TITLE - APPL FUSED SALT PROCESS TO COAT TANTALUM ON L CAL LINERS

PROBLEM - PRESENTLY NO FULL SCALE PRODUCTION CAPABILITY EXISTS AT WATERVLIET ARSENAL TO APPLY TANTALUM TO THE I. D. OF LARGE LINERS. THESE COATINGS MUST BE DEPOSITED FROM A FUSED SALT BATH.

SOLUTION - ESTABLISH THE CAPABILITY TO COAT LARGE CALIBER LINERS ON A PRODUCTION BASIS.

(8474) TITLE - APPL OF PARTIAL REFRACTORY LINERS TO CANNON TUBES

PROBLEM - FUTURE CANNON TUBES WILL BE SUBJECTED TO HIGHER TEMPERATURE, PRESSURE AND VELOCITY. TUBES AS NOW DESIGNED WILL WEAR OUT MUCH FASTER. PROTOTYPE EQUIPMENT TO INSTALL ADVANCED TECHNOLOGY LINERS IN TUBES NOW EXISTS.

SOLUTION - MODIFY THE EXISTING PROTOTYPE FACILITY TO HANDLE ALL CURRENT AND FORESEEABLE PRODUCTION TUBES. INSTALL ADVANCED TECHNOLOGY LINERS USING THIS EQUIPMENT.

(8621) TITLE - SPRAY ROLLING FOR TUBE MANUFACTURE

* CATEGORY *

* QUALITY CONTROL/TESTING *

COMPONENT — FIRE CONTROL

(8561) TITLE - DIGITAL IMAGE DIAGNOSTIC TECHNIQUES

PROBLEM - NU PROBLEM PROVIDED BY ARADCOM.

SOLUTION - NO SOLUTION PROVIDED BY ARADCOM.

COMPONENT — GUN SYSTEMS

(8370) TITLE - AUTOMATED INSPECTION OF WEAPONS COMPONENTS

PROBLEM - FOR BARREL MFG, CURRENT HAND GAGED INSPECTION IS A MAJOR TIME FACTOR. BARREL STRAIGHTENING IS ALSO DONE MANUALLY AS MANY AS 13 TIMES DURING THE MFG CYCLE. NEW DNC EQUIP BEING PROCURED VIA PIF 68X7986 REQUIRES CENTRAL CONTROL.

SOLUTION - AUTOMATE, TO MAX FEASIBLE DEGREE, INSPECTION OPERATIONS. USING LASER TECHNOLOGY, EQUIP A STRAIGHTENING PRESS WITH FEEDBACK CONTROL TO SELECT LOCATION FOR APPLICATION OF BENDING FORCES. CONTROL ALL DNC EQUIPMENT WITH A CNC MASTER UNIT.
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<th>COMPONENT — GUN SYSTEMS (CONTINUED)</th>
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<td>(B415) TITLE — ROBOTIC EMPLACEMENT DEVICE FOR INSPECTION BY X-RAY (REDIX)</td>
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<td>PROBLEM — RADIOGRAPHIC INSPECTION IS USED EXTENSIVELY TO ASSURE THE QUALITY OF HOWITZER CARRIAGES DURING MFG. TO OBTAIN SATISFACTORY X-RAYS ALIGNMENT IS CRITICAL USING THE PRESENT METHOD CONSISTENCY OF EXPOSURE IS IMPOSSIBLE.</td>
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<tr>
<td>SOLUTION — REPLACE THE MANUAL RADIOGRAPHIC POSITIONING WITH AN AUTOMATED ROBOTIC DEVICE CAPABLE OF PRECISELY ALIGNING WELDMENTS AND CASTING</td>
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<td>(B434) TITLE — EDDY CURRENT INSPECTION OF GUN TUBES</td>
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<td>PROBLEM — THE CURRENT GUN TUBE PRODUCTION ID INSPECTION TECHNIQUES, ADRSPELSCOPE AND MAGNETIC PARTICLE, ARE SLOW AND SUBJECT OPERATOR ERROR. THESE TECHNIQUES DO NOT HAVE THE CAPABILITY TO PRODUCE PERMANENT RECORDS OF FLAW LOCATIONS.</td>
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<td>SOLUTION — DEVELOP A EDDY CURRENT INSPECTION SYSTEM HAS THE CAPABILITY TO DETECT AND PERMANENTLY RECORD SURFACE CRACKS UP .010 INCHES DEEP DURING THE MACHINING PROCESS. THIS TECHNIQUE WILL ADD ONLY ONE MINUTE TO THE MACHINING PROCESS</td>
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<td>(B436) TITLE — QUENCH CYCLE PROFILE MEASUREMENT SYSTEM</td>
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<td>PROBLEM — THE QUENCH CYCLE DURING HEAT TREAT PLAYS AN IMPORTANT PART IN THE QUALITY OF GUN TUBE FORCINGS. QUENCH CRACKS HAVE BEEN OCCURRING IN THE NURSE END OF 105MM ROTARY FORGED GUN TUBES. THE CURRENT QUENCH CYCLE HAS LITTLE OR NO CONTROL.</td>
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<tr>
<td>SOLUTION — DEVELOP A NONCONTACT EDDY CURRENT AND/OR NONCONTACT EMAT(ELECTROMAGNETIC ACoustical TRANSMISSION) ULTRASONIC SYSTEM TO PROVIDE QUENCH CYCLE TEMPERATURE TIME TRANSFORMATION INFORMATION ON REAL TIME BASIS.</td>
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<td>(B253) TITLE — MACHINE TOOL DYNAMIC MEASUREMENTS AND DIAGNOSTICS</td>
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<td>PROBLEM — VIBRATIONS IN MACHINE TOOLS CAN CAUSE POOR MACHINING OPERATIONS AND BREAKDOWNS. IT IS ESSENTIAL TO RAPIDLY DETERMINE BOTH THE CAUSE OF THE CHATTER AND MACHINE TOOL PROBLEMS BEFORE THEY CAUSE A FAILURE.</td>
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<tr>
<td>SOLUTION — A MEASUREMENT INSTRUMENT IS NEEDED TO ANALYZE ITS VIBRATIONS AND NOTIFY PERSONNEL WHAT CORRECTIVE ACTION IS NECESSARY, I.E., MACHINE SPINDLE AND PULLEY SHOULD BE BALANCED.</td>
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</table>
COMPONENT — TUBES

(8473) TITLE - APPL FUSED SALT PROCESS TO COAT TANTALUM ON L. CAL LINERS

PROBLEM — PRESENTLY NO FULL SCALE PRODUCTION CAPABILITY EXISTS AT WATERTIET ARSENAL TO APPLY TANTALUM TO THE I. D. OF LARGE LINERS. THESE COATINGS MUST BE DEPOSITED FROM A FUSED SALT BATH.

SOLUTION — ESTABLISH THE CAPABILITY TO COAT LARGE CALIBER LINERS ON A PRODUCTION BASIS.

(8474) TITLE - APPL OF PARTIAL REFRUCTORY LINERS TO CANNON TUBES

PROBLEM — FUTURE CANNON TUBES WILL BE SUBJECTED TO HIGHER TEMPERATURE, PRESSURE AND VELOCITY. TUBES AS NOW DESIGNED WILL WEAR OUT MUCH FASTER.

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SOLUTION — MODIFY THE EXISTING PROTOTYPAL FACILITY TO HANDLE ALL CURRENT AND FORESEEN PRODUCTION TUBES. INSTALL ADVANCED TECHNOLOGY LINERS USING THIS EQUIPMENT.

(8621) TITLE — SPRAY ROLLING FOR TUBE MANUFACTURE

***************
* CATEGORY *
***************
* QUALITY CONTROL/TESTING *
***************

COMPONENT — FIRE CONTROL

(8561) TITLE — DIGITAL IMAGE DIAGNOSTIC TECHNIQUES

PROBLEM — NO PROBLEM PROVIDED BY ARRAFACOM.

SOLUTION — NO SOLUTION PROVIDED BY ARRAFACOM.

COMPONENT — GUN SYSTEMS

(8370) TITLE — AUTOMATED INSPECTION OF WEAPONS COMPONENTS

PROBLEM — FOR BARREL NG, CURRENT HAND GAGED INSPECTION IS A MAJOR TIME FACTOR. BARREL STRAIGHTENING IS ALSO DONE MANUALLY AS MANY AS 13 TIMES DURING THE MFG CYCLE. NEW D. C. MACHINING BEING PRODUCED VIA PIF 66X7986 REQUIRES CENTRAL CONTROL.

SOLUTION — AUTOMATE, TO MAX FEASIBLE DEGREE, INSPECTION OPERATIONS. USING LASER TECHNOLOGY, EQUIP A STRAIGHTENING PRESS WITH FEEDBACK CONTROL TO SELECT LOCATION FOR APPLICATION OF BENDING FORCES. CONTROL ALL D. C. MACHINING WITH A CNC MASTER UNIT.
## COMPONENT -- GUN SYSTEMS

### (8415) TITLE - ROBOTIC EMPLACEMENT DEVICE FOR INSPECTION BY X-RAY (REDIX)

**Problem** - Radiographic inspection is used extensively to assure the quality of gun tube forgings. To obtain satisfactory X-ray alignment is critical. Using the present method consistency of exposure is impossible.

**Solution** - Replace the manual radiographic positioning with an automated robotic device capable of precisely aligning weldments and casting.

### (8434) TITLE - EDDY CURRENT INSPECTION OF GUN TUBES

**Problem** - The current gun tube production and inspection techniques, borescope and magnetic particle, are slow and subject operator error. These techniques do not have the capability to produce permanent records of flaw locations.

**Solution** - Develop a eddy current inspection system has the capability to detect and permanently record surface cracks of .001 inches deep during the machining process. This technique will add only one minute to the machining process.

### (8436) TITLE - QUENCH CYCLE PROFILE MEASUREMENT SYSTEM

**Problem** - The quench cycle during heat treat plays an important part in the quality of gun tube forgings. Quench cracks have been occurring in the muzzle end of 105MM ROTARY FORGED GUN TUBES. The current quench cycle has little or no control.

**Solution** - Develop a noncontact eddy current and/or noncontact electromagnetic acoustic transmission ultrasonic system to provide quench cycle temperature time transformation information on real time basis.

## COMPONENT -- MISCELLANEOUS

### (8253) TITLE - MACHINE TOOL DYNAMIC MEASUREMENTS AND DIAGNOSTICS

**Problem** - Vibrations in machine tools can cause poor machining operations and breakdowns. It is essential to rapidly determine both the cause of the chatter and machine tool problems before they cause a failure.

**Solution** - A measurement instrument is needed to analyze its vibrations and notify personnel what corrective action is necessary, i.e., machine spindle and pulley should be balanced.

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**FUNDING ($)**

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**CATEGORY**

- SMALL CALIBER
component — barrels

(7955) Title - small arms weapons new process production technology

Problem - gun barrel mfg procedures reflect antiquated technology and rely on mass removal of material by conventional machining methods. current equip represents 1940-50 technology. new materials compound the problem.

Solution - reduce to practice new techniques for cal 50 to 40mm barrels by establishing the technology and process equipment required to bridge gap between capabilities and requirements.

(8266) Title - investment cast liners of substitute alloys

Problem - an alternate investment-cast gun tube liner material is required to serve as a backup and/or replacement for the current strategic cobalt-base investment cast alloy.

Solution - establish vacuum melting and casting capabilities for the investment casting of gun tube liners.

(8524) Title - refractory metal coating for gun tubes

Problem - there is a need to provide improved rapid fire gun tubes, and a need to replace liner materials made of cobalt and its alloys (a critical strategic material).

Solution - develop and optimize the process variables of the refractory metal coatings and the application procedures of these coatings on gun barrel liners.

(8533) Title - technology for erosion resistant coating for gun barrels

Problem - gun barrels suffer erosion at the breech end of the weapon. ceramics or refractory metals may off-set erosion but the problem of lining the barrel with these materials has not been resolved on full scale weapons.

Solution - demonstrate the application of coatings and/or liners on small and large cal barrels. a ceramic (perhaps titanium diboride) would be best in small barrels whereas a refractory metal (perhaps columbium) would be best suited for large barrels.

(8536) Title - molybdenum alloy gun barrel liners

Problem - methods for processing molybdenum alloy are being studied so that its unique properties can be used for sustained rapid fire weapons. it will be necessary to establish and apply the methods on an adequate scale.

Solution - the applicability of one or more methods (hot isostatic pressing, extrusion, injection molding, etc) will be demonstrated. specifications for materials and processes will be established.
COMPONENT --- COMPONENTS

(0471) TITLE - SQUEEZE CASTING OF SMALL CAL WEAPONS

PROBLEM - NO PROBLEM PROVIDED BY ARRACOM.
SOLUTION - NO SOLUTION PROVIDED BY ARRACOM.

COMPONENT --- GENERAL

(0324) TITLE - PROCESS CONTROLS FOR P/M WEAPONS COMPONENTS

PROBLEM - PRESENT METHODS OF PRODUCING WEAPON COMPONENTS IS MAINLY BY
     MACHINING FROM BARTHED STOCK. THIS IS A HIGH COST METHOD WHICH PRODUCES MUCH
     ALLOY STEEL SCRAP.
SOLUTION - FORGE PARTS FROM P/M STEEL FOR SAVINGS AND INCREASED DURABILITY AND
     REDUCED USE OF ALLOY STEEL.

(0468) TITLE - IMPR MFG PLUS HANDLING TECHNIQUES FOR SMALL CAL WEAPONS

PROBLEM - CURRENT MANUAL MATERIALS HANDLING AND ASSEMBLY TECHNIQUES CAUSE
     NON-OPTIMAL MACHINE UTILIZATION AND HIGH LABOR COSTS.
SOLUTION - DEMONSTRATE THE APPLICATION OF A MODIFIED GENERAL PURPOSE
     INDUSTRIAL ROBOT IN A PRODUCTION ENVIRONMENT FOR MATERIALS HANDLING,
     DEMONSTRATE THE APPLICATION OF A FLEXIBLY PROGRAMMED ASSEMBLY MACHINE FOR
     SMALL WEAPONS COMPONENTS.

(0525) TITLE - GROUP TECHNOLOGY FOR S/C COMPONENT

PROBLEM - PRIOR YEAR ICM RELATED MMT PROJECTS DEVELOPED PROCESS PLANNING AND
     PAST CLASSIFICATION SOFTWARE. HOWEVER NO DATA BASE HAS BEEN ASSEMBLED TO
     PERMIT THE SELECTION OF AN OPTIMUM PROCESS FOR A GIVEN PART OR ESTIMATING
     COSTS RELATED TO SUCH A PROCESS.
SOLUTION - A DATA BASE WILL BE DEVELOPED FOR FAMILIES OF MAJOR SMALL CALIBER
     5.56MM -40MM WEAPONS COMPONENTS USING SOFTWARE ALREADY IN USE IN OTHER
     AREAS. DATA ON NEW PRODUCT CONFIGURATIONS WILL BE PROGRAMMED AND PROCESS
     PLANNING SYSTEMS EXERCISED.

(0526) TITLE - PROCESSING OF HIGH STRENGTH/LIGHT WEIGHT WEAPONS COMPONENTS

PROBLEM - UTILIZATION OF METAL MATRIX TECHNOLOGY WILL DEPEND ON THE
     DEVELOPMENT OF A MFG BASE FOR THE ECONOMICAL FABRICATION OF HETEROGENEOUS
     MATERIALS. BY 1985, MATERIAL SYSTEMS AND PROCESSING/PROPERTY RMTS WILL HAVE
     BEEN IDENTIFIED.
SOLUTION - DEFINE MATERIAL COMBINATIONS/PROPERTIES AND PROCESSING. Prototype
     FABRICATE COMPONENTS BY MORE ONE CONTRACTOR. EVALUATE THE MATERIAL BY
     RIGOROUS LAB TESTING AND IDENTIFY INSPECTION PROCEDURES.
(8528) TITLE - FABRICATION OF COMPOSITE WEAPON COMPONENTS

PROBLEM - CONVENTIONAL WEAR RESISTANCE SURFACE COATINGS ARE APPLIED BY ELECTROPLATING AND ARE OFTEN BRITTLE, HAVE VARIABLE COMPOSITION AND STRUCTURE AND ARE LIMITED IN APPLICATION BY GEOMETRICAL CONSTRAINTS.

SOLUTION - EXTEND THE USE OF MULTI-LAYER MATERIALS (COPPER ALLOY/STEEL) PRODUCED BY THE P/M PROCESS WHICH ARE CURRENTLY BEING USED FOR BEARINGS TO FORM WEAR AND EROSION RESISTANT LAYERS.

(8530) TITLE - LIGHTWEIGHT P/M WEAPON COMPONENTS

PROBLEM - MODERN WEAPONS REQUIRE THAT MATERIALS HAVE A HIGH SPECIFIC STRENGTH (STRENGTH TO DENSITY RATIO) IN ORDER TO REDUCE THEIR WEIGHT.

SOLUTION - THE AF AND NAVY HAVE DEVELOPED METAL MATRIX COMPOSITE MATERIALS THAT HAVE HIGHER SPECIFIC STRENGTHS THAN STEEL OR ALUMINUM ALLOYS. DEVELOP THE PROCESSING PARAMETERS FOR PRODUCING THESE MATERIALS INTO WEAPON COMPONENTS.

(8662) TITLE - FABRICATION OF P/M WEAPON COMPONENTS

PROBLEM - THE ARMY HAS BEEN SLOW TO TAKE ADVANTAGE OF THE POWDER METALLURGY PROCESS DUE TO THE LOW CORRELATION BETWEEN WROUGHT AND P/M STEELS AND THE RESULTING CONFUSION CAUSED IN PROCUREMENT WHEN A P/M PART IS SPECIFIED AS AN ALTERNATE TO A WROUGHT PART.

SOLUTION - DEVELOP MILITARY PROCESS SPECS FOR HIGH DENSITY AND COPPER INFILTRATED STEELS TO PERMIT INTERCHANGEABILITY BETWEEN WROUGHT AND P/M WEAPON COMPONENTS, THUS AVOIDING THE NEED TO CHANGE THE DRAWING OR TDP FOR EACH COMPONENT.

COMPONENT -- MISCELLANEOUS

(8670) TITLE - PROCESS CONTROL IMPROVEMENT IN SMALL CAL WEAPON FAB

COMPONENT -- SPRINGS

(8267) TITLE - STRESS PEENING OF HELICAL COMPRESSION SPRING

PROBLEM - THE FATIGUE LIFE AND RELIABILITY OF CRITICAL SPRINGS IN SOME WEAPON SYSTEMS IS LESS THAN DESIRABLE.

SOLUTION - IMPROVE THE FATIGUE LIFE AND RELIABILITY OF THE WEAPON SPRINGS BY OPTIMIZING THE PRODUCTION PROCESS PARAMETERS SUCH AS SHOT SIZE, SHOT INTENSITY, AND SPRING STRESS LEVEL.
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<thead>
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<th>CATEGORY</th>
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<td>Airframe</td>
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<td>Turbine Engine</td>
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US ARMY AVIATION RESEARCH AND DEVELOPMENT COMMAND

(AVRADCOM)

The US Army Aviation Research and Development Command (AVRADCOM), with headquarters at St. Louis, MO, is responsible for Army aviation research, development, product improvement, acquisition of assigned materiel, initial procurement, and production. The Command directs the Research and Technology Laboratories with headquarters at NASA - Ames Research Center, Moffett Field, CA; US Army Avionics Agency and Laboratory, Fort Monmouth, NJ; Applied Technology Laboratory at Ft. Eustis, VA; US Army Bell Plant Activity, Fort Worth, TX; and the US Army Hughes Plant Activity, Culver City, CA. Three project managers, Aircraft Survivability Equipment, CH-47 Modernization Program, and Navigation/Control Systems, are located at AVRADCOM. PM Advanced Attack Helicopter (AAH) and PM Blackhawk are located at AVRADCOM, but are under the direct control of HQ, DARCOM.

The overall emphasis of the Army's aviation MMT program is to perfect technologies which have a good probability of implementation and high potential benefits. For the most part, efforts are directed towards projects which offer both cost reductions and product improvements. The results of these projects will be made available to other Government agencies and to Industry.

The most important criteria of aircraft materials are strength and low weight. A large part of the aviation MMT program is dedicated to establishing processes to replace metals with materials which have better strength to weight ratios. Composite materials suitable for aviation have been developed and are being used; however, techniques for the production and application of composites need further development to achieve increased use.

The use of composite materials in Army aircraft is anticipated to increase as a result of current work in R&D and MT leading to an all-composite helicopter fuselage. Raw material costs are expected to decrease with the increased use of composites in DOD and Industry. Also, as confidence in the use of composites increases, reservations held by the design and (quality control groups) will diminish, and composites will be incorporated in the earliest stages of weapon development. This will result in increases in MMT work.

Composite projects are planned for virtually every part of the helicopter. Several projects are planned in the airframe area. One will establish manufacturing methods for application of composites to a main fuselage primary structure (the rear fuselage of the Blackhawk). A project planned in the rotor area will establish a manufacturing process for the main rotor blade of the Blackhawk. In the drive area, one project will focus on the drive shaft and another will result in methods for manufacturing a gearbox housing.
Several projects will attack technical problem areas that affect all composite manufacturing. These projects address automation of cutting and layup operations, and improvements in machining, fastening, and new materials. The development of automated techniques will be pursued in cooperation with the Air Force, the lead service in this area.

Perhaps the most significant project areas in terms of advancing composites manufacturing and usage is in the development of improved and new quality control techniques. Projects planned in this area will address materials characterization, in-process controls, and non-destructive evaluation. These projects will ensure optimum processing and material performance, which will increase confidence in composites.

There are many areas in aircraft in which metals can not be replaced. Projects have been submitted to improve production of these items. Since many aircraft metals used in the propulsion system are tough and expensive, machining to final shape is difficult and produces costly scrap. Improving powder metal technology will provide components much closer to final shape, greatly reducing the time and effort to produce the final product. Several projects are included to implement recent advances in gear manufacturing and should provide an improved item at a lower cost. Projects are also planned to find ways of repairing rather than scrapping complex items which are damaged in the manufacturing process. An effort is planned to replace metal turbine blades with ceramic blades. This will provide better operating characteristics at lower cost.
### AVRADCOM

**COMMAND FUNDING SUMMARY (THOUSANDS)**

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## MMT Five Year Plan

### Category: Airframe

### Component — Fuselage Structures

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<td>COMPOSITE REAR FUSELAGE MANUFACTURING TECHNOLOGY</td>
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<td>7387</td>
<td>LOW COST RADAR CAMOUFLAGE AIRFRAME MATERIAL</td>
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### Component — General

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<td>7001</td>
<td>MFG TECHNOLOGY FOR AIRFRAME AND SECONDARY STRUCTURES</td>
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<td>PROD OF Ti62 COATED LONG LIFE TOOLS</td>
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<td>7456</td>
<td>LOW COST TOOLING FOR AIRFRAME AND ROTOR COMPONENTS</td>
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COMPONENT — MISC COMPONENTS

(7396) TITLE - INTEGRAL LOW COST FASTENING SYSTEMS FOR RPV'S

PROBLEM - JOINING OF COMPONENTS IN RPV SYSTEMS IS ACCOMPLISHED BY THE TRADITIONAL SCREW, NUT, AND BOLT METHODS. UTILIZATION OF THESE METHODS ADD HIGH FABRICATION AND ASSEMBLY COST AND WEIGHT TO THE SYSTEM.

SOLUTION - THIS PROJECT WILL DEVELOP THE TECHNOLOGY FOR UTILIZATION AND INTEGRATION OF PLASTIC FASTENERS, SNAP LATCHES, AND OTHER LOW COST MANUFACTURE AND ASSEMBLY TECHNIQUES INTO THE PRODUCTION OF RPV SYSTEMS.

COMPONENT — SECONDARY STRUCTURES

(7183) TITLE - SEMI-AUTO COMPOSITE MFG SYS FOR FUSELAGE SEC STRUCT

PROBLEM - HELICOPTER FUSELAGE STRUCTURES HAVE HIGH MANUFACTURING COST DUE TO HIGH PART COUNT AND HIGH ASSEMBLY COSTS. METHODS OF COMPOSITE FABRICATION HAVE BEEN INVESTIGATED BUT HAND OPERATIONS RESULT IN HIGH LABOR COSTS.

SOLUTION - USE EQUIPMENT AND TECHNIQUES DEVELOPED BY INDUSTRY IN SUPPORT OF AIR FORCE COMPOSITE COMPONENT PROGRAMS. THE SELECTED SYSTEM WILL BE UPDATED AND MODIFIED TO ACCOMODATE HELICOPTER COMPONENTS WHICH ARE MORE COMPLEX AND HAVE MORE CURVATURE THAN AF COMP.

(7344) TITLE - RIM MOLDING OF LOW COST SECONDARY STRUCTURES

PROBLEM - PRESENT METHODS OF FABRICATING AIRCRAFT SECONDARY STRUCTURES (ESPECIALLY ACCESS DOORS) INVOLVE EXCESSIVE LABOR AND EXPENSIVE MATERIALS. STRUCTURES MADE FROM FIBER REINFORCED SANDWICH PANELS AND/OR FORMED SHEET METAL OFTEN REQUIRE COMPLEX ASSEMBLY.

SOLUTION - ESTABLISH A PROCESS TO PRODUCE THESE SECONDARY STRUCTURES FROM REACTION INJECTED MOLDED (RIM) URETHANES. RIM IS A LOW PRESSURE MOLDING TECHNIQUE WHICH CAN USE LOW COST COMPOSITE MOLDS TO GIVE EXTREMELY COST EFFECTIVE STRUCTURES.

(7385) TITLE - COMPOSITE ENGINE INLET

PROBLEM - MOLDING COMPOSITES TO SHAPES SUCH AS THAT OF THE BLACK HAWK INLET IN PRODUCTION HAS NOT BEEN DEMONSTRATED.

SOLUTION - ESTABLISH A PRODUCT-- MOLDING PROCESS FOR MANUFACTURING AN INLET COMPOSED OF ALUMINIZED GLASS FIBERS IN A POLYAMIDE MATRIX.

(7390) TITLE - FIBER REINFORCED THERMOPLASTIC STRUCTURE

PROBLEM - HELICOPTER SECONDARY AIRFRAME STRUCTURES ARE EXPENSIVE AND A FREQUENT CAUSE OF DOWNTIME. THE CONTINUAL REPAIR AND REPLACEMENT OF THESE ITEMS IS A MAJOR AIRFRAME OPERATIONAL COST FACTOR.

SOLUTION - ESTABLISH A MANUFACTURING METHOD TO INCORPORATE HIGH STRENGTH AND HIGH MODULUS FIBERS INTO THERMOPLASTIC FOR HELICOPTER STRUCTURES.
COMPONENT -- STRUCTURAL MEMBERS

(7193) TITLE - ADV FILAMENT WIND FOR AIRCRAFT COMPONENTS

PROBLEM - CURRENT COMMERCIAL PRACTICES ON FILAMENT WINDING ARE EXPENSIVE.

SOLUTION - A NUMBER OF RECENT DEVELOPMENTS IN FILAMENT WINDING TECHNOLOGY ORIGINATING IN THE U.S., DENMARK, AND HUNGARY SHOW PROMISE OF EXPANDING THE FLEXIBILITY OF THE FILAMENT WINDING PROCESS.

(7342) TITLE - PULTRUSION OF HONEYCOMB SANDWICH STRUCTURES

PROBLEM - FABRICATION OF HONEYCOMB SANDWICH PANELS IS LABOR INTENSIVE AND FACE-TO-CORE BONDING OFTEN TAKES TWO CURE OPERATIONS. PULTRUSION CAN BE USED FOR CONTINUOUS PRODUCTION BUT COMMERCIAL PARAMETERS AND TOOLING ARE NOT SUITABLE FOR MILITARY USE.

SOLUTION - ESTABLISH TECHNOLOGY NECESSARY FOR PRODUCTION PULTRUSION OF SANDWICH STRUCTURES, INCLUDING BEAMS, FOR USE IN COMPOSITE AIRFRAMES. PARAMETERS WILL BE GENERATED AND OPTIMIZED FOR PULTRUSING MILITARY QUALITY FLOORING.

(7373) TITLE - SAND PUNCH SPF OF TITANIUM

PROBLEM - MANY AIRFRAME PARTS CONSIST OF MULTIPLE DETAILS RIVETED OR SPOT-WELDED TOGETHER THAT INCREASE THE FORMING CYCLE, TOOLING COSTS, AND LABOR. ALSO MANY PART CONTOURS ARE IMPOSSIBLE TO FORM BY CONVENTIONAL METHODS.

SOLUTION - THIS PROJECT WILL DEVELOP A 'SAND PUNCH' METHOD OF SUPERPLASTICALLY FORMING TITANIUM ALLOYS AS A PRACTICAL, ECONOMICAL PRODUCTION METHOD.

(7374) TITLE - BI-MATRIX CARBON-CARBON STRUCTURAL COMPONENTS

PROBLEM - RECENT ADVANCES IN THE DEVELOPMENT OF LASER WEAPONS HAVE REAPPRAISED THE TIMING FOR THE INTRODUCTION OF LASER TACTICAL WEAPONS.

SOLUTION - THIS PROJECT WILL DEVELOP THE MANUFACTURING TECHNOLOGY NECESSARY FOR PRODUCTION AND RETROFIT OF BI-MATRIX CARBON-CARBON STRUCTURAL COMPONENTS. BI-MATRIX C-C IS A HIGH STRENGTH LIGHTWEIGHT INTEGRAL HIGH ENERGY LASER PROTECTIVE BARRIER SYSTEM.

(7389) TITLE - SUPERPLASTIC FORMING OF ALUMINIUM COMPONENTS

PROBLEM - CURRENT METHODS OF MACHINING ALUMINIUM FORGINGS ARE EXPENSIVE AND REQUIRE AN EXCESSIVE NUMBER OF PARTS.

SOLUTION - ESTABLISH FABRICATION TECHNOLOGY NECESSARY TO MANUFACTURE ALUMINIUM AIRFRAME COMPONENTS THROUGH THE APPLICATION OF SUPERPLASTIC FORMING OF ALUMINIUM ALLOY SHEET MATERIAL.
COMPONENT -- STRUCTURAL MEMBERS

(7414) TITLE - JOINING OF REIN THERMOPLASTIC COMPOSITE STRUCT

PROBLEM - UTILIZATION OF FIBER REINFORCED THERMOPLASTIC RESIN SYSTEMS TO FORM STRUCTURAL ELEMENTS CURRENTLY ARE JOINED BY ADHESIVE BONDING WHICH TAKES HOURS TO CURE.

SOLUTION - USE LOW COST DIRECT MATERIAL JOINING METHODS SUCH AS ULTRASONIC SEAM OR SPOT WELDING, DIRECT THERMAL FUSION, ETC FOR REINFORCED THERMOPLASTIC STRUCTURAL ELEMENTS.

(7436) TITLE - HIGH PERFORMANCE METAL MATRIX COMPOSITE STRINGER FORMS

PROBLEM - EPOXY MATRIX COMPOSITES FOR ADVANCED APPLICATIONS HAVE OUTSTANDING MECH PROPERTIES BUT LACK STABILITY IN HIGH TEMP/HUMIDITY ENVIRONMENTS. MANTECH FOR STRINGER FORMS HAS REACHED A MILESTONE ON PILOT SCALE BUT MUST BE SCALABLE TO AIRFRAME CONFIGURATION.

SOLUTION - DEVELOP PROCESS AND TOOLING FOR UNIDIRECTIONAL FORMS OF METAL MATRIX COMPOSITES. THE PROCESS IS CHARACTERIZED BY A SINGLE STEP MOE ACHIEVING CONSOLIDATION, HIGH PERF PROPERTIES, VARIED CROSS SECTION, PRECISE DIMENSIONS AND EXTENDED LENGTH.

COMPONENT -- STRUCTURAL PANELS

(7359) TITLE - POLYIMIDE FOAM FOR MULTIFUNCTIONAL AIRCRAFT STRUCT

PROBLEM - NUMEX/POLYIMIDE FOAM HAS BEEN DEVELOPED AS A STRUCTURAL CORE FOR MULTIFUNCTIONAL AIRCRAFT SANDWICH STRUCTURES. CHOPPED GLASS AND GRAPHITE ARE INCORPORATED INTO THE FOAM TO GIVE REQUIRED CHARACTERISTICS. PRODUCTION IS HIGH COST WITH LARGE VARIATIONS.

SOLUTION - AN AUTOMATED FOAM DISPENSING UNIT WILL BE COMBINED WITH HONEYCOMB FORMING AND SHAPING EQUIPMENT TO FORM CURVED OR COMPLEX SHAPED HONEYCOMB CORE WITH CURED POLYIMIDE FOAM IN PLACE. MICROWAVE, RF, OR FORCED AIR WILL BE USED FOR CURING.

(7395) TITLE - HAND HELD WATER JET CUTTING

PROBLEM - CONVENTIONAL METHODS OF CUTTING FLAT AND FORMED COMPOSITE AND NONMETTALLIC PANELS RESULTS IN RAPID TOOL WEAR AND HIGH DUST LEVELS. WHEN USED ON KEVLAR FUZZING OF EDGES OCCURS RESULTING IN SECONDARY OPERATIONS.

SOLUTION - THIS PROJECT WILL DEVELOP A HAND HELD WATER JET CUTTER TO BE USED FOR CUTTING COMPOSITES.
COMPONENT -- GENERAL

(7006) TITLE - MMT MAN TECHNOLOGY FOR AVIONICS

PROBLEM - MANUFACTURING PROBLEMS ARISING FROM INSUFFICIENTLY DEVELOPED STATE-OF-THE-ART TECHNOLOGY ARE RESPONSIBLE FOR VARIOUS FAILURES IN THE AVIONICS AREA.

SOLUTION - DEVELOP TECHNOLOGY TO MANUFACTURE NEW OR IMPROVED TECHNIQUES THAT WILL INCREASE RELIABILITY AND REDUCE LIFE CYCLE COSTS IN THE AVIONICS FIELD.

(7406) TITLE - REINFORCED THERMOPLASTIC CONTROLS

PROBLEM - CONVENTIONAL BELLCRANKS ARE CAST WITH BEARINGS AND BUSHINGS INDIVIDUALLY DRILLED AND PRESSED IN. BEARING REPLACEMENT IS A TIME CONSUMING PROCESS AND INCURS THE RISK OF BEARING DAMAGE.

SOLUTION - DEVELOP THE PROPER COMBINATION OF MATERIALS AND PROCESSES TO PRODUCE LOW COST INJECTION MOLDED BELLCRANKS HAVING BEARINGS MOLDED IN PLACE.

(7412) TITLE - INFRARED DETECTOR FOR LASER WARNING RECEIVER

PROBLEM - SUPPLY OF GALLIUM ARSENIDE ETALUNS FOR USE AS IR DETECTORS IS LIMITED. METHODS FOR DIFFUSING THE DETECTORS JUNCTION, FOR SURFACE PASSIVATION, FOR BONDING THE INTERDIGITATED ETALON TO THE INTERDIGITATED DETECTOR ARE LARGELY HAND METHODS.

SOLUTION - DEVELOP ALTERNATE SOURCES OF GA-AS MATERIAL, AND AUTOMATE METHODS FOR CONTROLLING JUNCTION DIFFUSION, FOR PASSIVATION, AND FOR BONDING LEADS TO THE DETECTOR ARRAY. BUILD SAMPLE DETECTORS.

(7418) TITLE - COMPOSITE ELECTRO-OPTICAL SYSTEM(EDS)

PROBLEM - MECHANICAL RIGIDITY, STABILITY, OVERALL WEIGHT, AND COSTS ARE PRINCIPLE AREAS AFFECTING THE UTILIZATION AND AFFORDABILITY OF SOPHISTICATED EDSS.

SOLUTION - A COMPOSITE BASED EDS WILL BE FABRICATED UTILIZING THE RESULTS OBTAINED IN THE SLS PROGRAM.

COMPONENT -- GUIDANCE SYSTEMS

(7383) TITLE - USE OF MOLDED PLASTIC HARDWARE IN TWO AXIS DRY GYROSCOPES

PROBLEM - THE PRIMARY COST DRIVER IN THE MANUFACTURE OF CURRENT INERTIAL GYROSCOPES IS THE MACHINING OF SMALL PRECISION COMPLEX METAL PARTS. THE MACHINED PARTS ARE HIGH COST AND ALSO REPRESENT PRODUCTION LEAD TIME PROBLEMS.

SOLUTION - MOLD THE GYROSCOPES FROM CARBON FIBER COMPOSITES.
COMPONENT — GUIDANCE SYSTEMS

(7407) TITLE — AUTOMATED LASER SOLDERING

PROBLEM — CURRENT TECHNOLOGY UTILIZES REFLOW SOLDER AND WAVE SOLDER TECHNIQUES FOR PRINTED CIRCUIT BOARD ASSEMBLIES. THESE METHODS ARE HIGH COST AND BE UNRELIABLE.

SOLUTION — THIS PROBLEM WILL DEVELOP LASER SOLDERING TECHNIQUES FOR ATTACHING COMPONENTS AND INTEGRATED CIRCUITS TO PRINTED CIRCUIT BOARDS.

(7445) TITLE — DIGITAL/OPTICAL POSITION TRANSDUCERS

PROBLEM — IN ORDER TO PRODUCE THE DIGITAL/OPTICAL POSITION TRANSDUCERS ECONOMICALLY, WAYS OF MAKING THE FIBER OPTIC DELAY BOBBINS SMALL WITHOUT BREAKAGE DUE TO WINDING AND ENVIRONMENT ARE NEEDED. A FIBER MATERIAL NEEDS TO BE SELECTED FOR PERFORMANCE REQUIREMENT.

SOLUTION — ESTABLISH THE REQUIRED METHODS AND USE THE PROPER MATERIALS TO MAKE THE TRANSDUCER MORE COMPETITIVE WITH ELECTROMECHANICAL TRANSDUCERS.

COMPONENT — BEARINGS

(7334) TITLE — ESTABLISH MANTECH FOR POWDER PROC ROLLING BEARINGS

PROBLEM — LIFE IMPROVEMENTS CONDUCTED ON POWDER PROCESSED AISI M50 STEEL HAVE BEEN OBSERVED WHEN COMPARED TO WROUGHT CONSUMABLE VACUUM ARLOY (CVM) AISI M50 STEEL.

SOLUTION — DEVELOP ECONOMICALLY SOUND PRODUCTION PROCEDURES FOR QUALITY ASSURANCE OF THE POWDER, PRESSING AND SINTERING, AND SUBSEQUENT OPERATIONS TO MANUFACTURE FINISHED COMPONENTS. THE COMPONENTS WILL BE PRESS TO NEAR NET SHAPE.

COMPONENT — GEARS

(7003) TITLE — MANUFACTURING TECHNOLOGY FOR DRIVE PARTS AND COMP

PROBLEM — MANUFACTURING PROBLEMS ARISING FROM INSUFFICIENTLY DEVELOPED STATE-OF-THE-ART TECHNOLOGY ARE RESPONSIBLE FOR FAILURE IN PRODUCTION BUY ITEMS.

SOLUTION — DEVELOP TECHNOLOGY TO MANUFACTURE METALLIC AND NON-METALLIC DRIVE PARTS FROM EXISTING OR NEW MATERIALS TO INCREASE RELIABILITY AND DECREASE LIFE CYCLE COSTS.

FUNDING ($000)

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## COMPONENT — GEARS

### (7155) TITLE — COST EFFECTIVE MFG METHODS FOR HELICOPTER GEARS

**Problem** — Demand in helicopter operation of greater reliability of high performance gears at lower cost has required that improved processing and evaluation techniques be instituted.

**Solution** — Project will address the total gear manufacturing process, integrating automatic non-destructive inspection procedures and replacing individual tooth grinding with a combination of ausrolling and a final rotary tooth finishing procedure.

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### (7187) TITLE — POWDER MET GEARS FOR GAS TURBINE ENGINES

**Problem** — Produce gears for turbine engines at a lower cost.

**Solution** — Develop the manufacturing and qualification for the production of lightly stressed, low temperature powder metallurgy gears for selected non-critical applications.

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### (7189) TITLE — POWDER METALLURGY GEARS FOR GAS TURBINE COMPONENTS

**Problem** — New high temperature gear materials now planned for service in helicopter drive trains are becoming increasingly difficult to process due to their higher alloy content. As the difficulty increases, so does the cost.

**Solution** — Powder matal near net shape processing coupled with advanced surface processing represents the best approach for these materials. This project will establish a full manufacturing and quality assurance sequence.

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### (7298) TITLE — EVALUATION OF HIGH TEMPERATURE CARBURIZING

**Problem** — Gear carburizing is currently carried out with a relatively slow endothermic process typically at 1700 deg F, which requires surface protection against decarburizing during the cycle or a post heat treatment removal of the decarburized layer.

**Solution** — Reduce processing time by increasing the operating capacity. Also investigate vacuum carburizing and hardening of various gear configurations in order to produce a more uniform carbon profile of gear teeth.

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### (7376) TITLE — AUTO INSPECT AND PRECISION GRINDING OF SB GEARS

**Problem** — Current MFG method for spiral bevel gears is labor intensive requiring contact pattern checks with expensive master mating gears. The pattern shifts with a change in torque and temperature. As a result, the tooth form experiences great stress.

**Solution** — Develop an automated process of grinding spiral bevel gears by tape controlled machines, based on a coordinate sys made possible by a partial non-involute tooth form.

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<td>COMPONENT -- GEARS</td>
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<td>(7394) TITLE -- DOUBLE HELICAL GEAR</td>
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<tr>
<td>PROBLEM -- THE LIFE LIMITING FAILURE MODE OF AIRCRAFT GEARS IS GEAR TOOTH PITTING OR SPALLING. THE DOUBLE HELICAL GEAR PLANETARY SYSTEM WILL UPGRADE PERFORMANCE OF THE TRANSMISSION.</td>
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<td>SOLUTION -- THIS PROJECT WILL ESTABLISH THE MANUFACTURING PROCESS TO PRODUCE THE ONE PIECE DOUBLE-HELICAL GEAR PLANETARIES BY SHAPING, SHAVING, HARDENING, AND MACHINING TO REDUCE TRANSMISSION FAILURE RATES.</td>
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<td>(7399) TITLE -- CARPENTER EX-00053 GEAR STEEL</td>
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<tr>
<td>PROBLEM -- THE CURRENT MUST USE CARBURIZING GEAR STEEL IS AMS 6265. IT IS USUALLY TEMPERED AT 300-350°F AND IS NOT SUITABLE FOR HIGH HOT-HARDNESS APPLICATIONS.</td>
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<td>SOLUTION -- QUALIFY EX-00053 GEAR STEEL (20 PERCENT STRONGER IN BENDING FATIGUE STRENGTH) AS THE NEXT GENERATION CARBURIZING GEAR STEEL BY FABRICATING AND COMPARISON TESTING THE COMMON TYPES OF GEARS MADE ON EX-00053 AND AMS 6265.</td>
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<td>(7405) TITLE -- PLASMA NITRIDING OF HELICOPTER GEARS</td>
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<td>PROBLEM -- CONVENTIONAL AMMONIA GAS NITRIDING MUST BE PRECEDED BY EXTENSIVE CHEMICAL AND ABRASIVE CLEANING BEFORE EXPOSURE TO THE NITRIDING ATOMOSPHERE BECAUSE THE CUTTING TOOLS BURNISHED METAL SURFACES RESIST THE PENETRATION OF THE CASE HARDENING NITRIDE.</td>
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<td>SOLUTION -- DEVELOP A PLASMA NITRIDING PROCESS. THE PLASMA IDEALLY BLAST CLEANS THE SURFACE AND PROMPTLY SATURATES THE SURFACE WITH NITRIDE. THE NITROGEN THEN DIFFUSES INTO THE SURFACE.</td>
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<td>(7455) TITLE -- HIGH HOT HARDNESS GEAR STEEL PROCESSING REFINEMENT</td>
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<td>PROBLEM -- PROCESSING OF HIGH HOT HARDNESS GEAR STEELS INCLUDES DOUBLE VACUUM MELTING (DVM) TO ACHIEVE AEROSPACE QUALITY STICK. DVM IS EXPENSIVE AND LEAVES RESIDUAL INCLUSIONS THAT CAN AFFECT SCRAP RATES AND GEAR LIFE.</td>
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<td>SOLUTION -- THIS PROJECT WILL APPLY COST EFFECTIVE ELECTROSLAG REMELTING OR ELECTRON BEAM MELTING TECHNIQUES TO REDUCE THE PROCESS COST OF HIGH HOT HARDNESS GEAR FORGINGS.</td>
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<td>(7324) TITLE -- FREEWHEEL SPRING CLUTCH MANUFACTURING PROCESS</td>
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<tr>
<td>PROBLEM -- WITH THE HIGH OUTPUT SPEED OF TODAY'S ENGINES, THE NEED EXISTS FOR A COST EFFECTIVE FABRICATION PROCESS OF HIGH SPEED OVERRUNNING CLUTCHES TO BE USED IN HELICOPTER TRANSMISSIONS.</td>
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<td>SOLUTION -- DEVELOP A PROCESS TO PRODUCE HELICAL SPRINGS WITHOUT THE NEED OF 'START-STOP' HOLES WHICH CREATE AN IMBALANCE AND STRESS CONCENTRATION UTILIZING METAL MACHINING PROCESSES.</td>
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<td>7393 TITLE PROD OF COMPOSITE PITCH HOUSING</td>
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<td>7326 TITLE ADAPT OF ELECTRON BEAM WELDING FOR REPAIR SHAFTS</td>
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<tr>
<td><strong>PROBLEM</strong> - DURING OVERHAUL OF HELICOPTER TRANSMISSIONS THE PERCENTAGE OF PART REJECTION FOR SPLINE WEAR IS HIGH FOR GEARS WITH SPLINE INTEGRAL SHAFTS.</td>
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<td><strong>SOLUTION</strong> - ESTABLISH THE TOOLING AND INSPECTION PROCEDURES FOR ELECTRON BEAM (EB) WELDING OF COMPLEX GEAR SHAFT/SPLINE ELEMENTS. BY THIS METHOD THE MOST EXPENSIVE ELEMENT (THE GEAR) CAN BE SAVED BY A SINGLE LOW COST WELD OF A NEW SPLINE TO THE GEAR/SHAFT.</td>
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<td><strong>COMPONENT</strong> -- TRANSMISSION HOUSING</td>
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<tr>
<td>7354 TITLE INTEGRALLY STIFFENED HELICOPTER TRANSCASE</td>
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<tr>
<td><strong>PROBLEM</strong> - THE LOW STIFFNESS OF THE CURRENT CH-47 CAST MAGNESIUM ALLOY TRANSMISSION CASE CAUSES EXCESSIVE GEAR WEAR, EXCESSIVE NOISE AND EXCESSIVE VIBRATION.</td>
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<td><strong>SOLUTION</strong> - THIS PROJECT WILL ESTABLISH THE MANUFACTURING PROCESS FOR CASTING FIBER REINFORCED, INTEGRALLY STIFFENED CH-47 TRANSMISSION CASES.</td>
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<tr>
<td>7378 TITLE STAINLESS STEEL FABRICATED HOUSING</td>
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<tr>
<td><strong>PROBLEM</strong> - HELICOPTER TRANSMISSION HOUSINGS ARE MADE FROM MAGNESIUM CASTINGS. THEY ARE COSTLY AND HAVE HIGH REPLACEMENT RATES AT OVERHAUL DUE TO CRACKS AND CORROSION.</td>
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<tr>
<td><strong>SOLUTION</strong> - APPLY VARIOUS FABRICATION TECHNIQUES TO VARIOUS MATERIALS SUCH AS STAINLESS STEEL TO PRODUCE A LIGHTER WEIGHT, NON-CORROSIVE, AND LESS COSTLY HOUSING.</td>
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<td><strong>PROBLEM</strong> - CONVENTIONAL GEAR HOUSINGS CONSISTING OF MAGNESIUM EXHIBIT LOW MODULUS, LOW FATIGUE STRENGTH, AND SUSCEPTIBILITY TO CORROSION.</td>
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<tr>
<td><strong>SOLUTION</strong> - ESTABLISH A COST EFFECTIVE FILAMENT WINDING MANUFACTURING METHOD FOR A GRAPHITE FIBER/HIGH TEMPERATURE RESIN COMPOSITE HOUSING.</td>
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* CATEGORY *
* FACTORY MODERNIZATION *
* ************************** *
### MMT Five Year Plan

<table>
<thead>
<tr>
<th>Component</th>
<th>Title - Aircraft Electronics Mfg Productivity Improvement Program</th>
<th>Program</th>
</tr>
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<tbody>
<tr>
<td><strong>(7426)</strong></td>
<td><strong>Title</strong> - Aircraft Electronics Mfg Productivity Improvement Program</td>
<td><strong>Program</strong></td>
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<tr>
<td><strong>Problem</strong></td>
<td>Electronics manufacturing facilities are in need of modernization. Aging facilities, technology, and methods have resulted in high manufacturing costs and slow deliveries.</td>
<td><strong>SOLUTION</strong> - Analyze the manufacturing facilities of a selected contractor (Martin Marietta) with focus on productivity, automation, cost savings, and plant modernization.</td>
</tr>
<tr>
<td><strong>(7427)</strong></td>
<td><strong>Title</strong> - Attack Helicopter Productivity Improvement (API) Program</td>
<td><strong>Program</strong></td>
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<tr>
<td><strong>Problem</strong></td>
<td>The manufacturing facilities, methods, and production management systems of prime contractors are not in the latest state-of-the-art condition. This results in high cost and late delivery.</td>
<td><strong>SOLUTION</strong> - Contractors facility will be evaluated, and will result in an incentive contractual plan for plant modernization and automation, computerization, improved production planning, control, handling and inventory, and establish MIS systems.</td>
</tr>
<tr>
<td><strong>(7428)</strong></td>
<td><strong>Title</strong> - IP1 Program - AVCO Lycoming - Turbine Engines</td>
<td><strong>Program</strong></td>
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<tr>
<td><strong>Problem</strong></td>
<td>The facilities, methods, and management systems of AVCO Lycoming are outdated. This results in elevated cost, low productivity, late delivery and reduced capacity.</td>
<td><strong>SOLUTION</strong> - The entire manufacturing environment will be studied and problem areas identified. State-of-the-art systems, facilities and methods will be designed and implemented.</td>
</tr>
<tr>
<td><strong>(7429)</strong></td>
<td><strong>Title</strong> - IP1 Program - Sikorsky Aircraft - UH-60 Blackhawk</td>
<td><strong>Program</strong></td>
</tr>
<tr>
<td><strong>Problem</strong></td>
<td>The manufacturing facilities, methods and production management systems of Sikorsky are not in the latest state-of-the-art condition. This results in high manufacturing cost, lower productivity and slow delivery.</td>
<td><strong>SOLUTION</strong> - An incentive contractual plan will be arranged to help the contractor invest the major share of the needed capital to modernize and automate the production facilities and improve management systems.</td>
</tr>
<tr>
<td><strong>(7433)</strong></td>
<td><strong>Title</strong> - IP1 Program - Bell Helicopter Textron Inc - AHIP</td>
<td><strong>Program</strong></td>
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<tr>
<td><strong>Problem</strong></td>
<td>The manufacturing facilities, methods and production management systems at Bell Helicopter Textron, Inc. are not up to the level in the general aerospace industry. This results in high cost and slow delivery.</td>
<td><strong>SOLUTION</strong> - An incentive contractual plan will be arranged to help Bell invest the major share of the needed capital to bring its manufacturing capability up to the state-of-the-art in the general aerospace industry.</td>
</tr>
</tbody>
</table>
COMPONENT — MISCELLANEOUS

(CONTINUED)

(7442) TITLE — IPI PROGRAM - BEEING VERTOL INC - CH-47D HELICOPTER

PROBLEM - THE MANUFACTURING FACILITIES, METHODS AND PRODUCTION MANAGEMENT SYSTEMS AT BEEING VERTOL, INC. ARE NOT UP TO THE LEVEL IN THE GENERAL AEROSPACE INDUSTRY. THIS RESULTS IN HIGH COST AND SLOW DELIVERY.

SOLUTION - AN INCENTIVE CONTRACTUAL PLAN WILL BE ARRANGED TO HELP BEEING INVEST THE MAJOR SHARE OF THE NEEDED CAPITAL TO BRING ITS MANUFACTURING CAPABILITY UP TO THE STATE-OF-THE-ART IN THE GENERAL AEROSPACE INDUSTRY.

(7449) TITLE — IPI PROGRAM - LOCKHEED MISSILES + SPACE CO - RPV

PROBLEM - THE MANUFACTURING FACILITIES, METHODS AND PRODUCTION MANAGEMENT SYSTEMS AT LOCKHEED MISSILES AND SPACE CO. ARE NOT UP TO THE STATE-OF-THE-ART LEVEL IN INDUSTRY. THIS WILL RESULT IN HIGHER COSTS AND SLOW DELIVERY.

SOLUTION - AN INCENTIVE CONTRACTUAL PLAN WILL BE ARRANGED TO HELP LOCKHEED, SUNNYVALE, CA, INVEST THE MAJOR SHARE OF THE NEEDED CAPITAL TO BRING ITS MANUFACTURING CAPABILITY UP TO THE STATE-OF-THE-ART IN THE GENERAL AEROSPACE INDUSTRY.

*********************************************************
* CATEGORY *
* GENERAL *
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COMPONENT — ALL

(7362) TITLE — ENG DESIGN HANDBOOK FOR TITANIUM CASTINGS

PROBLEM — NO PROVISION HAS BEEN MADE FOR COLLECTING INFORMATION FROM THE ADVANCING STATE OF THE ART IN CAST TITANIUM ALLOYS.

SOLUTION — THIS PROJECT WOULD COLLECT INFORMATION FROM PAST AND ONGOING PROJECTS DEALING WITH HIGH QUALITY TITANIUM CASTINGS, CREATE NEW DATA TO FILL TECHNICAL GAPS, AS REQUIRED, AND GENERATE AN ENGINEERING DESIGN HANDBOOK.

(7443) TITLE — ROBOTICS FOR HIGH PRODUCTIVITY FORGINGS

PROBLEM — THE NEED FOR INCREASED PRODUCTIVITY COUPLED WITH DECREASED FUNDING DICTATES THAT CURRENT TECHNOLOGY, SUCH AS ROBOTICS, MUST BE UTILIZED FULLY EFFECTIVELY IN THE MANUFACTURING PROCESS. AS FORGING CAPACITY DECREASES PRODUCERS NEED TO IMPROVE METHODS.

SOLUTION — AN ADVANCE SYSTEM WOULD INCLUDE A ROBOT, AN IMAGE SENSING AND THERMAL VIEWING SUB-SYSTEM GATHERING AND PROVIDING INFORMATION TO A MINI-COMPUTER. THIS DATA WOULD BE USED TO CONTROL FORM AND HEATING OF THE WORK-PIECE.
COMPONENT -- SAFETY

(7022) TITLE - PDI OF POLYPHOSPHAZENE FIRE RESIST HYDRAULIC FLUIDS

PROBLEM - CURRENT HYDRAULIC FLUIDS THAT MEET REQUIRED PERFORMANCE
SPECIFICATIONS ARE FLAMMABLE.

SOLUTION - THE DEVELOPMENT OF PHOSPHAZENE FLUIDS DEMONSTRATE THERMAL
STABILITY, VISCO-ELASTIC PROPERTIES, AND FIRE RESISTANCE. THIS WOULD
INCREASE THE FIRE SAFETY OF ARMY AIRCRAFT.

COMPONENT -- BLADE

(7392) TITLE - RADIATION CURING OF ROTOR BLADES

PROBLEM - BLADE COATINGS ARE BUILT UP IN MULTI-LAYERS EACH LAYER REQUIRING
SOLVENT FLASH-OFF TIME. MAIN ROTOR-BLADES CAN CONSUME UP TO 10 MANHOURS FOR
COATING OPERATIONS.

SOLUTION - THIS PROGRAM WOULD PROVIDE THE RADIATION CURABLE COATINGS
FORMULATION TEST DATA, ECONOMIC JUSTIFICATION STUDIES AND FACILITY DESIGN
CRITERIA FOR THE RADIATION CURING OF ROTOR BLADE COATINGS.

(7403) TITLE - ELECTRONIC BLADE BALANCE SYSTEM

PROBLEM - THE STATIC BALANCING OF ROTOR BLADES USING CURRENT METHODS RESULTS
IN A SIGNIFICANT DIRECT LABOR AND ELAPSED TIME EXPENDITURE.

SOLUTION - DEVELOP A COMPUTER ASSISTED BLADE BALANCE MACHINE WHICH DETERMINES
THE AMOUNT AND LOCATION OF CORRECTIVE BALANCE WEIGHT ADDITIONS.

(7404) TITLE - AUTOMATED CURING CYCLES

PROBLEM - PRESENT CURING PROCESSES ARE BASED ON THE PREPREG MANUFACTURE?S
RECOMMENDED CURING CYCLE DEPENDENT ON A FIXED SCHEDULE OF TEMP AND PRESS W
TIME. THIS IS IMPRACTICAL IN A PRODUCTION ENVIRONMENT.

SOLUTION - DEVELOP A SYSTEM FOR ELECTRONICALLY MONITORING THE CURING OF ORGANIC
LAMINATING RESIN SYSTEMS USING THE CURING AND PRESSURE CONTROL SYSTEM OF THE
CURING EQUIPMENT.
COMPONENT -- BLADE/COMPOSITE STRUCTURES

(7339) TITLE - COMPOSITE TAIL ROTOR BLADE

PROBLEM - FILAMENT WINDING FROM A SOLID FLEXBEAM TO AN OPEN SPAR SECTION, WINDING TO NET SHAPE, IMPROVED RESIN CONTROL AND TOLERANCE CONTROL MUST BE OBTAINED TO ENHANCE THE COST EFFECTIVENESS OF FLEXBEAM TAIL ROTORS.

SOLUTION - TECHNIQUES WILL BE DEVELOPED FOR CONTINUOUS FILAMENT WINDING FROM OPEN TO CLOSED SECTIONS, WINDING NET CONTOUR SHAPE, OPTIMIZING TOLERANCE CONTROL WITH IMPROVED TOOLING, AND IMPROVED RESIN CONTROL TO ENSURE MINIMUM WEIGHT COMPONENTS.

(7340) TITLE - COMPOSITE MAIN ROTOR BLADE

PROBLEM - CURRENT PRODUCTION COMPOSITE BLADE PROGRAMS HAVE NOT BEEN ORIENTED TOWARD OPTIMIZING MANUFACTURING TECHNIQUES/PROCESSES RELATED TO BLADE CONFIGURATIONS, FABRICATION METHODS, AND IMPROVED STRUCTURAL RELIABILITY.

SOLUTION - IMPROVED METHODS WILL INCLUDE SOFT INFLATABLE MANDRELS, INCREASE IN FIBER BAND WIDTH, IMPROVED MATRIX CONTROL PROCEDURES, BALANCED SHELL TOOLING, AND NET SHAPE WINDING.

(7382) TITLE - LOW COST COMPOSITE MAIN ROTOR BLADE FOR THE UH-60A

PROBLEM - MANUFACTURING TECHNOLOGY FOR COCURING GLASS AND GRAPHITE FILAMENT WOUND MAIN ROTOR BLADES HAS NOT BEEN ESTABLISHED FOR THE PRODUCTION ENVIRONMENT.

SOLUTION - DEVELOP FILAMENT WINDING TECHNOLOGY FOR FABRICATING D SPARS THROUGH OPTIMIZED WINDING OF WET FILAMENTS.

(7388) TITLE - MANUFACTURING PROOF TESTING OF COMPOSITE ROTOR BLADES

PROBLEM - THERE IS A LACK OF A TECHNIQUE WHICH CAN ADEQUATELY DETERMINE STRUCTURAL INTEGRITY OF COMPOSITE MAIN ROTOR BLADES AT THE CONCLUSION OF THE FABRICATION CYCLE.

SOLUTION - ESTABLISH AN ACOUSTIC EMISSION TECHNIQUE FOR PROOF TESTING COMPOSITE ROTOR BLADES.

COMPONENT -- BLADE/SPAR

(7360) TITLE - EXTRUSION OF PRECISION HOLLOW AIRCRAFT COMPONENTS

PROBLEM - SOME HOLLOW COMPONENTS, SUCH AS TITANIUM BLADE SPARS, ARE MANUFACTURED FROM SHEET BY WELDING A TUBE AND HOT FORMING. THIS IS A VERY EXPENSIVE TECHNIQUE.

SOLUTION - CAD/CAM TECHNIQUES, RECENTLY DEVELOPED FOR EXTRUSION OF SOLID SHAPES, CAN BE APPLIED TO HOLLOW TO IMPROVE EXTRUSION TOLERANCES AND REDUCE MANUFACTURING COSTS.
COMPONENT -- HUB

(7241) TITLE - HOT ISOSTATICALLY PRESSED TITANIUM CASTINGS

PROBLEM - THE CURRENT METHOD OF MANUFACTURING ROTOR HUBS RESULTS IN EXCESSIVE USE OF MATERIALS AND MACHINING. PROJECT FOR FABRICATION OF A COMPOSITE MAIN ROTOR HUB HAS BEEN CANCELLED. THE CURRENT FORGED HUB IS A LONG-LEAD TIME ITEM.

SOLUTION - ESTABLISH THE MANUFACTURING PROCESS FOR HOT ISOSTATIC PRESSING (HIP) OF A CAST BLACKHAWK TITANIUM ROTOR HUB. THE REQUIRED MATERIAL PROPERTIES ARE ATTAINABLE AND A COST SAVINGS OF 36 PERCENT IS EXPECTED.

(8139) TITLE - COMPOSITE MAIN ROTOR HUB

PROBLEM - UNACCEPTABLE SIZE AND WEIGHT PENALTIES ARE INCURRED WHEN CONVENTIONAL METALLIC MATERIALS ARE USED FOR ADVANCED HUB DESIGNS.

SOLUTION - DEVELOP THE FABRICATION TECHNOLOGY, TOULING AND AUTOMATED TECHNIQUES NECESSARY TO MANUFACTURE COMPOSITE ROTOR HUBS.

COMPONENT -- MISC COMPONENTS

(7004) TITLE - MFG TECHNOLOGY FOR ROTOR ITEMS AND ASSOCIATE COMPS

PROBLEM - MANUFACTURING PROBLEMS ARISING FROM INSUFFICIENTLY DEVELOPED STATE-OF-THE-ART TECHNOLOGY ARE RESPONSIBLE FOR VARIOUS FAILURES IN PRODUCTION BUY ITEMS.

SOLUTION - DEVELOP TECHNOLOGY TO MFG ROTOR ITEMS AND ASSOCIATED COMPONENTS FROM EXISTING OR NEW MATERIALS THAT WILL INCREASE RELIABILITY AND REDUCE LIFE CYCLE COSTS.

(7119) TITLE - NON-DESTRUCTIVE EVAL TECHNIQUES FOR COMPOSITE STRUCTURES

PROBLEM - IMPLEMENTATION OF COMPOSITE STRUCTURES IN THE ARMY AIRCRAFT IS DEPENDANT UPON THE ABILITY TO DETECT AND EVALUATE DEFECTS.

SOLUTION - ESTABLISH A Viable AND COMPREHENSIVE IN-PROCESS INSPECTION PROGRAM FOR NON-DESTRUCTIVE INSPECTION OF COMPOSITE STRUCTURES.

(7345) TITLE - IN-PROCESS CONTROL OF RESIN MATRIX CURE

PROBLEM - CONVENTIONAL CONTROL OF THE CURE STAGE DURING COMPOSITE HARDWARE MANUFACTURING IS ATTAINED THROUGH MANUAL OR AUTOMATIC CONTROL OF THE AUTOCLAVE/PRESS TEMPERATURE AS A FUNCTION OF TIME. THIS METHOD IGNORES THE CHEMICAL STATE OF THE RESIN DURING CURE.

SOLUTION - USE IN-PROCESS CONTROL TECHNIQUES CAPABLE OF MONITORING THE RESIN FLOW/CURE BEHAVIOR TO ENSURE PRODUCTION OF COMPONENTS HAVING CONSISTENTLY HIGH QUALITY.
**COMPONENT — CERAMIC COMPONENTS**

**(7350) TITLE — CERAMIC COMPONENTS FOR TURBINE ENGINES**

**PROBLEM** — METAL BLADES/VANES FOR TURBINE ENGINES ARE HIGH COST, USE CRITICAL MATERIALS, AND HAVE UNACCEPTABLE TEMPERATURE LIMITATIONS. CERAMIC MATERIALS WHICH HAVE BETTER PROPERTIES ARE NOT USED BECAUSE OF NON-REPRODUCABLE PROPERTIES AND SHAPE LIMITATIONS.

**SOLUTION** — SILICON NITRIDE FORMED BY INJECTION MOLDING AND REACTION BONDING IS SUITABLE FOR VANES, AND SILICON CARBIDE FORMED BY INJECTION MOLDING AND PRESSURELESS SINTERING HAS TEMPERATURE AND PRESSURE CHARACTERISTICS SUITABLE FOR BLADES.

**COMPONENT — Combustor**

**(7322) TITLE — LOW COST TRANSPARATION COOLED COMBUSTOR LINER**

**PROBLEM** — COMBUSTOR LINERS OF ADVANCED GAS TURBINE ENGINES ARE REQUIRED TO SURVIVE USING LESS COOLING AIRFLOW THAN HERETOFORE AVAILABLE. STATE OF THE ART TRANSPARATION COOLED LINERS CAN MEET THE REQUIREMENTS BUT MANUFACTURING PROCESSES ARE NOT COST EFFECTIVE.

**SOLUTION** — REFINING A LOW-COST MANUFACTURING TECHNIQUE TO FORM THE NECESSARY COMPLEX SHAPES AND COOLING PASSAGES. PROCESS WILL BE USABLE WITH COMMON COMBUSTOR LINER ALLOYS TO BE CONSISTENT WITH THE LOW-COST CONCEPT BEING PURSUED. JOINING WILL ALSO BE REFINED.

**(7377) TITLE — SPF/DB STATIC STRUCTURE FOR TURBINE ENGINES**

**PROBLEM** — TITANIUM STATIC COMPONENTS OF TURBINE ENGINES USE FORGINGS OR CASTINGS WELDED TO SHEET STOCK AND MACHINED ALL OVER. THIS PROCESS IS TOO COSTLY AND HAS POOR UTILIZATION OF CRITICAL MATERIAL.

**SOLUTION** — ADAPT THE SPF/DB TECHNOLOGY TO THE MANUFACTURE OF A TITANIUM STATIC COMPONENT OF A TURBINE ENGINE.

**COMPONENT — COMPRESSOR**

**(7143) TITLE — MFG OF SPRAY ABRADABLE GAS PATH SEAL SYSTEM**

**PROBLEM** — METALLIC SYSTEMS CURRENTLY USED IN HIGH PRESSURE TURBINE SEALS DEGRADE DUE TO EROSION, CORROSION, AND ADVERSE RUB BEHAVIOR RESULTING IN INCREASED CLEARANCES OVER THE TURBINE BLADE TIPS AND LOSS OF ENGINE PERFORMANCE.

**SOLUTION** — EXTENSIVE R&D WORK HAS BEEN PERFORMED UNDER NASA, ARMY, NAVY CONTRACTS, AND R&D TO DEVELOP VARIOUS CERAMIC SEAL MATERIAL SYSTEMS. MANUFACTURING PROCESS PARAMETERS WILL BE ESTABLISHED FOR PLASMA-SPRAYED ZIRCONIUM OXIDE SEAL COMPONENTS.
COMPONENT -- COMPRESSOR (CONTINUED)

(7285) TITLE -- CAST TITANIUM IMPELLER FOR TURBINE ENGINE

PROBLEM -- CURRENT CENTRIFUGAL COMPRESSOR IMPELLERS ARE FABRICATED BY MACHINING THE FLOWPATH AND BLADE SURFACES FROM A FORGING. THIS RESULTS IN A SUBSTANTIAL LOSS OF MATERIAL AND EXPENSIVE MACHINING OPERATIONS.

SOLUTION -- ESTABLISH THE FABRICATION OF TITANIUM COMPRESSOR IMPELLERS BY CASTING AND HOT-ISOSTATIC PRESSING (HIP). THIS METHOD WILL REDUCE FABRICATION COSTS BY 40 PERCENT. R&D CONDUCTED BY GAS TURBINE ENGINE MANUFACTURERS HAS DEMONSTRATED FEASIBILITY.

(7291) TITLE -- TITANIUM POWDER METAL COMPRESSOR IMPELLER

PROBLEM -- WHEN COMPLEX CONFIGURATIONS, SUCH AS CENTRIFUGAL IMPELLERS AND COMPRESSOR ROTORS ARE UTILIZED IN GAS TURBINE ENGINES, TYPICALLY HIGH MANUFACTURING COST ARE ENCOUNTERED.

SOLUTION -- DEVELOP OVERALL PROCESS CONTROLS CAPABLE OF REPRODUCIBLY PRODUCING 100% DENSE PARTS WITH TENSILE AND FATIGUE STRENGTHS EQUAL TO THOSE OF HIGH QUALITY TITANIUM FORGINGS.

(7415) TITLE -- RECOVERING DAMAGED T700 COMPRESSOR BLISKs

PROBLEM -- BLISKs (INTEGRAL BLADES AND DISKS) ARE USED IN THE T700 ENGINE COMPRESSOR STAGES 1 THRU 5. DAMAGE TO ANY ONE BLADE DURING MANUFACTURING OR IN THE FIELD RESULTS IN SCRAPPING THE WHOLE BLISK.

SOLUTION -- USE OF PRESSURE BONDING TO REPLACE DAMAGED AIRFOILS PROVIDES PROPERTIES EQUAL TO THE PARENT METAL. HIGH FREQUENCY INDUCTION HEATING WITH SIMULTANEOUS APPLICATION OF PRESSURE HAS BEEN DEMONSTRATED TO BE FEASIBLE FOR BLISK APPLICATION.

(7434) TITLE -- INJECTION FORGING OF TITANIUM IMPELLERS

PROBLEM -- AIRCRAFT QUALITY IMPELLERS FOR AUXILIARY POWER UNITS AND MAIN POWER PLANTS ARE PRESENTLY BEING FABRICATED FROM TITANIUM FORGINGS BY LABOR INTENSIVE AND COSTLY OPERATIONS.

SOLUTION -- ESTABLISH AN INJECTION FORGING PROCESS TO PRODUCE A NEAR NET SHAPE FORGING. THIS PROCESS HAS BEEN USED SUCCESSFULLY TO FORGE COMPRESSOR BLADE ROOTS IN TITANIUM, STEEL AND SUPERALLOYS.
COMPONENT -- COMRESSOR/TURBINE DISK

(7457) TITLE - APPLICATION OF FINE GRAINED PREFORMS

PROBLEM - INGOT METALLURGY RESULTS IN LARGE GRAIN SIZES AND SEGREGATION/MICROSTRUCTURAL EFFECTS THAT YIELD POOR METAL FLOW AND EXPENSIVE LOW LIFE TOOLING.

SOLUTION - ESTABLISH THE PROCESSES FOR GAS TURBINE COMPONENTS FROM FINE-GRANED INGOT TECHNOLOGY. ISOTHERMAL FORGING TECHNIQUES WILL PRODUCE A FINE-GRANED, LOW FLOW STRESS PREFORM WITHOUT THE USE OF A POWDER METALLURGY STEP.

COMPONENT -- GENERAL

(7002) TITLE - MFG TECHNOLOGY FOR HI-PERFORMANCE ENGINES AND COMPONENTS

PROBLEM - MANUFACTURING PROBLEMS ARISING FROM INSUFFICIENTLY DEVELOPED STATE-OF-THE-ART TECHNOLOGY ARE RESPONSIBLE FOR FAILURES IN PRODUCTION BUY ITEMS.

SOLUTION - DEVELOP TECHNOLOGY TO MANUFACTURE EXISTING OR ANTICIPATED HI-PERFORMANCE ENGINE AND ASSOCIATED COMPONENTS USING CURRENT OR NEW MATERIALS.

(7248) TITLE - CLOSED LOOP MACHINING, MID-FRAME

PROBLEM - THE ENGINE MID-FRAME HAS 22 DIAMETERS WITH TOLERANCES RANGING FROM .001 IN. THESE TOLERANCES RESULT IN HIGH MACHINING, REWORK AND INSPECTION COSTS.

SOLUTION - DEVELOP CLOSED LOOP MACHINING THAT WILL AUTOMATICALLY COMPENSATE FOR ANY DEVIATION IN NUMERICAL CONTROLLED PROGRAMMED PLAN THEREBY REDUCING PRODUCTION COSTS.

(7435) TITLE - IRON BASE ALLOYS BY A RAPID SOLIDIFICATION PROCESS

PROBLEM - THE NEED FOR INCREASED PERFORMANCE CAPABILITY OF CURRENT AND NEW TURBINE SYSTEMS DICTATES THAT HIGH TEMPERATURE MATERIALS BE AVAILABLE FOR USE IN COMPONENTS.

SOLUTION - NEW RAPIDLY SOLIDIFIED IRON-BASE ALLOYS ARE BEING DEVELOPED THAT OFFER IMPROVED PERFORMANCE, LOWER COST AND REDUCED USE OF STRATEGIC MATLS. THIS PROJECT WILL QUALIFY THE PROCESSING TECHNOLOGY AND DEMONSTRATE COST AND PERFORMANCE BENEFITS.

COMPONENT -- SEALS

(7366) TITLE - SPIRAL SELF-ALTING SEAL

PROBLEM - LABYRINTH SEALS HAVE HIGH LEAKAGE RATES AND CAUSE SIGNIFICANT POWER LOSS. 700 DATA SHOW ENGINE POWER LOSSES OF 2-17 PCT DUE TO THE SEAL LEAKAGE. ACCURACY OF GROOVES AND PARALLELISM OF FACES NEED TO BE DEVELOPED.

SOLUTION - DEVELOP NEW TECHNECH FOR FABRICATION OF SPIRAL GROOVE SELF ACTING SEALS. R&D HAS DEMONSTRATED THE HIGH-SPEED, LOW-WEAR, AND LOW-LEAKAGE CAPABILITY OF THE SPIRAL SEAL.
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<th>COMPONENT — SEALS</th>
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<td>67410 TITLE — SMALL ENGINE TURBINE SEAL OPTIMIZATION</td>
<td><a href="#">Description of problem and solution related to small engine turbine seals.</a></td>
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<td>FUNDING ($000)</td>
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<tr>
<td>COMPONENT — TURBINE BLADES</td>
<td>(CONTINUED)</td>
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<tr>
<td>67356 TITLE — COATINGS FOR UPGRADING PERF. OF GAS TURBINE ALLOYS</td>
<td><a href="#">Description of problem and solution related to turbine blade coatings.</a></td>
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<tr>
<td>67371 TITLE — INTEGRATED BLADE INSPECTION SYSTEM (IBIS)</td>
<td><a href="#">Description of problem and solution related to blade inspection system.</a></td>
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<tr>
<td>67416 TITLE — ADVANCED TURBINE AIRFOIL CASTINGS</td>
<td><a href="#">Description of problem and solution related to advanced turbine airfoil castings.</a></td>
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**Notes:**
- **Problem:** Efficiencies of small gas turbines are extremely sensitive to operating clearances between compressor and blade tips and the stationary seal components.
- **Solution:** This project will develop the technology for utilizing a dual density plasma-sprayed ceramic seal. The chemistry of the coating will be optimized along with the powder manufacturing process.
- **Problem:** Thermal expansion coefficient mismatch between the bond and ceramic layer results in thermal stress cracking with subsequent spalling within the ceramic overlay. R&D by private industry has shown the feasibility of thermal barrier ceramic overlays.
- **Solution:** Establish manufacturing technology for producing improved coatings on nickel-based superalloys. Plasma sprayed techniques will be utilized to optimize a Ni-Cr-Al-Y ceramic thermal barrier overlay by adding an intermediate layer on the blades.
- **Problem:** Inspection of turbine engine blades and vanes necessitates high accuracy. The effort is time consuming and susceptible to error.
- **Solution:** This project will improve the infrared, X-ray, and infrared thermography inspection modules by increasing reliability, repeatability and sensitivity. Also, inspection costs will be reduced.
- **Problem:** Turbine airfoils are designed to a stress rupture limit whether cooled or uncooled. This limit is low due to equiaxed cast superalloy materials currently used and their inherent grain boundary limitations.
- **Solution:** Advanced casting techniques permitting directionally-aligned grain growth eliminate the grain boundaries perpendicular to the stressed direction which increases the longitudinal strength, creep resistance, and rupture limits.
COMPONENT -- TURBINE DISKS

67361) TITLE - COMPUTER AIDED HIP OF ENGINE DISKS

PROBLEM - MOST ENGINE DISKS ARE PRODUCED FROM TITANIUM AND SUPERALLOYS BY FORGING AND MACHINING AT CONSIDERABLE COST. HOT ISOSTATIC PRESSING (HIP) IS AN APPLICABLE NEAR NET SHAPE PROCESS BUT IT REQUIRES EXPENSIVE TRIAL AND ERROR RUNS FOR THE PREFORMS.

SOLUTION - A COMPUTER-AIDED DESIGN TECHNIQUE WILL BE DEVELOPED FOR ACCURATE DESIGN OF HIP PREFORMS. THIS TECHNIQUE WILL SIMULATE THE SIMULTANEOUS DENSIFICATION AND HEAT TRANSFER DURING A HIP CYCLE. RECENT WORK HAS SHOWN THE FEASIBILITY OF THIS APPROACH.

67417) TITLE - LOW COST DISKS BY CAP

PROBLEM - POWDER METAL DISKS FORM A SIGNIFICANT PART OF THE ENGINE COST DUE TO EXPENSIVE TOOLING/DIE REQUIREMENTS AND HIGH PRESSURE CONSOLIDATION EXPENSE.

SOLUTION - RECENT DEVELOPMENTS IN CONSOLIDATION BY ATMOSPHERIC PRESSURE HAS SHOWN THAT SUPERALLOY POWDERS CAN BE CONSOLIDATED TO 98 PERCENT DENSITY AT A REDUCED COST. LOWER COST GLASS DIES CAN ALSO BE USED WHICH REDUCES THE COST FURTHER.

67453) TITLE - CERAMIC-FREE ATOMIZATION OF SUPERALLOY POWDER

PROBLEM - CERAMIC CONTENT IN SUPERALLOY POWDERS USED FOR TURBINE COMPONENTS LIMITS THE BENEFITS OF POWDER METALLURGY. GAS ATOMIZATION REPRESENTS A HIGH VOLUME, LOW COST APPROACH BUT IT HAS NOT PREVENTED CERAMIC ADDITIONS TO THE POWDER.

SOLUTION - THIS PROJECT WILL EVALUATE SUPERALLOY ATOMIZATION TECHNIQUES, DEMONSTRATE QUANTIFIABLE CERAMIC REDUCTIONS AND IMPROVE GAS TURBINE ENGINE COMPONENT COST AND MATERIAL PERFORMANCE.

COMPONENT -- TURBINE ROTORS

67191) TITLE - COST EFFECTIVE PRODUCTION OF COOLED TURBINE ROTORS

PROBLEM - PRODUCTION PROCESSES AND QUALITY CONTROL PROCEDURES DO NOT CURRENTLY EXIST FOR AIR-COOLED TURBINE ROTORS.

SOLUTION - DEVELOP A COST EFFECTIVE PROCEDURE FOR PRODUCING AND ASSURING THE QUALITY OF SINGLE AIR-COOLED ROTORS WHICH CAN DO THE WORK OF TWO STAGES UNDER PRESENT TECHNOLOGY.
COMPONENT -- TURBINE ROTORS

(7197) TITLE -- FABRICATION OF INTEGRAL ROTORS BY JOINING

PROBLEM -- CURRENT GAS TURBINE ROTORS ARE EITHER INTEGRALLY CAST OR THE BLADES
AND DISKS ARE SEPARATE UNITS. THE BLISK CONCEPT DOES NOT PERMIT OPTIMUM
MECHANICAL PROPERTIES OF THE UNIT AND THE OTHER METHOD REQUIRES COMPLEX AND
EXPENSIVE MACHINING.

SOLUTION -- A BONDED BLADE AND DISK IS FEASIBLE AND WILL REDUCE THE MAJOR
MACHINING REQUIREMENTS, STRESS CONCENTRATIONS, AND SIZE AND WEIGHT
CONSTRAINTS ON THE DESIGN. THIS ALSO ALLOWS MATERIAL SELECTION TO BE BASED
ON PERFORMANCE RATHER THAN JOINING CAPACITY.

(7300) TITLE -- IMPROVED LOW CYCLE FATIGUE CAST ROTORS

PROBLEM -- INTEGRALLY CAST TURBINE ENGINE ROTORS HAVE BEEN SHOWN TO BE COST
EFFECTIVE. HOWEVER, INVESTMENT CASTING RESULTS IN LARGE GRAIN SIZES IN THE
DISK REGION AND THIS REDUCES FATIGUE LIFE COMPARED TO WROUGHT MATERIAL.

SOLUTION -- DEFINE CASTING AND HEAT TREAT PARAMETERS, AND FINALIZE THE
MANUFACTURING TECHNOLOGY FOR ESTABLISHING FINE-GRAINED CAST ROTOR PRODUCTION
UTILIZING GRAIN-REFINEMENT TECHNIQUES.

(7351) TITLE -- COMPOSITE SHAFTING FOR TURBINE ENGINES

PROBLEM -- CURRENT MATERIAL CAPABILITIES ASSOCIATED WITH HIGH SPEED GAS
TURBINE ENGINE SHAFTING REQUIRE EXCESS BEARINGS AND CAREFUL DESIGN REGARDING
SHAFT DYNAMICS.

SOLUTION -- RECENT DEVELOPMENTS IN FABRICATING METAL MATRIX COMPOSITE SHAFTING
OFFER INCREASED STIFFNESS AND CRITICAL SPEEDS BY 30-40 PERCENT AND CAN
REDUCE THE DIAMETER.

(7401) TITLE -- CAST IMPELLER AND CLEAN CASTING

PROBLEM -- INVESTMENT CAST METAL HAS NUMEROUS SOURCES OF NON-METALLIC
CONTAMINATION DURING CONVENTIONAL PROCEEDING. THE RESULTING INCLUSIONS
REDUCE CASTING PROPERTIES OR INCREASE CASTING COST BY REQUIRING WELD REPAIR.

SOLUTION -- THIS PROJECT WILL SEEK TO IDENTIFY AND ELIMINATE THE MAJOR CAUSES
OF NON-METALLIC INCLUSIONS IN CASTINGS. THE FINDINGS WILL BE APPLIED TO THE
CASTING OF HIGH STRENGTH INCD 718 IMPELLERS AND OTHER CRITICAL COMPONENTS.

(7402) TITLE -- CAST INTEGRAL LOW PRESS TURBINE ROTOR

PROBLEM -- THE CURRENT PRACTICE FOR MFG T700 TURBINES IS TO ATTACH CAST
TURBINE BLADES TO A FORGED DISK. EXTENSIVE MACHINING OF THE AIRFOIL AND DISK
DOVETAIL JOINTS IS REQ'D.

SOLUTION -- DEVELOP THE PROCESS FOR INTEGRALLY CAST BLISKS AND PERFORM
ENDURANCE TESTING.
COMPONENT — TURBINE ROTORS

(7408) TITLE — MONO-ROTOR FAN FOR APU APPLICATIONS

PROBLEM — THE ROTOR T621-40 APU COSTS APPROXIMATELY 60 PERCENT OF THE
ACQUISITION COST OF THE ENGINE AFTER ASSEMBLY AND BALANCE.

SOLUTION — THE ROTOR ASSEMBLY FABRICATION METHOD HAS BEEN SIMPLIFIED BY
REPLACING THE EXISTING ROTOR BY A SINGLE CASTING AND INERTIA WELDING THIS TO
A SHAFT. THIS INTEGRAL MONOROTOR AND SHAFT CAN BE BALANCED IN THE FACTORY
PROVIDING A SINGLE LOW-COST COMPONENT.

(7409) TITLE — IMPROVED CAST TURBINE ROTOR

PROBLEM — DIFFicultIES HAVE BEEN ENCOUNTERED IN CASTING IN792 FOR POWER
TURBINE ROTORS AS THE ROTORS ARE SHROUDED AND CONTAIN RELATIVELY LONG
SLENDER AIRFOILS ATTACHED TO LARGE HUBS DESPITE THE UTILIZATION OF HIP
TECHNIQUES.

SOLUTION — SELECTED ALLOYS AND PROCESSES WILL BE EVALUATED IN A FULL SCALE
ROTOR CONFIGURATION USING IN 792 AS A BASELINE.

(7411) TITLE — SECOND GENERATION DUAL PROPERTY TRUBINE ROTORS

PROBLEM — SECOND GENERATION TURBINE DESIGNS COULD BECOME SIGNIFICANTLY MORE
ATTRACTIVE IN COST AND PERFORMANCE BY IMPLEMENTATION OF ADVANCED MATERIALS
AND DESIGN CONCEPTS.

SOLUTION — FABRICATE SECOND GENERATION DISKS BY THE LOWER COST CAP
(CONSOLIDATION BY ATMOSPHERIC PRESSURE) TECHNIQUE. MANUFACTURE IMPELLING
TUBES BY CASTING THEM AS AN INTEGRAL COMPONENT.

(7413) TITLE — COOLED RADIAL TURBINE MFG PROCESS

PROBLEM — THE PERFORMANCE AND FUEL CONSUMPTION OF GAS TURBINES IS DIRECTLY
RELATED TO THE TURBINE INLET TEMP AND THEREFORE TO THE MAX ALLOWABLE METAL
TEMP IN THE TURB BLADING. CURRENT PRODUCTION APU'S EXTENSIVELY Employ
UNCOOLED RADIAL TURBINE ROTORS.

SOLUTION — DEVELOP THE PROCESS FOR MANUFACTURING AN UNCOOLED RADIAL TURBINE
ROTOR, CONSISTING OF ADVANCED BLADE MATERIALS BONDED TO A POWDER METAL HUB,
CAPABLE OF OPERATING AT A TURBINE INLET TEMP SEVERAL HUNDRED DEGREES HIGHER
THAN EXISTING APU'S.
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The US Army Communications and Electronics Command (CECOM), headquartered at Ft. Monmouth, NJ, is responsible for research, development, production, and fielding of communications, tactical data, and command and control systems for the Army. CECOM consists of laboratory and technical support segments and Project Managers of Multi-Service Communications System (MSCS), Army Tactical Communications System (ATACS), and project managed elements of Army Tactical Data Systems (ARTADS), i.e., Tactical Fire Control System (TACFIRE), Missile Minder (AN/TSQ-37), Tactical Operations System (TOS), and Position Location Reporting System (PLRS).

CECOM's planned projects cover a variety of electronics problems with special emphasis on computer applications and circuit technology. Projects support efficient manufacturing of custom components for use in future tactical radios.

Four proposed projects will develop advanced methods for production of detector materials needed for night vision devices. Currently, photodetectors are produced on a small scale under laboratory conditions. Unit costs are high and quality and repeatability are low. Three of the projects are directed to the high quantity processing of large diameter mercury-cadmium-telluride boules, while the fourth project will establish automatic inspection capabilities for the HgCdTe wafers.

Several projects will obtain the necessary manufacturing technology for the precision crystals and temperature compensated resonators needed to meet the frequency stability requirements of Army tactical radios.

Program funding in the out-years largely anticipates micro-electronics as the driving force in componentry and built-in test capability for command, control, and communications systems. Computer-dominated methodologies are inherent in such areas as design, manufacture, and manufacturing documentation for communications systems and are expected to be of particular value for the short lead time, low volume production anticipated for future equipment and systems.
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COMPONENT — PHOTODETECTORS

(3101) TITLE — AUTOMATIC PURIFICATION OF TELLURIUM

Problem — Part per billion purity of tellurium is a limiting factor in achievement of high purity mercury-cadmium-tellurium detectormaterial.

Solution — Implement new technique for distillation and sensitive impurity analysis.

(3102) TITLE — LARGE MERCURY CADMIUM TELLURIUM BOULES

Problem — Quantity of useable wafers from small diameter boule is limited.

Solution — Provide technology for larger diameter of boule manufacturing.

(3103) TITLE — BATCH RECRYSTALLIZATION OF HgCdTe BOULES

Problem — Manually controlled annealing lengthens production time, limits production rate.

Solution — Install larger batch-processing capacity with automatic control.

(3104) TITLE — AUTO INFRARED SCANNING OF HgCdTe WAFERS

Problem — Manual infrared scanning of wafers to determine their quality is slow, requires lengthy setup and produces inconsistent results.

Solution — Establish automatic scanning techniques with control software.

COMPONENT — MISCELLANEOUS

(3073) TITLE — TACTICAL GRAPHICS DISPLAY PANEL

Problem — Fab of electroluminescent display panels requires reproducible dispositions of electroluminescent phosphor dielectric layer and transparent conductors. Interconnection of integrated driver and shift register circuits is necessary.

Solution — Uniform repeatable thin film depositions will be established over substrate sizes up to 12 inch diagonal measure. Cost will be reduced by optimum cleaning, handling, and production sealing techniques.
## COMPONENT — JTIIDS

**(3094) TITLE — COMMUNICATIONS TECHNOLOGY TECHMOD FOR JTIIDS**

**PROBLEM** - COMMUNICATIONS EQUIPMENT IS MANUFACTURED USING LABOR INTENSIVE, LOW VOLUME PROCESSES. MACHINES ARE OLD AND UNAUTOMATED. NEW METHODS, PROCESSES AND EQUIPMENT ARE NEEDED.

**SOLUTION** - USE FLEXIBLE MANUFACTURING TECHNIQUES, COMPUTER AIDED MANUFACTURING, GROUP TECHNOLOGY, COMPUTER CONTROLLED EQUIPMENT, ROBOTS, AND AUTHORIZED CONVEYORS. USE AUTOMATIC INSERTION, VAPOR PHASE AND WAVE SOLDERING, AND NUMERICALLY CONTROLLED MACHINING.

### CATEGORY

**FREQUENCY CONTROL**

## COMPONENT — CRYSTALS

**(3047) TITLE — LOW COST HIGH STABILITY QUARTZ RESONATORS**

**PROBLEM** - SINCgars FREQUENCY STABILITY REQUIREMENTS CANNOT BE MET WITH PRESENTLY AVAILABLE MASS PRODUCED CRYSTALS. HAND PICKED, LOW YIELD CRYSTALS ARE REQUIRED AND PRODUCTION PROBLEMS WILL ARISE DUE TO A SHORTAGE OF PRECISION CRYSTALS.

**SOLUTION** - ACHIEVE THE TECHNOLOGY NECESSARY TO PRODUCE LARGE QUANTITIES OF HIGH STABILITY, LOW COST CRYSTALS.

## COMPONENT — OSCILLATORS

**(3048) TITLE — MICROPROCESSOR COMPENSATED CRYSTAL OSCILLATOR**

**PROBLEM** - LOW POWER TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS WITH STABILITY (1-5X10E-7) SUITABLE FOR USE IN JAN PROOF ARMY RADIOS (SINCgars) ARE NOT AVAILABLE IN PRODUCTION QUANTITIES.

**SOLUTION** - ESTABLISH PRODUCTION CAPABILITY FOR COST EFFECTIVE, LONG LIFE, STABLE TCXO'S WHICH UTILIZE MICROPROCESSOR FOR TEMPERATURE COMPENSATION FUNCTION.

### CATEGORY

**GENERAL**

### FUNDING ($000)

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<td>(3100) TITLE</td>
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<td>PROBLEM</td>
<td>FUTURE COMPONENT DENSITY, SOLDERING INTOLERANCE OF MANY COMPONENTS,</td>
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<td>AND REDUCED CURRENT LEVELS ARE FORCING REDUCTION OF ETCHED CONDUCTOR</td>
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<td>WIDTH AND SPACING. OPEN SOLDER BATHS ARE AN ENVIRONMENTAL CONCERN WHICH</td>
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<td>DICTATES NEED FOR NEW MANTECH.</td>
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<tr>
<td>SOLUTION</td>
<td>PROVIDE PRODUCTION TECHNOLOGY FOR BOARDS USING FINE WIRE AS CONDUCTOR</td>
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<td></td>
<td>MATERIAL WITH JOINTS FORMED BY COPPER PLATING OR LASER WELDING/SOLDERING.</td>
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<td>(3069) TITLE</td>
<td>SEGMENTATION OF ATE FUNCTIONS FOR PRODUCTION USE</td>
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<td>PROBLEM</td>
<td>ARMY ELECTRONIC ITEMS MUST BE TESTED ON EXPENSIVE AUTOMATIC TESTERS</td>
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<td>THAT CONTAIN MORE CAPABILITY THAN NEEDED AND COST MORE THAN MOST Firms</td>
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<td>CAN AFFORD.</td>
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<tr>
<td>SOLUTION</td>
<td>RECONFIGURE THE ANZUM-410 EQUATE TESTER TO PERMIT A MINIMUM OF</td>
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<td>MODULES TO DO SOME LOW ORDER TESTING AND PERMIT ADD-ONS TO BE ADDED TO</td>
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<td>UPGRADE THE GEAR TO HANDLE ADDITIONAL TESTS AS NEEDED. WORK ON SOFTWARE</td>
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<td>COMPATIBILITY.</td>
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<td>(3091) TITLE</td>
<td>LIGHTWEIGHT SURVIVABLE ANTENNA FOR ARMOR VEHICLES</td>
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<td>PROBLEM</td>
<td>THE COST OF THE STAND BY ANTENNA USED ON ARMORED VEHICLES IS</td>
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<td>EXCESSIVE DUE TO THE EMPLOYMENT OF LOW USAGE, SPECIALIZED STEEL ALLOYS</td>
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<td>AND THE LONG PROCESSING TIME SUCH MATERIALS REQUIRE.</td>
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<td>SOLUTION</td>
<td>THE CURRENT HEAVY STEEL PLATE ANTENNA WILL BE REPLACED WITH A</td>
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<td>REINFORCED PLASTIC (COMPOSITE) ANTENNA WITHOUT ALTERING ELECTRICAL</td>
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<td>PROPERTIES. THE RADIATING MEMBER WILL BE METAL PLATED.</td>
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<td>(3095) TITLE</td>
<td>AUTO REVIEW AND VERIFICATION OF TECH DATA PACKAGES</td>
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<tr>
<td>PROBLEM</td>
<td>APPROXIMATELY 85% OF CECOM S NEW ENGINEERING DRAWINGS ARE PREPARED</td>
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<td>MANUALLY BY A DRAFTSMAN. THIS METHOD IS LABOR INTENSIVE, TIME CONSUMING,</td>
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<td>ERROR PRONE, AND NOT FLEXIBLE FOR MULTIPLE ENGINEERING CHANGES.</td>
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<tr>
<td>SOLUTION</td>
<td>THE ENGINEERING DATA BOTH NEWLY ACQUIRED AND ARCHIVED WILL BE</td>
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<td>DIGITIZED AND STORED IN ELECTRONIC MEDIA. PROCEDURES WILL BE IDENTIFIED</td>
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<td>FOR USING COMMERCIALLY AVAILABLE COMPUTER SYSTEMS.</td>
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COMPONENT -- MISCELLANEOUS

(3096) TITLE - AUTO SUPPORT FOR RAM PROGRAM

PROBLEM - PROCEDURES FOR THE ACQUISITION AND MAINTENANCE OF DATA FOR DARCOM RELIABILITY, AVAILABILITY AND MAINTAINABILITY (RAM) PROGRAM ARE MANUAL, TIME CONSUMING AND ERROR PRONE. INACCURATE DATA IS PROCURED AND THE RESULTS OF ENGINEERING CHANGES ARE NOT TRACED.

SOLUTION - THE REQUIREMENTS FOR AN AUTOMATED DATA BASE WILL BE ESTABLISHED. THE ASSOCIATED TOOLS WILL PERMIT THE AUTOMATIC GENERATION OF DATA AND REPORTS THROUGH THE PRODUCT LIFE CYCLE.

(9289) TITLE - AUTOTEST OF MICROWAVE DEVICE WAFERS (CAM)

PROBLEM - THE NEED TO WAIT UNTIL PACKAGING IS COMPLETE BEFORE TESTING MICROWAVE DEVICES (WAFERS, TRANSISTORS) RUNS UP THE COST BECAUSE PACKAGING COST IS APPRECIABLE. BUT TESTING OF DEVICE CHIPS CANNOT NOW BE DONE.

SOLUTION - DEVELOP AN AUTOMATED MEASURING SYSTEM FOR EVALUATION THE SEMICON MTL. AT THE WAFER LEVEL, CHECKING EACH DIE AUTOMATICALLY. PERFORM BOTH DC AND RF PROBE MARK UNDER-SPEC DIES. PROVIDE DIAGNOSTIC DATA TO PERMIT CHANGING THE PROCESS TO IMPROVE YIELD.

(9290) TITLE - AUTOMATIC MICROWAVE SEMICONDUCTOR DEVICE TESTING (CAM)

PROBLEM - PRESENT PRODUCTION TESTING METHODS FOR HIGH FREQUENCY DEVICES ARE INADEQUATE. DEVICE CHARACTERIZATION IS SLOW AND EXPENSIVE, AND IS MOSTLY DONE BY HAND. SMALL SIGNAL READINGS CAN BE TAKEN BUT NOT LARGE SIGNAL READINGS.

SOLUTION - MODIFY AND EXTEND PRESENT AUTOMATIC TEST EQUIPMENT, FIXTURES AND COMPUTER ROUTINES TO NON-DESTRUCTIVELY TEST HIGH FREQUENCY DEVICES, CAPTURE DATA ON DEVICE PARAMETERS AND QUALITY. MODIFY AN AUTOMATIC NETWORK ANALYZER TO DO THIS. USE DATA IN DESIGN.

COMPONENT -- CIRCUITRY

(3083) TITLE - 36-4D AND 54-58 GHZ Gunn OSCILLATOR PRODUCTION PROCESS

PROBLEM - PRESENT METHODS OF MANUAL ASSY, TESTING, TRIMMING AND ADJUSTING OF SUBASSEMBLIES AND FINAL ASSY IS COSTLY. SUCH METHODS WILL NEGATIVELY EFFECT PROVISIONING AND MAINTENANCE BECAUSE OF PARTS INTERCHANGEABILITY PROBLEMS.

SOLUTION - ESTABLISH MANUFACTURING PROCEDURES FOR NEW MODULE WITH 50 PERCENT DECREASE IN PARTS COUNT, IMPROVED PARTS UNIFORMITY AND REDUCED PRODUCTION COST.
COMPONENT — CIRCUITRY

(19773) TITLE - COMPUTER AID F/PREP OF AUTO ANALOG CIRCUIT PROD TEST PROG

PROBLEM - INDUSTRY DOES NOT POSSESS PROGRAMS TO VALIDATE THE TEST PROGRAMS
REQUIRED TO TEST ANALOG CIRCUITS.

SOLUTION - PREPARE A TESTING PROGRAM THAT WILL VALIDATE AND EVALUATE ANALOG
TEST PROGRAMS.

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COMPONENT — FIBER

(3089) TITLE - CONTINUOUS OPTIC FIBER FROM DOMESTIC MATERIALS

PROBLEM - AN AUTOMATIC VAPOR-PHASE AXIAL DEPOSITION (ADP) PROCESS WILL BE
ADAPTED TO FORM SILICA FOR OPTIC FIBER. THIS PROCESS WILL ELIMINATE SILICA
DEPENDENCE UPON FOREIGN SOURCE AVAILABILITY, UNIFORMITY AND PRICE.

SOLUTION - AUTOMATIC COMPUTER CONTROL WILL BE UTILIZED TO REGULATE GAS FLOW
RATES AND MATERIAL DEPOSITION THICKNESS. GLASS SINTERING TEMPERATURE?
TARGET AREA TEMPERATURE PROFILE WILL BE OPTIMIZED. TARGET ROTATIONAL SPEED
WILL BE DETERMINED.

(3090) TITLE - GAINASP LIGHT EMITTING DIODES

PROBLEM - THE PRESENT METHOD OF FABRICATION IS LOW VOLUME AND LABOR
INTENSIVE. LEDS ADAPTABLE TO MILITARY SYSTEMS ARE AVAILABLE BUT INDUSTRY
WILL NOT DEVELOP WITH ITS OWN FUNDS BECAUSE OF LIMITED PRODUCTION
PROCUREMENT.

SOLUTION - SEMI-AUTOMATIC PROCESSES WILL ADDRESS MOUNTING, CONTACT WIRE
ATTACHMENT, PACKAGE ASSEMBLY, ALIGNMENT OF THE FIBER OPTIC AND FINAL
ACCEPTANCE TESTING. OTHER AREAS ARE epitaxy, etching, masking, dicing, coatings
AND SEALING.

(9784) TITLE - RUGGEDIZED TACTICAL FIBER OPTIC CABLE ASSEMBLY

PROBLEM - APPLYING A PROTECTIVE COATING ONTO EACH FIBER HAS NOT BEEN DONE IN
PRODUCTION QUANTITIES. BUNDLING THE FIBERS AND APPLYING A PLASTIC SHEATH
MUST BE WORKED OUT.

SOLUTION - DEVELOP EQUIPMENT TO EXTRUDE A PLASTIC KYNAR COVERING ONTO EACH
OPTIC FIBER AND EXTRUDE A PROTECTIVE PLASTIC SHEATH OVER THE CABLE.
ESTABLISH TERMINATION METHODS.
COMPONENT --- SWITCHES

(3D68) TITLE - INCREASE PRODUCTIBILITY OF VARACTORS AND PIN DIODES

PROBLEM - PRESENTLY AVAILABLE VARACTORS AND PIN DIODES MADE BY SILICON DIODE TECHNOLOGY ARE EXPENSIVE. THE IR PRODUCTION TECHNIQUES ARE VERY LABOR INTENSIVE, YIELDS ARE LOW, AND UNIFORMITY IS POOR. MATCHING REQUIRES EXTENSIVE TESTING.

SOLUTION - USE GALLIUM ARSENIDE FOR THESE DEVICES. USE AUTOMATIC CONTROL SYSTEM FOR PROCESSES INSTEAD OF MANUAL PROCEDURES TO INCREASE YIELD. DEPOSIT A MEDIUM TEMPERATURE PASSIVATION LAYER ON PIN DIODES TO IMPROVE RELIABILITY AND UNIFORMITY.

FUNDING ($000)

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<td>(3089) TITLE -- CONTINUOUS OPTIC FIBER FROM DOMESTIC MATERIALS</td>
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<td>PROBLEM -- AN AUTOMATIC VAPOR-PHASE AXIAL DEPOSITION (VAD) PROCESS WILL BE ADAPTED TO FORM SILICA FOR OPTIC FIBER. THIS PROCESS WILL ELIMINATE SILICA DEPENDENCE UPON FOREIGN SOURCE AVAILABILITY, UNIFORMITY AND PRICE.</td>
</tr>
<tr>
<td>SOLUTION -- AUTOMATIC COMPUTER CONTROL WILL BE UTILIZED TO REGULATE GAS FLOW RATES AND MATERIAL DEPOSITION THICKNESS. GLASS SINTERING TEMPERATURE? TARGET AREA TEMPERATURE PROFILE WILL BE OPTIMIZED. TARGET ROTATIONAL SPEED WILL BE DETERMINED.</td>
</tr>
</tbody>
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| (3090) TITLE -- INTEGRAL LIGHT EMITTING DIODES |
| PROBLEM -- THE PRESENT METHOD OF FABRICATION IS LOW VOLUME AND LABOR INTENSIVE. LED'S ADAPTABLE TO MILITARY SYSTEMS ARE AVAILABLE BUT INDUSTRY WILL NOT DEVELOP WITH ITS OWN FUNDS BECAUSE OF LIMITED PRODUCTION PROCUREMENT. |
| SOLUTION -- SEMI-AUTOMATIC PROCESSES WILL ADDRESS MOUNTING, CONTACT WIRE ATTACHMENT, PACKAGE ASSEMBLY, ALIGNMENT OF THE FIBER OPTIC AND FINAL ACCEPTANCE TESTING. OTHER AREAS ARE EPITAXY, ETCHING, MASKING, Dicing, COATINGS AND SEALING. |

| (9784) TITLE -- RUGGEDIZED TACTICAL FIBER OPTIC CABLE ASSEMBLY |
| PROBLEM -- APPLYING A PROTECTIVE COATING ONTO EACH FIBER HAS NOT BEEN DONE IN PRODUCTION QUANTITIES. BUNDLING THE FIBERS AND APPLYING A PLASTIC SHEATH MUST BE WORKED OUT. |
| SOLUTION -- DEVELOP EQUIPMENT TO EXTRUDE A PLASTIC KYNAR COVERING ONTO EACH OPTIC FIBER AND EXTRUDE A PROTECTIVE PLASTIC SHEATH OVER THE CABLE. ESTABLISH TERMINATION METHODS. |
COMPONENT — SWITCHES

(3D68) TITLE — INCREASE PRODUCIBILITY OF VARACTORS AND PIN DIODES

PROBLEM — PRESENTLY AVAILABLE VARACTORS AND PIN DIODES MADE BY SILICON DIODE TECHNOLOGY ARE EXPENSIVE. THE IR PRODUCTION TECHNIQUES ARE VERY LABOR INTENSIVE, YIELDS ARE LOW, AND UNIFORMITY IS POOR. MATCHING REQUIRES EXTENSIVE TESTING.

SOLUTION — USE GALLIUM ARSENIDE FOR THESE DEVICES. USE AUTOMATIC CONTROL SYSTEM FOR PROCESSES INSTEAD OF MANUAL PROCEDURES TO INCREASE YIELD. DEPOSIT A MEDIUM TEMPERATURE PASSIVATION LAYER ON PIN DIODES TO IMPROVE RELIABILITY AND UNIFORMITY.
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The US Army Depot System Command (DESCOM), with headquarters at Letterkenny Army Depot, Chambersburg, Pennsylvania, commands and controls the twelve depots and seven depot activities in the United States and West Germany which comprise the US Army Depot System. Activated in September 1976, this command employs over 37,500 civilians and nearly 1,400 military personnel and manages an annual budget in excess of $1.5 billion.

DESCOM is a major interface with the soldier in the field. The depots store and ship a broad range of general supplies and munitions managed by the Army Defense Logistics Agency, and other agencies, to US and allied units worldwide. Half of DESCOM's personnel and three-quarters of its budget are dedicated to depot-level maintenance on most of the equipment in the Army's inventory.

DESCOM's planned projects span repair and overhaul operations for tracked/wheeled vehicles and communications systems, and energy conservation.

The vehicle related projects include robotics applications which will reduce personnel exposure to hazardous cleaning and refinishing operations, and will improve repair procedures which are time consuming or labor intensive. Significant efforts are directed to the overhaul of track pads and shoes. These include an automated system for the disassembly of double pin track, a high pressure water jet system to remove worn rubber pads from the track shoe, and injection molding and curing processes for replacement pads.

In the communications/electronics area, DESCOM will conduct projects to refinish electronics shelters and to establish in-house capabilities for the test and repair of microwave power devices.
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MIM FIVE YEAR PLAN
RCS DRCMT 126

FUNDING ($000)

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</table>

* COMPONENT -- HULL/BODY

(2001) TITLE - PROVIDE PROTOTYPE ROBOTS FOR AUTOMATED BLAST CLEANING

PROBLEM - HULLS OF VEHICLES ARE BLAST CLEANED TO REMOVE OLD PAINT AND RUST PRIOR TO PAINTING. THE CURRENT METHOD IS MANUAL. LABOR INTENSIVE, TIME CONSUMING, AND CREATES AN UNHEALTHY SITUATION FOR THE WORKERS.

SOLUTION - A FASTER, MORE PRODUCTIVE, AND MORE PRECISE BLAST CLEANING OPERATION WILL BE DEVELOPED USING INDUSTRIAL ROBOTS. A ROBOT SYSTEM USING THREE ROBOTS CONCURRENTLY WILL BE DESIGNED, INSTALLED, DEBUGGED, AND PROVEN OUT.

* COMPONENT -- LOADING

(4006) TITLE - ROBOTIC POLYURETHANE CAMOUFLAGE PAINTING

PROBLEM - CURRENTLY MADE DOES NOT UTILIZE AUTOMATED ROBOTIC PAINTING CAMOUFLAGE PAINTING TECHNOLOGY.

SOLUTION - PRODUCE A ROBOTIC PAINTING SYSTEM COMPLETE WITH A PAINT BOOTH, INFRA-RED TUNNEL, PAINT SYSTEM, TOW CONVEYOR, AND 3 EA. PROGRAMMABLE ROBOTS.

* COMPONENT -- SUSPENSION SYSTEM

(4002) TITLE - ROBOTIZED WELDING OF M113A2 SUSPENSION

PROBLEM - THE CURRENT Method OF WELDING THE M113A2 SUSPENSION SYSTEM IS TIME CONSUMING AND LABOR INTENSIVE.

SOLUTION - ROBOTIZE THE WELDING OPERATION TO REDUCE MAN HOURS FROM ELEVEN TO SIX FOR A LABOR SAVING OF 56 DOLLARS PER HULL.
**COMPONENT -- ENGINE**

(7001) TITLE - AUTOMATED DYNAMOMETER CONTROL FOR STANDARDIZED INSPECTION TESTING

**PROBLEM** - ALL ENGINES ARE TORN DOWN WHILE 20% COULD BE RESTORED TO OPERATION WITHOUT PHYSICAL TEARDOWN. TEARDOWN IS 1/3 COST OF OVERHAUL - ALL ENGINES REBUILT REQUIRE A 4 HOUR DYNAMOMETER OPERATIONAL TEST CYCLE.

**SOLUTION** - AUTOMATE CURRENT MANUALLY OPERATED DYNAMOMETER TEST CELLS ALLOWING PRESHOP INSPECTION WITHOUT TEARDOWN AND REDUCING REBUILT ENGINE RUN-IN TIME BY EIGHTY PERCENT.

<table>
<thead>
<tr>
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<tbody>
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**COMPONENT -- POWER**

(7004) TITLE - MICROWAVE POWER DEVICE PERFORMANCE ANALYSIS CAPABILITY

**PROBLEM** - INOPERATIVE MICROWAVE TUBES AND DEVICES REQUIRE SCREENING TO VERIFY TUBE CONDITION AND MARGINAL PERFORMANCE FOR DETERMINING REPAIR WORK. SCREENING IS PERFORMED MANUALLY WHICH IS TIME CONSUMING, INACCURATE AND COSTLY.

**SOLUTION** - AN AUTOMATED SCREENING FACILITY WHICH INCLUDES FIXTURES, TEST EQUIPMENT, POWER SUPPLIES AND REQUIRED CONTROLS WILL BE SET-UP USING INDIVIDUAL TEST STATIONS FOR ANALYZING FAILED MICROWAVE DEVICES.

<table>
<thead>
<tr>
<th>CATEGORY</th>
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<tr>
<td>FACTORY MODERNIZATION</td>
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**COMPONENT -- MISCELLANEOUS**

(7002) TITLE - LONG RANGE DEPOT PRODUCTIVITY IMPROVEMENT PROGRAM - LEAP.

**PROBLEM** - THE LACK OF UP-TO-DATE MANUFACTURING AND PROCESSING TECHNOLOGY HAS RESULTED IN HIGHER OVERHAUL/REBUILD COSTS AND ALSO LIMITATIONS TO BOTH PRESENT AND FUTURE MISSION NEEDS THROUGHOUT THE DEPOT.

**SOLUTION** - UPDATE THE DEPOT WITH THE LATEST STATE-OF-THE-ART EQUIPMENT AND PROCESS TECHNOLOGY AVAILABLE TO SUPPORT THE PRESENT AND FUTURE WORKLOADS AND MISSIONS.

<table>
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</table>

(7001) TITLE - ANNISTON PRODUCTIVITY IMPROVEMENT PROGRAM (PHASE I)

**PROBLEM** - PRODUCTION AND STORAGE FACILITIES ARE OLD, CRAMPED, AND/OR FUNCTIONALLY UNSUITE FOR THE ACTIVITIES HOUSED. TOOLS AND EQUIPMENT ARE ON THE AVERAGE 25 YEARS BEHIND THE STATE-OF-THE-ART.

**SOLUTION** - ANALYZE AND RESEARCH PRODUCTION OPERATIONS IN TERMS OF PRODUCTIVITY.
(4002) TITLE - CAM APPLICATION OF ROBOTICS TO SHELTER REFINISHING
PROBLEM - SPRAY PAINTING AND SANDING OF ALUM SKINNED MILITARY CONTAINERS IS LABOR INTENSIVE AND CREATES A HARSH WORKING ENVIRONMENT. DEVICES TO SENSE PRESENCE AND ABSENCE OF PAINT + TO CONTROL HEAT BUILD-UP TO PREVENT ALUM SKIN DELAMINATION ARE NEEDED.
SOLUTION - DEVELOP A ROBOT EQUIPMENT SPECIFICATION AND DESIGN WITH NECESSARY FEEDBACK MECHANISMS.

(2003) TITLE - PROCESS ENERGY CONSERVATION AT LETTERKENNY ARMY DEPOT
PROBLEM - AN EXCESS VOLUME OF ENERGY IS BEING CONSUMED ON DEPOT VIA PROCESS ENERGY (MISSION ACTIVITIES SUCH AS PRODUCTION, MAINTENANCE, TESTING, AND DEVELOPMENT). THE EXISTING EMCS IS NOT EMPLOYED TO MONITOR OR CONTROL PROCESS ENERGY.
SOLUTION - THE EMCS MUST BE EFFECTIVELY APPLIED IN ORDER TO REALIZE A SIGNIFICANT ENERGY REDUCTION IN THE AREA OF PROCESS ENERGY CONSUMPTION.

COMPONENT - RUBBER PADS
(4003) TITLE - RUBBER INJECTION MOLDING OF DOUBLE PIN TRACK
PROBLEM - REBUILD OF TRACK BLOCKS FOR COMBAT VEHICLES IS CURRENTLY BEING ACCOMPLISHED WITH 1940'S TECHNOLOGY. THIS REQUIRES THE BONDING OF RAW RUBBER TO THE STEEL BASE COMPONENT AND COMPRESSION CURING FOR TWO HOURS.
SOLUTION - ESTABLISH AN AUTOMATED (ROBOT) INJECTION MOLDING PROCESS THAT WILL CURE THE RUBBER TRACK PAD ON THE TRACK SHOE IN TEN MINUTES OR LESS.

(4005) TITLE - WATER JET MATERIAL REMOVAL SYSTEM
PROBLEM - CURRENT PRODUCTION METHODS OF REMOVING RUBBER FROM TRACK COMPONENTS ARE LABOR INTENSIVE AND PRESENT ENVIRONMENTAL AND SAFETY HAZARDS TO THE WORKERS.
SOLUTION - DESIGN, WRITE SPECIFICATIONS, AND FABRICATE A PROTOTYPE PRODUCTION HIGH PRESSURE WATER JET SYSTEM TO REMOVE THE RUBBER FROM THE TRACK COMPONENTS.
COMPONENT — SHOES

(4DD4) TITLE - AUTOMATED DISASSEMBLY OF DOUBLE PIN TRACK

PROBLEM - DISASSEMBLY OF DOUBLE PIN TRACK SHOE SET ASSEMBLIES IS CURRENTLY LABOR INTENSIVE USING MANUAL HAND TOOLS RESULTING IN LOW PRODUCTIVITY.

SOLUTION - ESTABLISH AN AUTOMATED DISASSEMBLY PROCESS FOR DOUBLE PIN TRACK SHOE ASSEMBLIES.
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>PAGE</th>
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ERADCOM is the Army's focal point for electronics research, development and acquisition (RDA) activities, and maintains programs in such areas as electronics signal intelligence, electronic warfare, atmospheric sciences, target acquisitions and combat surveillance, electronic fuzing, radars, sensors, night vision, radar frequency and optical devices, nuclear weapons effects, instrumentation and simulation, and fluidics.

Seven laboratories are integrated into ERADCOM's structure. These laboratories are product oriented and as a result can identify major problem areas where applied MMT efforts can provide important benefits. Although ERADCOM and its laboratories identify and manage projects, the bulk of the actual work is contracted out to industry.

In the category of integrated electronics, ERADCOM will pursue the establishment of various technologies for Very High Speed Integrated Circuits (VHSIC). These newly identified projects, beginning in FY85, include a manufacturing capability for microelectronic packages, an interconnection method for microelectronic packages, a direct write electron beam patterning process, and fabrication methods for low cost, stable, and durable X-ray masks and mask membranes.

Improving sighting capabilities is an area of prime concern to all the Services. Several projects for significant improvements in production techniques for image intensifiers are included in the Plan. The development of millimeter wave and infrared laser systems for all-weather and smoke fighting is being pursued. This will require the development of new sensors for control systems. Improved techniques will be needed to insure the quality and quantity of such systems. Projects are also included that deal with thermal optical systems. These include the present generation Common Modules and future second generation systems such as the ATAC and MISTAF FLIRS (Forward Looking Infrared Systems) and the Thermal Weapon Sight (TWS).
<table>
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COMPONENT — ARRAYS

(5057) TITLE - 3-5 MICRON TE COOLED FOCAL PLANE MODULES

PROBLEM - IMPROVED THERMAL IMAGING EQUIPMENT OPERATING AT 3-5 MICRONS REQUIRE USE OF HIGH DENSITY MATRIX DETECTOR ARRAY IN THE ORDER OF 2000 ELEMENTS. THIS EQUIPMENT CAN'T BE PRODUCED WITH TODAY'S THERMAL IMAGING OFF-FOCAL-PLANE ARRAY TECHNOLOGY.

SOLUTION - INITIATE A PHASED PROGRAM TO ESTABLISH CONTROLLED MANUFACTURING PROCESSES AND TEST METHODS TO PRODUCE INTEGRATED FOCAL PLANE ARRAY KOOLER/DEWAR MODULES TO OPERATE AT 195 K. ESTABLISH AND VALIDATE PRODUCTION AND TEST METHODS FOR COMPLETED MODULE.

(5063) TITLE - VACUUM DEWARS FOR MOSAIC ARRAYS FOR 2ND GEN. FLIR

PROBLEM - NEW DEWAR CONCEPTS MUST BE ESTABLISHED TO HOUSE THE NEW GENERATION FOCAL PLANE ARRAYS SUCH THAT VACUUM INTEGRITY AND MECHANICAL STABILITY ARE MAINTAINED.

SOLUTION - DEVELOP PRODUCTION TECHNIQUES FOR LOW OUT-GASSING DEWAR COMPONENTS.

(5077) TITLE - 2 GEN 8-12 MICRON COMMON MODULE F.P. RETROFIT

PROBLEM - IMPROVED THERMAL IMAGING EQUIPMENT OPERATING AT 8-12 MICRONS REQUIRE USE OF HIGH DENSITY MATRIX DETECTOR ARRAY IN THE ORDER OF 10000 ELEMENTS. THIS EQUIPMENT CAN'T BE PRODUCED WITH TODAY'S THERMAL IMAGING OFF-FOCAL-PLANE ARRAY TECHNOLOGY.

SOLUTION - INITIATE A PHASED PROGRAM TO ESTABLISH CONTROLLED MANUFACTURING PROCESSES AND TEST METHODS TO PRODUCE INTEGRATED FOCAL PLANE ARRAY KOOLER/DEWAR MODULES FOR COMMON MODULE RETROFIT PROGRAMS.

(5125) TITLE - ROOM TEMPERATURE NMMW DETECTOR ARRAYS

PROBLEM - EFFICIENT RADIATION COUPLING BETWEEN ANTENNAS AND DETECTORS REQUIRES EXTREME DIMENSIONAL AND INDEX OF REFRACTION TOLERANCES.

SOLUTION - DEVELOP METHODS TO DEPOSIT DIELECTRIC / THIN FILM METAL WAVEGUIDE STRUCTURES WITH PREDICTABLE AND CONTROLLABLE EFFECTIVE INDICES OF REFRACTION.
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<td>PROBLEM — LOW YIELD ON CURRENT METHOD OF MANUFACTURE OF COMMON MODULE DETECTOR ARRAYS. GROWTH OF HgCdTe CRYSTALS REQUIRES MANUAL LAPPING, POLISHING &amp; THINNING TO ACHIEVE PERFORMANCE SPECIFICATIONS.</td>
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<td>SOLUTION — USE LIQUID PHASE EPITAXIAL GROWTH OF THIN-FILM ON COTE SUBSTRATE ELIMINATING MANUAL STEPS.</td>
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<td><strong>(9221)</strong> TITLE — THERMAL WEAPONS SYSTEM (TWS) ADVANCED FOCAL PLANE, PHASE I</td>
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<tr>
<td>PROBLEM — HIGH DENSITY MATRIX DETECTOR ARRAYS CANNOT BE PRODUCED WITH CURRENT THERMAL IMAGERY ARRAY TECHNOLOGY.</td>
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<tr>
<td>SOLUTION — ESTABLISH CONTROLLED MANUFACTURING PROCESSES AND TEST METHODS TO PRODUCE INTEGRATED FOCAL PLANE MODULES, ESTABLISH AND VALIDATE PRODUCTION AND TEST METHODS FOR COMPLETED MODULE.</td>
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<tr>
<td>PROBLEM — SUPERIOR HIGH PERF. MATERIALS REQUIRED FOR 2 GEN. FLIR TE COOLERS ARE AVAILABLE ONLY IN RESEARCH QUANTITIES &amp; QUALITIES. TRANSITION FROM RESEARCH TO PRODUCTION WILL Introduce VARIOUS DEGRADATION FACTORS.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION — ESTABLISH PRE-PRODUCTION METHODS &amp; TECHNIQUES FOR HIGH QUALITY CONTROL NECESSARY TO MEET 2 GEN. FLIR DEMANDS.</td>
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<tr>
<td><strong>(9049)</strong> TITLE — EBO-CCO ARRAYS (800X800)</td>
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<td>PROBLEM — BDD X BDD ELEMENT CCD ARRAYS ARE CURRENTLY BEING FABRICATED IN THE RESEARCH LAB WITH LOW YIELD AND H</td>
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<tr>
<td>SOLUTION — DEVELOP MANUFACTURING METHODS TO IDENTIFY AND MAXIMIZE YIELD AND MINIMIZE COST &amp; COST</td>
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<tr>
<td><strong>(9059)</strong> TITLE — LINEAR RESONANCE COOLERS — PHASE I</td>
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<td>PROBLEM — SECOND GENERATION FLIR’S WILL EMPLOY MAGNETIC SUSPENSIONS IN THE CRYOGENIC COOLERS. MAINTAINING CRITICAL SUSPENSION TOLERANCES IN PRODUCTION WILL REQUIRE DEVELOPING EXTENSIVE QUALITY CONTROL PROCEDURES.</td>
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<tr>
<td>SOLUTION — DEVELOP MANUFACTURING METHODS FOR MAINTAINING CRITICAL TOLERANCES.</td>
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<tr>
<td><strong>(5073)</strong> TITLE — ADVANCED MECHANICAL COOLERS FOR 2ND GEN. FLIR’S</td>
<td></td>
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<tr>
<td>PROBLEM — SECOND GEN OR SENSORS ARE NOW VERY SUSCEPTIBLE TO VIBRATIONS AND THERMAL FLUCTUATIONS TO A LARGER DEGREE THAN CONVENTIONAL FIRST GEN SYSTEMS.</td>
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</tr>
<tr>
<td>SOLUTION — DEVELOP MANUFACTURING TECHNIQUES FOR REDUCING THERMAL FLUCTUATIONS AND VIBRATIONS</td>
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<tr>
<td>COMPONENT — INFRARED/UV</td>
<td>(CONTINUED)</td>
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<tr>
<td>(5086) TITLE — SOLID STATE PYROELECTRIC IMAGER</td>
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<tr>
<td>PROBLEM — LOW YIELD OF PYROELECTRIC MATERIAL SUITABLE FOR RETINA, LOW YIELD OF INTERCONNECT FROM PYROELECTRIC MATERIAL TO THE CCD.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION — DEVELOP METHODS FOR THE PRODUCTION OF LARGE AMOUNTS OF PYROELECTRIC MATERIAL, DEVELOP INTERCONNECT TECHNIQUES FOR THE PRODUCTION OF PYROELECTRIC RETINA.</td>
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| COMPONENT — METAL DEWAR AND UNBUNDLED LEADS | |
| (9180) TITLE — MMT FOR METAL DEWAR AND UNBUNDLED LEADS | |
| PROBLEM — THE GOLD WIRE BONDED CONNECTIONS ARE MADE BY HAND WHICH IS A TENIOUS AND EXPENSIVE PROCESS. THE GLASS STEM IS HAND FASHIONED AND IS PRONE TO DAMAGE. | |
| SOLUTION — FABRICATING THE STEM WITH THIN METAL WALLS USING PRINTED CIRCUIT FEED THROUGHS WILL REDUCE THE DEFECS IN PRODUCTION AND DECREASE COST. | 3800 700 |

| COMPONENT — THERMAL WEAPONS SYSTEM (TWS) ELECTRONICS, PHASE I | |
| (9220) TITLE — THERMAL WEAPONS SYSTEM (TWS) ELECTRONICS, PHASE I | |
| PROBLEM — HIGH DENSITY, HIGH RELIABILITY CIRCUIT CHIPS NEEDED BY THE TWS PROGRAM ARE NOT NOW AVAILABLE. | |
| SOLUTION — ESTABLISH MANUFACTURING TECHNIQUES TO PRODUCE RELIABLE HIGH YIELD, HIGH DENSITY CHIPS OF THE TYPE NEEDED BY THE TWS PROGRAM. | 225 |

| COMPONENT — LASER | |
| (5066) TITLE — 1 TO 3 MICRON AVALANCHE DETECTORS | |
| PROBLEM — MANUF. COSTS, VOLUME PRD. TECHNIQUES AND RELIABILITY HAVE TO BE ADDRESSED. | 470 |
| SOLUTION — ESTABLISH MANUFACTURING CAPABILITY FOR VOLUME PRODUCTION OF RELIABLE, LOW COST 1-3 MICRON AVALANCHE DETECTORS. | |

<p>| COMPONENT — NUCLEAR | |
| (2000) TITLE — RADIATION HARDNESS ASSURANCE TEST FOR MUS DEVICES | |
| PROBLEM — MUS INTEGRATED CIRCUITS MUST WITHSTAND RADIATION DUSSERGES, AND SO MUST UNDERGO RADIATION TESTING. TESTING SHOULD PREFERREDLY BE DONE ON THE VENDOR’S ASSEMBLY LANE, WITHOUT THE USE OF COSTLY RADIATION EQUIPMENT. | 700 |
| SOLUTION — USE THE FIELD INDUCED INJECTION AND IMPACT IONIZATION (FII) TEST. THIS PURELY ELECTRICAL TEST IS A GOOD INDICATOR OF RADIATION RESPONSE. USING NO RADIATION, IT WILL REDUCE THE COST OF THE TEST EQUIPMENT AND TESTING OPERATIONS. | |</p>
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<tr>
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<tr>
<td><strong>(9D67) TITLE - UNIVERSAL INTEGRATED OPTICS MODULE</strong></td>
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<tr>
<td><strong>PROBLEM</strong> - PRESENT INTEGRATED OPTICS DEVICES ARE COMPOSED OF SEPARATE LIGHT SOURCE, PROCESSOR AND DETECTOR. IT IS POSSIBLE TO COMBINE THESE COMPONENTS ON A SINGLE CHIP. FABRICATION METHODS AND RELIABILITY HAVE TO BE IMPROVED.</td>
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<tr>
<td><strong>SOLUTION</strong> - DEV. FABR. METHODS FOR OPTIMUM INTERFACE OF LIGHT SOURCE AND DETECTOR WITH ACOUSTO-OPTIC DEVICES.</td>
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<tr>
<td><strong>(3505) TITLE - HIGH CONTRAST CATHODE RAY TUBE</strong></td>
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<tr>
<td><strong>PROBLEM</strong> - HIGH CONTRAST CRT DISPLAYS FOR DAY-NIGHT NIGHT VISION GOGGLES ARE CURRENTLY UNAVAILABLE. OPTICAL FILTERS ARE ENVIRONMENTALLY LIMITED FOR THIS APPLICATION. PHOSPHOR TECHNIQUES ARE AVAILABLE BUT OPTIMIZATION AND ECONOMICS HAVE NOT BEEN SHOWN.</td>
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<tr>
<td><strong>SOLUTION</strong> - USE OF OPTIMIZED BILAYER TRANSPARENT PHOSPHORS WITH A BLACK ABSORBENT LAYER PROVIDES THE HIGH CONTRAST DISPLAY FOR THE SEVERAL MODELS. OPTIMIZATION OF PHOSPHOR TECHNIQUES FOR 5 IN AND LARGER CRT's WILL BE ECONOMICALLY JUSTIFIED.</td>
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<tr>
<th>CATEGORY</th>
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<td><strong>(9D10) TITLE - BUNDLED GRID CONVERGENT ELECTRON GUN</strong></td>
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<tr>
<td><strong>PROBLEM</strong> - PRESENT TECHNOLOGY CAN NOT BE USED TO BUILD GRIDED MILLIMETER WAVE TUBES. MUST USE HIGH VOLTAGE MODULATOR FOR PULSED OPERATION.</td>
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<tr>
<td><strong>SOLUTION</strong> - THE PROCESSES OF CHEMICAL VAPOR DEPOSITION OF BORON NITRIDE, GRID FABRICATION AND BONDING OF GRIDS TO THE CATHODE BY LOW COST PRODUCTION TECHNIQUES WILL BE DEVELOPED.</td>
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</table>
**COMPONENT — BEAM**

*(9019) TITLE — LASER-CUT SUBSTRATES FOR MW TUBES*

PROBLEM - PRESENT CFA JAMMER TUBES EMPLOY HIGH COST, PRECISION ANODE CIRCUITS LIMITING UTILIZATION IN OPTIMIZED EM SYSTEMS. HIGH PERFORMANCE AND LOW WEIGHT AT MINIMUM COST IS REQUIRED TO FIELD DESIRED EM SYSTEMS.

SOLUTION - UTILIZE LASER-CUT ANODE CIRCUIT SUBSTRATES TO ACHIEVE DESIRED RF PERFORMANCE AND MINIMIZE PARTS AND OVERALL DEVICE COST. ALSO EMPLOY PHOTOLITHOGRAPHIC TECHNIQUES TO FORM MEANDERLINE CIRCUIT. USE BERYLLIA SUBSTRATE MATERIAL FOR DIELECTRIC SUPPORTS.

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**COMPONENT — CATHODE**

*(9111) TITLE — VAPOG ORGANIC METALLIC EPITAXIAL GROWTH PROCESS*

PROBLEM - LIQUID EPITAXIAL GROWTH PROCESS REQUIRES A LARGE AND COSTLY HIGH TEMP REACTORS, LARGE QUANTITIES OF SATURATION MELT MATERIALS, C) COSTLY QUALITY GALLIUM ARSENIDE SUBSTRATES, D) LENGTHY OPERATION PROCESS PER SINGLE GROWTH.

SOLUTION - THE VAPOG-ORGANIC-METALLIC PROCESS WILL ENABLE MINIMUM FACILITIZATION REQUIREMENTS, USE OF CONTROLLED GASES REQUIRING NO MELT MATERIALS, POSSIBLE USE OF LESS EXPENSIVE SUBSTANCES, AND MULTIGROWTH PRODUCTION ORIENTED PROCESS.

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**COMPONENT — MAGNETRONS**

*(9219) TITLE — MAGNETRONS FOR SECONDARY EMITTERS*

PROBLEM - THESE DEVICES HAVE HIGH THERMAL DISSIPATION REQS (HIGH PEAK AND MEAN POWER W/ LONG PULSE CAPABILITY). OTHER FACTORS - SIZE, WEIGHT, COST, RELIABILITY, AND REPRODUCIBILITY PRESENT PROBLEMS.

SOLUTION - ESTABLISH NEW MFG TECHNIQUES TO PRODUCE HIGHER THERMAL CAPABILITY MAGNETRON RF POWER SOURCES FOR SECONDARY EMMITTER APPLICATIONS. COMPUTER AIDED DESIGN AND NEW REFRACTORY MATERIALS WILL BE APPLIED.
(9102) TITLE - HIGH COERCIVITY HIGH ENERGY PRODUCT MAGNETS

PROBLEM - PRESENT RARE EARTH MAGNETS LIMIT TWT DESIGNS TO AN UPPER FREQUENCY OF 1800 Hz. NEW TWT DESIGNS FOR THE RANGE ABOVE 18 GHz INTO THE MMWAVE RANGE REQUIRE NEW HIGHER COERCIVITY, HIGHER ENERGY PRODUCT MAGNETS NOT COMMERCIAL AVAILABLE IN THE USA.

SOLUTION - DEVELOP US MANUFACTURING CAPABILITY FOR SAMARIUM-TWO COBALT METAL SUBSTITUENTS TO ENHANCE THE COERCIVITY AND ENERGY PRODUCT

(9196) TITLE - INDUSTRIAL PRODUCTIVITY IMPROVEMENT (ELECTRONICS)

PROBLEM - MANY ELECTRONICS ITEMS PRODUCED FOR ARMY ARE BUILT IN FACTORIES NOT USING MODERN METHODS AND EQUIPMENT, AUTOMATIC MATERIALS HANDLING SYSTEMS, OR COMPUTERIZED MANAGEMENT INFORMATION SYSTEMS. THESE PLANTS MUST BE UPDATED TO IMPROVE PRODUCTIVITY.

SOLUTION - ANALYZE A CONTRACTORS FACILITY, EVALUATING BOTH MANUFACTURING TECHNIQUES AND MANAGEMENT SYSTEMS. INCLUDE MATERIALS HANDLING, LAYOUT, INVENTORY CONTROL, LAM, PRODUCTION EQUIPMENT, AND MIS. IDENTIFY NEW METHODS & EQUIPMENT. DEVELOP A CAPITAL ACQ. PROGRAM.

(5069) TITLE - FABRIC OF OVERTONE MINIATURE PRECISION CRYSTALS

PROBLEM - MINIATURIZED PRECISION QUARTZ CRYSTALS IN MICROCIRCUIT PACKAGES ARE FRAGILE AND DIFFICULT TO FABRICATE.

SOLUTION - IMPROVE PRODUCTION TECHNIQUES FOR MINIATURE OVERTONE QUARTZ CRYSTALS THROUGH BETTER POLISHING, HANDLING, MOUNTING/BONDING AND PACKAGING TECHNIQUES.
COMPONENT -- CRYSTALS

(5134) TITLE - HIGH PURITY LOW DISLOCATION QUARTZ

PROBLEM - COMMERCIAL QUARTZ CONTAINS IMPURITIES AND DISLOCATIONS WHICH MAKE THE MATERIAL UNSUITABLE FOR RESONATORS TO BE USED IN SPECTRUM SYSTEMS. THIS IS ESPECIALLY TRUE IN RADIATION ENVIRONMENTS.

SOLUTION - ESTABLISH A CAPABILITY FOR MANUFACTURING HIGH PURITY AND LOW DISLOCATION DENSITY QUARTZ.

COMPONENT -- OSCILLATORS

(5083) TITLE - MINIATURE MOLECULAR FREQUENCY STANDARDS/CLOCKS

PROBLEM - OPTIMALLY JAM AND SPOOF RESISTANT SIGNAL STRUCTURES CANNOT BE USED IN TACTICAL SYSTEMS BECAUSE PRECISION CLOCKS WITH THE REQUIRED ACCURACIES, SIZE AND POWER CONSUMPTION REQUIRED FOR HIGHLY MOBILE USER UNITS DO NOT EXIST.

SOLUTION - PROVIDE PRODUCTION SOURCES FOR MINIATURE (APPROX. 40 CUBIC INCHES) MOLECULAR FREQUENCY STANDARDS/CLOCKS CAPABLE OF PROVIDING MICROSECOND TIMEKEEPING FOR AT LEAST 24 HOURS IN TACTICAL ENVIRONMENT.

(5133) TITLE - STANDARD FREQUENCY/TIME MODULES

PROBLEM - USER ELEMENTS IN MOST MODERN C3 AND POS/NAV SYSTEMS REQUIRE PRECISION CLOCKS THAT NEED TO BE SYNCHRONIZED AT MISSION START TO MASTER TIMING UNITS. SYSTEM SPECIFIC MASTER TIMING UNITS ARE COST INEFFICIENT, REQUIRING SEVERAL DIFFERENT MODULES AT A BASE.

SOLUTION - ESTABLISH PRODUCTION CAPABILITY FOR A UNIVERSAL TIMING MODULE CAPABLE OF SERVICING USER UNITS OF A VARIETY OF DIFFERENT C3 AND POS/NAV SYSTEMS WITH PRECISE SYNCH DATA.

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* CATEGORY *
* GENERAL *
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COMPONENT -- COMPONENTS

(5107) TITLE - MILLIMETER WAVE POWER SOURCE COMBINER

PROBLEM - DIODE PARAMETERS VARY GREATLY FROM UNIT TO UNIT. PACKAGING METHODS ARE UNSATISFACTORY FOR COMBINER CIRCUITS. TUNING COMBINER ELEMENTS AND ADJUSTING ASSOCIATED MODULATING CIRCUITS TAKES WEEKS OF EFFORT TO OBTAIN REQUIRED PERFORMANCE LEVELS.

SOLUTION - OPTIMIZE FABRICATION PROCESS AND ESTABLISH TECHNIQUES OF DIODE AND PACKAGE PRODUCTION RESULTING IN HIGH YIELDS OF REPRODUCIBLE COMBINER USABLE DEVICES. OPTIMIZE COMBINER CIRCUITS AND MODULATORS FOR HIGH PERFORMANCE AND UNCOMPLICATED TUNINGS.
COMPONENT — COMPONENTS (CONTINUED)

(5108) TITLE — LOW COST PRECISION MICROWAVE PHASE SHIFTER

PROBLEM — MODERN LOW SIDE LOBE PHASED ARRAY ANTENNAS REQUIRE PRECISION PHASE SHIFTERS. PRESENTLY PRECISION PHASE SHIFTERS ARE TOO EXPENSIVE BECAUSE OF THE LARGE AMOUNT OF LABOR REQUIRED TO ACHIEVE THE DESIRED PERFORMANCE.

SOLUTION — SOLUTION IS TO REDUCE PHASE SHIFTER AND ITS DRIVER CIRCUITRY COST THROUGH AUTOMATION OF ASSEMBLY TECHNIQUES, ACTIVE MICROWAVE PHASE TRIMMING AND TESTING OF THE PHASE SHIFTER.

COMPONENT — MISCELLANEOUS

(5D17) TITLE — NON-HERMETIC HYBRID MICROCIRCUITS

PROBLEM — SEALED CHIP TAPE CARRIER TECHNIQUES OFFER LOW COST ASSEMBLY AND ENVIRONMENTAL PROTECTION OF INTEGRATED CIRCUIT CHIPS ON HYBRID MICROCIRCUITS. SIMILAR TREATMENT OF DISCRETE TRANSISTOR AND DIODE CHIPS IS NOT ECONOMICALLY FEASIBLE.

SOLUTION — ESTABLISH PRODUCTION TECHNIQUES FOR SEALING AND HANDLING DISCRETE SEMICONDUCTOR DEVICE CHIPS INCLUDING TESTING AND BONDING OF CHIPS TO HYBRID MICROCIRCUITS.

(5297) TITLE — SAW DEVICES WITH SUIC-MICRON ELECTRODES

PROBLEM — QUANTITY PUN CAPABILITY FOR SURFACE ACOUSTIC WAVE (SAM) DEVICES, WHICH USE TRANSDUCER GEOMETRIES WITH MICRON OR SUIC-MICRON ELECTRODE DIMENSIONS, DOES NOT EXIST. SAM DEVICES ARE CURRENTLY A PRODUCT OF A HIGHLY SKILLED R&D GROUP.

SOLUTION — OPTIMIZE E-BEAM PHOTOLITHOGRAPHIC PROCEDURES TO MAKE THEM AVAILABLE AS QUANTITY PRODUCTION TOOLS. DEMONSTRATE PILOT PUN FOR SAM DEVICES W/ RECD ELECTRODE DIMENSIONS ON PIEZOELECTRIC SUBSTRATES.
COMPONENT -- CIRCUITRY (CONTINUED)

(5001) TITLE - SOLID STATE SCAN CONVERTER COPLANAR MICROELECTRONICS

PROBLEM - HIGH PERFORMANCE FLIR'S WITH REMOTE TV COMPATIBLE DISPLAYS REQUIRE SOLID STATE SCAN CONVERTERS FOR SIGNAL PROCESSING. CURRENT PRINTED CIRCUIT BOARD TECHNOLOGY PREVENTS IMPLEMENTATION OF THESE ELECTRONICS INTO HIGH DENSITY PACKAGES.

SOLUTION - UTILIZE A 3 DIMENSIONAL MICROELECTRONIC INTERCONNECTION TECHNOLOGY AIMED AT HIGH PRODUCTION VOLUME WHERE LOW UNIT COST, HIGH DEVICE DENSITY, GOOD POWER DISSIPATION, HIGH LOGIC SPEED AND LOW EMI SUSCEPTIBILITY ARE DRIVING REQUIREMENTS.

(5132) TITLE - VHSIC FABRICATION USING ELECTRON BEAM TECHNOLOGY

PROBLEM - SUBMICRON INTEGRATED CIRCUIT FABRICATION METHODS HAVE BEEN DEVELOPED FOR DEVICES HAVING CONDUCTIVE SILICON SUBSTRATES, OTHER CHOICES OF LOW CONDUCTIVITY SUBSTRATES CANNOT BE USED BECAUSE PROCESS CONDITIONS HAVE NOT BEEN DEVELOPED.

SOLUTION - USING SILICON ON SAPPHIRE OR GALLIUM ARSENIDE SUBSTRATES SUBMICRON INTEGRATED CIRCUIT DEVICE PRODUCTION PROCESSES WILL BE DEVELOPED INCORPORATING DIRECT WRITE ELECTRON BEAM PATTERNING.

(5137) TITLE - FABRICATION TECHNIQUES FOR HIGH SPEED VHSIC

PROBLEM - R AND D DESIGNS OF VHSIC MODULES ARE ENCOUNTERING YIELD PROBLEMS AFTER TRANSFER TO PRODUCTION LINES. HIGH DENSITY OF CIRCUITS IS NOT COMPATIBLE WITH EXISTING IN-PROCESS SCREENING AND PROCESS CONTROL METHODS.

SOLUTION - VHSIC CHIP WILL BE SUBJECT TO DESIGN INTERACTIONS AND PROCESS CHANGES TO MAKE CIRCUITS PRODUCEABLE ON PRODUCTION LINE AND IMPROVE YIELDS. HIGH SPEED TEST METHODS WILL DEVELOP TO REDUCE COST OF PRODUCTION SCREENING.

(5168) TITLE - AUTOMATIC RETICLE INSPECTION SYSTEM, PHASE 1

PROBLEM - THERE IS NO WAY TO CHECK TAPE-GENERATED RETICLE PATTERNS AGAINST THE COMPUTER-GENERATED MASTER TAPE. VISUAL INSPECTION OF RETICLES FOR PINHOLES OR DUST PARTICLES IS VERY DIFFICULT.

SOLUTION - USE PATTERN RECOGNITION EQUIPMENT TO COMPARE THE RETICLE PATTERN WITH THE ORIGINAL COMPUTER OUTPUT. MAKE A RECORD OF DEFECTS THAT WILL PERMIT REPAIR OF THE RETICLE.

(9905) TITLE - LOW COST MONOLITHIC GALLIUM ARSENIDE MM IC'S

PROBLEM - SIZE EIGHT COST CONSTRAINTS LIMIT APPLICATION OF MICROWAVE ICS FOR MANY SYSTEMS APPLICATIONS. DRAMATIC REDUCTIONS PARTICULARLY COST ARE POTENTIALLY AVAILABLE ALONG WITH ORDER OF MAGNITUDE RELIABILITY IMPROVEMENT.

SOLUTION - ESTABLISH PRODUCTION CONTROLS FOR BULK FABRICATION OF GALLIUM ARSENIDE MONOLITHIC CIRCUIT FUNCTIONS DRAW ON PRIOR R&D AND MDT EFFORTS IN E-BEAM, ION IMPLANT, AND VAPOR EPITAXY TO FULLY AUTOMATE PRODUCTION OF AMPLIFIER AND RECEIVER FUNCTIONS.
### COMPONENT -- GUIDANCE SYSTEM

**(9195) TITLE - VHSIC CMOS/SOS DIGITAL CORRELATOR**

**PROBLEM** - 8-CHANNEL CORRELATORS IN CMOS/SOS TECHNOLOGY ARE HIGH COST AND AVAILABILITY IS LIMITED.

**SOLUTION** - ESTABLISH A SECOND SOURCE BY TRANSFERRING FULL TECHNOLOGY, INCLUDING PATTERN DATA TAPES FROM PKHE VHSIC CONTRACTOR.

**FUNDING ($000)**

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**(9212) TITLE - MICROELECTRONIC PACKAGES FOR VHSIC**

**PROBLEM** - THE PRODUCIBILITY OF CERAMIC PACKAGES WITH HIGH TERMINAL COUNTS LEADS TO POOR YIELDS AND HIGH PACKAGING COST.

**SOLUTION** - UNDER FY40 R&D, AN ATTEMPT HAS BEEN MADE TO IMPROVE POOR MULTILAYER FINE PITCH PACKAGE YIELDS. THIS MMT EFFORT WILL TRANSFORM THESE TECHNIQUES TO THE MANUFACTURING MODE.

**FUNDING ($000)**

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**(9213) TITLE - PRECISION HIGH-QUALITY VHSIC X-RAY MASKS**

**PROBLEM** - MASK MEMBERS FOR X-RAY LITHOGRAPHY OF VHSIC CIRCUITS ARE HIGH IN COST AND LACK GOOD, QUICK RESPONSE AND STABILITY.

**SOLUTION** - DEVELOP PROCEDURES, METHODS AND FABRICATION STEPS TO PRODUCE LOW-COST, STABLE AND DURABLE X-RAY MASKS AND MASK MEMBERS.

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**(9214) TITLE - HIGH SPEED I/A CONVERTER FOR VHSIC E-BEAM SYSTEM**

**PROBLEM** - I/A CONVERTERS NEEDED FOR HIGH-SPEED VHSIC E-BEAM MACHINES ARE EXTREMELY HIGH IN COST AND HAVE VERY LIMITED AVAILABILITY.

**SOLUTION** - ESTABLISH A SOURCE FOR PRODUCING HIGH-SPEED I/A CONVERTERS.

**FUNDING ($000)**

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**(9215) TITLE - HIGH-SPEED DIGITAL VHSIC MICROCIRCUITS**

**PROBLEM** - THE PROBLEM OF INSERTION OF VHSIC TECHNOLOGY INTO PLS WILL BE ADDRESSED TO REDUCE BOTH COST AND SIZE OF THE EQUIPMENT.

**SOLUTION** - MULTILAYER PACKAGES ARE BEING DEVELOPED TO MAXIMIZE CIRCUIT PACKING AND INTERCONNECTION EFFICIENCY. SOURCES FOR PACKAGES TO HOUSE VHSIC CIRCUITS AND INTERCONNECTION BOARDS WILL BE ESTABLISHED TO REDUCE SIZE AND COST OF PLS MODULES.

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**CATEGORY**
- **LASER**

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<td>(9113) TITLE - 10-MICRON PULSED WAVEGUIDE LASER</td>
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<td>PROBLEM - PRESENTLY PULSED WAVEGUIDE CARBON DIOXIDE LASERS FOR USE AS SOURCES FOR MISSILE BEAMRiders AND BEACONS ARE FABRICATED IN SMALL QUANTITIES BY HIGHLY SKilled PERSONS, ELECTRODES, MIRRORS, AND CERAMIC CAVITY HOUSING REQ. PRECISE FABRICATION AND ASSY.</td>
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<tr>
<td>SOLUTION - ESTABLISH LARGE SCALE PRODUCTION OF LASER COMPONENTS INCLUDING MIRRORS, ELECTRODES, AND LASER ENVELOPES TO REDUCE COSTS. DEVELOP UNITS THAT ARE RESISTANT TO THE SHOCK AND VIBRATION OF A TANK ENVIRONMENT.</td>
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<td>(9135) TITLE - FAR INFRARED LASER JAMMER SOURCE</td>
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<td>PROBLEM - CO2 LASER SOURCES MUST BE USED FOR OPTICAL COUNTERMEASURES AGAINST THERMAL IMAGES AND OTHER FIR DEVICES.</td>
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<tr>
<td>SOLUTION - DEVELOP COST-EFFECTIVE PRODUCTION TECHNIQUES.</td>
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<td>(9136) TITLE - HIGH POWER TUNABLE LONG WAVELENGTH INJECTION LASER</td>
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<tr>
<td>PROBLEM - FEW PRODUCTION METHODS HAVE BEEN DEVELOPED FOR HIGH POWER INJECTION LASERS.</td>
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<tr>
<td>SOLUTION - DEVELOP PRODUCTION CAPABILITIES FOR FABRICATING SINGLE AND STACKED INJECTION LASERS AT LONG WAVELENGTH FOR USE IN ADVANCED FIBER OPTICS COMMUNICATION, TRAINING DEVICES AND RANGEFINDERS.</td>
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<td>(9222) TITLE - LONG LENGTH NPO YAG BOULES</td>
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<td>PROBLEM - HIGH QUALITY Nd/YAG BOULES ARE EXTREMELY DIFFICULT TO GROW EVEN AFTER TWO PREVIOUS MTT EFFORTS ATTEMPTED TO INCREASE YIELD, RDD SIZE AND RDD EXTRACTION.</td>
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<tr>
<td>SOLUTION - A NEW CRYSTAL GROWTH METHOD, VERTICAL SOLIDIFICATION OF MELT (VSMO), PROMISES AN EFFICIENT, LOW COST SOLUTION TO THE SHORTAGE OF RDD MATERIAL. THIS PROCESS DEMONSTRATED IN THE LAB, NEEDS TO BE TRANSITIONED TO FULL PRODUCTION.</td>
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<td>(9122) TITLE - QUATERNARY INJECTION LASERS</td>
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<td>PROBLEM - NO VOLUME PRODUCTION METHODS EXIST FOR PRODUCING TRAINING LASERS.</td>
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<tr>
<td>SOLUTION - DEVELOP PRODUCTION CAPABILITY FOR INJECTION LASERS FROM VAPOUR PHASE EPITAXY FABRICATION METHOD FOR USE IN FIBER-OPTIC COMMUNICATION DEVICES AND EYE-SAFE TRAINING DEVICES.</td>
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<td>SOLUTION - DEVELOP PRODUCTION CAPABILITY FOR INJECTION LASERS FROM VAPOUR PHASE EPITAXY FABRICATION METHOD FOR USE IN FIBER-OPTIC COMMUNICATION DEVICES AND EYE-SAFE TRAINING DEVICES.</td>
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</table>
COMPONENT -- MATERIALS

(5200) TITLE -- WIDE BAND TUNABLE LEAD-SALT INJECTION LASERS AND DETECTORS

PROBLEM -- EXPECTED HIGH DEMAND FOR TUNABLE Pb-SALT DIODES + DETECTORS REQUIRE
NEW TECHNIQUES FOR PRODUCING HIGH QUALITY, QUALITY ITEMS. COMMERCIAL DIODES
ARE MADE BY DIFFUSION TECHNIQUES EVEN THOUGH LPE GROWN DIODES EXHIBIT BETTER
PERFORMANCE PARAMETERS.

SOLUTION -- SELECT SUBSTRATE GROWTH TECHNIQUE TO PRODUCE LARGE BOULES THAT HAVE
LOW INPURITY DENSITY AND UNIFORM CONCENTRATION GRADIENT. ESTABLISH LPE
GROWTH AND MONOLITHIC MATERIALS PROCESSING TECHNIQUES USEFUL TO FABRICATE
LASER ARRAYS.

COMPONENT -- LENSES

(5192) TITLE -- THERMAL WEAPONS SYSTEM (TWS) IR OPTICS -- PHASE 1

PROBLEM -- IR OPTICS FOR TWS WILL CONTAIN SEVERAL ELEMENTS WITH ASPHERIC
SURFACES WHICH WILL PROBABLY BE MICROMACHINED BY NC DIAMOND CUTTING TOOLS.
PRESENT METHOD TURNS ONE SURFACE ON ONE ELEMENT AT A TIME. THIS IS
EXPENSIVE.

SOLUTION -- DETERMINE MINIMUM TOLERANCES REQUIRED AND DEVELOP EQUIPMENT AND
PROCESSES TO FABRICATE A PLURALITY OF LENS SURFACES SIMULTANEOUSLY. ALSO
DEVELOP PRODUCTION QUALITY TEST AND ACCEPTANCE TECHNOLOGY.

COMPONENT -- MISCELLANEOUS

(5024) TITLE -- BROADBAND MID INFRARED SOURCE

PROBLEM -- UNIQUE GEOMETRICAL SHAPES MUST BE FABRICATED AND ASSEMBLED IN
SOURCE PRODUCTION. HIGH COST RESULTS FROM EXTENSIVE MANUAL LABOR CONTENT.
THE TECHNIQUE FOR PRODUCING THE REFRACTORY EMITTER MATERIAL IS MARGINAL IN
MATERIAL REPRODUCIBILITY.

SOLUTION -- ESTABLISH AUTOMATED TECHNIQUE FOR PRODUCING EMITTER AND HEATER
ELEMENTS. ESTABLISH CONTROL OF PROCESS PARAMETERS THAT WILL RESULT IN
IMPROVED YIELD OF REFRACTORY EMITTER.

(5082) TITLE -- INTEGRATED OPTICS BUILDING BLOCK -- PHASE 1

PROBLEM -- NO PROBLEM GIVEN

SOLUTION -- NO SOLUTION GIVEN
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<td>(3087) TITLE</td>
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<tr>
<td>(3109) TITLE</td>
<td>ULTRAWIDE BANDWIDTH SAW DELAY LINES</td>
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<tr>
<td>PROBLEM</td>
<td>BROADBAND SAW DELAY LINES ARE REQUIRED FOR SIGNAL STORAGE DEVICE</td>
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<tr>
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<td>BANDWIDTH IS FIXED BY NEED TO STORE SIGNALS FOR A TEN MICROSECOND DURATION</td>
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<td>FOR SIGNALS RANGING OVER 500 MHZ BAND. DEVICE INSERTION LOSS AND MULTIPLE</td>
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<td>TRANSMIT REFLECTIONS MUST BE MINIMAL</td>
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<td>SOLUTION</td>
<td>ESTABLISH PRODUCTION CAPABILITY FOR SAW DELAY LINES OPERATING AT</td>
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<td>1 GHZ USING IDENTICAL BROADBAND, NON-PERIODIC INTERDIGITAL TRANSDUCERS ON</td>
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<td>LITHIUM NIOBATE SUBSTRATES. HIGH RESOLUTION PHOTOLITHOGRAPHIC FABRICATION</td>
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<td>WILL USE DIRECT PROJECTION PRINTING.</td>
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| (5186) TITLE     | LOW COST MILLIMETER WAVE FERRITE ISOLATOR |
| PROBLEM          | LACK OF VOLUME PRODUCTION TECHNIQUES FOR FERRITE ISOLATORS CAUSES |
|                  | THEIR PRICE TO BE HIGH; FERRITE RODS ARE GROUND BY HAND AND SMALL METAL |
|                  | HOUSINGS ARE MACHINED. PARTS MUST BE FITTED TOGETHER AND TESTED AT HIGH |
|                  | FREQUENCY. |
| SOLUTION         | USE REFRACORY GRINDING METHODS TO FORM ROODS OR PUCKS OF SINTERED |
|                  | FERRITE MATERIAL. USE NC MACHINING OF A LUMINUM DIE CAST HOUSINGS. FURNACE |
|                  | BRAZE CONNECTORS AND MOUNTINGS. TEST AUTOMATICALLY. |

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</table>
COMPONENT — BATTERIES

(5162) TITLE — EXJAM BATTERY MANUFACTURING TECHNOLOGY, PHASE I

PROBLEM — PRESENT R AND D MODELS OF UNATTENDED EXPENDABLE JAMMER RESERVE POWER SUPPLY (UEJPS) ARE HARD MADE 1 OR 2 AT A TIME. UNLESS FABRICATION/ASSEMBLY ARE PRODUCTION ENGINEERED, LABOR COSTS WILL MAKE THE BATTERY PROHIBITIVELY EXPENSIVE.

SOLUTION — EVALUATE THE VARIOUS STEPS IN FABRICATION/ASSEMBLY FOR UEJPS HOW BEST TO MAKE IN HIGH VOLUME. DESIGN, BUILD AND VALIDATE PROTOTYPE TOOLING AND MACHINERY FOR CONVERTING TO HIGH VOLUME PRODUCTION.

COMPONENT — CELLS

(9210) TITLE — HIGH ENERGY RECHARGEABLE LITHIUM CELLS

PROBLEM — PRESENT RECHARGEABLE LITHIUM CELLS ARE MANUFACTURED TO REQD SPECS BUT LABORATORY HAND METHODS ARE USED FOR CATHODE FAB, ASSY, CLOSEUP AND FILLING. 10 MH PER CELL IS REQD. A DRY ROOM ENVIRONMENT AND FRESH, HIGH QUALITY COMPONENTS ARE NEEDED.

SOLUTION — DESIGN AND BUILD A MFG FACILITY CAPABLE OF 840 RB CELLS PER 8 HOUR SHIFT (LT 1 MH PER CELL). PRODUCE CELLS IN 2.5 AND 6.0 AH SIZES, ASSEMBLE THEM INTO BATTERIES AND VERIFY TO SPECS BY FIRST ARTICLE AND PDN LOT TESTING.

(9211) TITLE — IMPROVED, HIGH CAPACITY BATTERY BA-5598/U AND BA-5590/U

PROBLEM — HIGH RATE PON TECHNIQUES ARE NEEDED FOR LITHIUM THIONYL CHLORIDE (LTC) BATTERIES. THE LTC BATTERY WILL BE IN PRISMATIC FORM VERSUS A CYLINDER. THE ONLY AVAILABLE PON LINES WILL BE PILOT TYPES WHICH WILL RESULT IN HIGH UNIT COSTS.

SOLUTION — THIS PROJECT WILL ESTABLISH TECHNIQUES TO ASSEMBLE LTC CELLS AND FABRICATE BATTERIES FROM THEM. THIS INCLUDES CELL AND BATTERY ASSY, INTRA-CELL ELECTRODE CONTACTS, ELECTRODE FORMATION, HANDLING AND CASE AND LIQUID FILLING.

COMPONENT — MISCELLANEOUS

(9037) TITLE — TW0 MEGAWATT HIGH ENERGY LASER SWITCH

PROBLEM — PROPOSED MILITARY DIRECTED BEAM WEAPONS WILL REQUIRE MULTIMEGAWATT AVERAGE PULSED POWER TO OPERATE DELIVERY SYSTEM.

SOLUTION — PRODUCE TWO MEGAWATT PULSE MODULES WHICH WILL CONVERT THE INCOMING 'MEGAWATTS OF DC POWER INTO M HIGH ENERGY PULSES. MODULES COULD BE STACKED TO MEET THE PARTICULAR SYSTEM NEEDS.

FUNDING ($000)

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<td><strong>(3D01)</strong> TITLE</td>
<td>MILLIMETER-WAVE INDIUM PHOSPHIDE GUNN DEVICES</td>
<td>PROBLEM - INADEQUATE CONTROL OF EPI MATERIAL AND DEVICE PROCESSING STEPS REQUIRING CLOSE TOLERANCES FOR EFFICIENT MM OPERATION RESULTS IN LOW YIELD POOR UNIFORMITY AND HIGH UNIT COST FOR MILLIMETER-WAVE INDIUM PHOSPHIDE GUNN DEVICES.</td>
<td>SOLUTION - PRODUCTION ENGINEERING IN EPITAXIAL MATERIAL PREPARATION, INJECTION-LIMITED CONTACT FORMATION, INTEGRAL HEAT SINK TECHNOLOGY AND PACKAGING WILL ESTABLISH MANUFACTURING TECHNIQUES AND CONTROLS RESULTING IN A COST REDUCTION OF MORE THAN TEN TO ONE.</td>
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<td><strong>(9053)</strong> TITLE</td>
<td>MILLIMETER-WAVE INTEGRATED CIRCUIT TRANSCIEVERS</td>
<td>PROBLEM - MILLIMETER-WAVE DIELECTRIC WAVEGUIDE INTEGRATED TRANSCIEVER MODULES IN THE 90 TO 220 GHZ REGION ARE DIFFICULT TO FABRICATE AND LIMITED IN PERFORMANCE. REPRODUCIBLE HIGH PERFORMANCE CHARACTERISTICS ARE DIFFICULT TO ACHIEVE WITH PRESENT DESIGN.</td>
<td>SOLUTION - ESTABLISH IMPROVED DESIGN TECHNIQUES FOR INTEGRATED MILLIMETER-WAVE DIELECTRIC WAVEGUIDE STRUCTURES SUCH THAT RELIABLE, HIGH PERFORMANCE TRANSCIEVER MODULES CAN BE FABRICATED IN LARGE QUANTITIES AT MINIMUM COST.</td>
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<td><strong>(9054)</strong> TITLE</td>
<td>MONOLITHICALLY MATCHED POWER GA-AS FETS</td>
<td>PROBLEM - GAAS MICROWAVE POWER FETS REQUIRE LARGE GATE WIDTHS TO ACHIEVE HIGH OUTPUT POWER LEVELS LOW TERMINAL IMPEDANCES ACOMPANY THE LARGE GATE WIDTHS AND ADVERSELY EFFECT A DEVICES BANDWIDTH CAPABILITY AND OVERALL RF PERFORMANCE.</td>
<td>SOLUTION - ESTABLISH PRODUCTION TECHNIQUES TO FABRICATE MONOLITHIC MATCHING CIRCUITS FOR POWER COMBINING A NUMBER OF SMALLER GATE WIDTH CELLS RESULTING DEVICES WILL HAVE HIGH USABLE TERMINAL IMPEDANCES AND INTRINSIC DEVICE RF PERFORMANCE WILL BE PRESERVED.</td>
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COMPONENT -- TRANSISTORS

(5075) TITLE -- MICROWAVE SILICON FETS

PROBLEM -- HIGH PERFORMANCE MICROWAVE SILICON FETS REQUIRE GRADED EPITAXIAL
ODPING PROFILES. HIGH YIELD DEMANDS GREATER PROCESS CONTROL.

SOLUTION -- PROCESSES FOR ACCURATELY CONTROLLING THE GROWTH OF GRADED EPITAXIAL
SILICON MATERIAL WILL BE ESTABLISHED.
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US ARMY MATERIALS AND MECHANICS RESEARCH CENTER
(AMMRC)

The Army Materials and Mechanics Research Center (AMMRC) is designated the DARCOM Lead Laboratory for Materials Testing Technology. In this role, AMMRC is responsible for management and direction of the DARCOM materials testing technology activities and formulation of the Materials Testing Technology (MTT) Program. This program formulation is accomplished by identifying and defining materials testing problem areas in response to system requirements of the DARCOM R&D and Readiness Commands and Project Managers utilizing materials testing technology. The Lead Laboratory mission also encompasses the advising and assisting of the major subordinate commands and Project Managers in the utilization of Materials Testing Technology in order to assure a smooth transition from the developmental to the production phases of the life cycle. Concurrent with the above responsibilities is the furnishing of technical assistance in the application of methods and techniques in solving material problems in connection with procured items.

The MTT Program has shown a steady growth over the last several years, from 2.5 million dollars in FY73 to 4.6 million dollars in FY82. This growth has been largely due to the increased participation in the Program by DARCOM Project Managers, as well as increased attention to the Program by DARCOM Quality Assurance managers. Another increasing trend within the MTT Program has also been the directing of more and more testing related projects to the MTT Program. Specific areas of effort are as follows:

a. Automated Testing

One of the primary needs in NDT and in inspection in general is to remove the decision-making from the inspector where possible. In FY 80 and beyond efforts will be intensively directed toward providing engineering prototype systems utilizing automated decision-making. These include automated radiographic and ultrasonic techniques, optical/laser techniques, and computerized chemical analysis. The ultimate goal in all automated testing systems is the essential feedback to the total system for automated process control.

b. Predictive Failure

The need for diagnostic measurement techniques for anticipation of catastrophic failure and for the measurement of remaining life, both in operating equipment and in units being overhauled and rebuilt, presents a tremendous opportunity for cost savings and reliability improvement. A principal thrust has come from the loss of diagnostics and in-situ measurements adjunct to non-destructive testing represents the real time use of NDT techniques with analysis and decision elements built in.
c. Materials

As the newer materials are utilized in major weapon systems, it is imperative that new and/or improved inspection techniques be available to measure characteristics or parameters to assure adequate and reliable performance. Of particular interest in the next five years are composites, elastomers, plastics, and ceramics, with continuing interest in metals and energetics (explosives, pyrotechnics, and propellants).

d. Techniques

Specifically covered in the objectives of the MTT Program is the investigation of specific physical principles which can potentially offer significant improvement in sensitivity, cost, portability, or speed, and combination of these. The development and application of techniques, such as ultrasonics, infrared, holography, spectroscopy, chromatography, etc., can significantly improve DARCOM materiel and offer substantial improvement in process control.

The MTT Program effected a test method categories classification change in FY 1980 to more accurately reflect certain current technology interests. Historically, the Program has always included the testing of electronic materials and materiel under one of three broad test method categories: nondestructive, chemical, or mechanical testing. However, electronic materials and materiel are often used in highly mission-critical applications and they usually employ and reflect advanced and sophisticated technologies, not only in their production but in their quality assurance inspection procedures. It was therefore determined that it would be in the best interest of the overall MTT Program to provide enhanced visibility to this highly relevant subject. Accordingly (starting in FY 1983), a fourth MTT test method category was established; namely, "Electronics".
<table>
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**Component — Miscellaneous**

(3052) **Title — Army Engineering Design Handbook for Production Support**

**Problem** — Technical scientific and engineering data is continually being generated within the Army and needs to be collected in appropriate documents.

**Solution** — Initiate revise and update data used in production of military hardware and equipment.

(6390) **Title — Program Implementation and Information Transfer**

**Problem** — The success of the MMT program is very dependent on whether the results of MMT work get implemented. This in turn is dependent on whether information concerning the MMT technology is made available and used by concerned parties.

**Solution** — Insure that the MMT results are documented and given wide distribution so as to encourage implementation.

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**Component — Chemical**

(6350) **Title — Materials Testing Technology (MMT)**

**Problem** — Current laboratory methods for chemical testing are specialized and expensive. Real time testing techniques are needed to control chemical processing.

**Solution** — Adapt quick response chemical testing equipment to automate the control of chemical processes.

**Component — Electronics**

(6350) **Title — Materials Testing Technology (MMT)**

**Problem** — Electronic items and ancillary devices are among the most technically sophisticated and mission-critical of the Army inventory. Current testing of these items is equally sophisticated, time-consuming, and difficult to adapt to production environment.

**Solution** — Adapt current and developing state-of-the-art testing techniques to simplified, rapid inspection systems for on-line real-time, production quality assurance.
COMPONENT — MECHANICAL

(6350) TITLE — MATERIALS TESTING TECHNOLOGY (MTT)

PROBLEM — METHODS OF MECHANICAL TESTING ARE BASICALLY TIME CONSUMING, LABORATORY TYPE OPERATIONS. THE TESTING IS OFTEN ULTIMATE AND THEREFORE DISTRACTIVE OR IT TENDS TO INTRODUCE RESIDUAL STRESS/STRAIN IN THE TESTED ITEMS.

SOLUTION — ESTABLISH IMPROVED REAL-TIME INSPECTION TECHNIQUES TO REDUCE PRODUCTION BOTTLENECKS ASSOCIATED WITH MECHANICAL TESTING. ALSO, THE OPTIMUM TESTING CRITERIA WILL BE ESTABLISHED WHEN NECESSARY.

COMPONENT — NON-DESTRUCTIVE TESTING

(6350) TITLE — MATERIALS TESTING TECHNOLOGY (MTT)

PROBLEM — DESTRUCTIVE AND CERTAIN CONVENTIONAL NON-DESTRUCTIVE TESTING TECHNIQUES ARE RESPECTIVELY UNSUITED AND INADEQUATE OR HARD TO BE ADAPTED TO ON-LINE PRODUCTION TESTING USAGE.

SOLUTION — DETERMINE FEASIBILITY OF ADAPTING LAB-PROVEN NOT METHODS OR MODIFY THE EXISTING TEST PROCEDURES FOR ON-LINE PRODUCTION QUALITY ASSURANCE TESTING.

FUNDING ($000)

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The US Army Missile Command is located at Redstone Arsenal, AL, and is responsible for research, development, and acquisition of missile systems for the Army. Facilities include flight test ranges, laboratories, and a simulation center.

Major systems managed by special project offices include STINGER (Shoulder-Fired Air Defense Guided Missile), US ROLAND (All-Weather Air Defense Missile System), MLRS (Multiple Launched Rocket System), Viper (Short-Range Anti-Tank Weapon), HELLFIRE (Helicopter-Carried Air-To-Ground Missile), PERSHING (400-Mile Range Air-To-Ground Missile) and the 2.75 Inch Air-To-Ground Rocket. MICOM is also the Army's center for laser research and manages efforts to apply lasers in missile guidance and as weapons.

MICOM supports technological thrusts in the following electronics areas: (1) Manufacturing techniques for multiple chips employing multiple technologies that are projected to be in the mainstream of the semiconductor marketplace for many years to come. (2) Electronic computer-aided manufacturing and hybrid computer-aided design and manufacturing in order to automate microelectronic production lines and therefore improve productivity, increase fabrication speed and decrease unit cost. (3) Elimination of precious metals from military hybrid micro-circuits and their replacement with materials which are universally available and economically attractive.

A major thrust in MICOM's MMT Program is guidance systems. A large amount of this effort is planned for work on printed circuits and seekers. Efforts in the electronics area include projects on plated-through holes, thin foils, wave soldering, and cleanliness criteria. The seeker area includes work on infrared optics, radio frequency, and laser optics. Other work planned on guidance systems include projects for windows and radomes, optics, and hybrid circuits.

Another thrust area is missile structures, which includes projects for airframes using metal, plastic, or composites. Efforts for composite airframes will address filament winding, inner shell forming and missile substructures. New joining, machining, and forming technologies will be investigated and applied.

Propulsion system components such as motor cases, nozzles, and propellants are the subjects of several manufacturing technologies efforts. Work will address production processes for fabricating composite motor cases with integral pole pieces and attachments, thermo-mechanical fabrication of steel motor cases and continuous propellant mixing and loading processes.

Proposals in the area of test equipment include work on electrical, x-ray and neutron equipment. Calibration efforts include infrared testing of PC boards, digital fault isolation, and automatic circuit tuning.
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**MMT FIVE YEAR PLAN**

**RC5 DRCMT 12b**

**FUNDING ($000)**

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**COMPONENT -- LAUNCHERS**

**1027 TITLE -- LOW COST SMALL ROCKET CONTAINER/LAUNCHER PODS**

PROBLEM -- CURRENT LAUNCH PODS ARE EXPENSIVE AND REQUIRE REUSE IN ORDER TO MAINTAIN COST PER ROUND AT AN ACCEPTABLE LEVEL.

SOLUTION -- LOW COST PLASTICS WILL BE APPLIED TO THE STRUCTURE. COMMERCIAL GRADE PLASTICS SUCH AS ABS, PVC, AND FOAMS IN MULDED AND FORCED SHAPE WILL BE CONSIDERED. LONG TERM SERVICE ENVIRONMENT WILL BE EVALUATED BY ACCELERATED AGING AND CREEP TESTING.

**COMPONENT -- CIRCUITRY**

**1063 TITLE -- SEMIADAPTIVE REEL TO REEL FLEX PRINT PROCESS**

PROBLEM -- CONVENTIONAL BATCH PROCESSING OF PRINTED WIRING BOARDS IS LABOR INTENSIVE. HAND LABOR IS BOTH COSTLY AND SUBJECT TO ERRORS WHICH ADDS REJECT LOSSES TO LABOR COSTS.

SOLUTION -- A REEL TO REEL MFG PROCESS FOR PCB'S WILL PRODUCE COMPLETE PCB'S FROM REELS OF LAD STICK IN A SEQUENTIAL SET OF OPERATIONS. THE OUTPUT CIRCUITS WILL BE FLAT CABLE OR FLEXIBLE CIRCUITRY.

**1075 TITLE -- ELECTRONICS COMPUTER AIDED MANUFACTURING (ECAM)**

PROBLEM -- ALTHOUGH INTEGRATED CIRCUITS, HYBRID CIRCUITS, PRINTED CIRCUITS AND CABLES ARE DESIGNED ON A COMPUTER, THERE IS LITTLE COMPUTERIZED CONTROL OF PROCESSES USED TO PRODUCE THESE ITEMS. A MASTER PLAN IS NEEDED TO DEFINE THE AREA AND REQUIREMENTS.

SOLUTION -- DEVELOP A LOW MAST P PLAN FOR COMPUTER-AIDED DESIGN AND MFG OF ELECTRONIC SYSTEMS. USE AIR FORCE'S ICAM AND NASA'S IPAD PROGRAMS TO DEFINE CAD/CAM AND ELECTRONIC TECHNOLOGIES TO MAKE INTEGRATED CIRCUITS, HYBRID CIRCUITS, PRINTED CIRCUITS, AND CABLES.

**1109 TITLE -- ROBOTIZED WIRE HARNESS ASSEMBLY SYSTEM**

PROBLEM -- WIRE HARNESS FABRICATION IS A LABOR INTENSIVE PROCESS. APPROXIMATELY 50% OF HARNESS FABRICATION TIME IS DEVOTED TO HANDLING, SORTING, AND IDENTIFICATION. HARNESS ASSEMBLY IS DONE BY HAND. PROCEDURES USE SEVERAL WORKSTATIONS AND REPEATED HANDLING.

SOLUTION -- A COMPUTER CONTROLED MANIPULATOR (ROBOT) WITH SIX DEGREES OF FREEDOM INCORPORATES WIRE PREPARATION, HARNESS ASSEMBLY, AND TESTING INTO A SINGLE WORKSTATION. AN INTEGRATED SYSTEMS APPROACH WILL INCORPORATE STATE-OF-THE-ART EQUIPMENT AND TECHNIQUES.
COMPONENT -- CIRCUITRY

(1127) TITLE - ULTRA HIGH RESOLUTION INSPECTION SYSTEM FOR LSI

PROBLEM - LARGE SCALE INTEGRATED(LSI) CIRCUITS INCLUDE MINIATURIZED COMPONENTS OF .001 INCHES OR LESS IN SIZE. IN ORDER TO INSPECT/DETECT CERTAIN PLANS, Twisting STACKING, PtM METALIZATION ETC., A MINIMUM X-RAY RESOLUTION 1000 LINES/INCH IS REQUIRED.

SOLUTION - DEVELOP A PROTOTYPE ULTRA HIGH RESOLUTION LSI INSPECTION SYSTEM USING A RECENTLY DEVELOPED X-RAY IMAGING TECHNIQUE, FIBER OPTIC SCINTILLATION PANEL. THIS SYSTEM WILL BE A DIRECT VIEWING PROTOTYPE IN DIRECT VIEWING PROTOTYPE FOR LSI.

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COMPONENT -- ALL

(1121) TITLE - MISSILE MANUFACTURING PRODUCTIVITY IMPROVED PROGRAM

PROBLEM - THE HELIFIRE MISSILE WILL BE BUILT IN FACILITIES THAT ARE NOT MODERNIZED WITH PROCESSES THAT ARE NOT OPTIMAL AND WITH EQUIPMENT THAT IS NOT UPDATED. A STUDY OF METHODS, EQUIPMENT AND FACILITIES IS NEEDED WITH A VIEW TOWARD MODERNIZATION.

SOLUTION - DEVELOP A PLANT MODERNIZATION PLAN IN WHICH GOVERNMENT AND THE COMPANIES SHARE IN THE UPGRADING OF PROCESSES AND EQUIPMENT AND ALSO DISSOLVE IN THE SAVINGS OBTAINED. CONSULT PROGRAMS AT RUCKMILL, COLUMBUS AND MARTIN, ORLANDO.

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COMPONENT -- CIRCUITRY

(1105) TITLE - PRODUCTION OF QUIET RADAR SIGNAL PROCESSORS USING VLSI TECHNOLOGY

PROBLEM - THE MANUFACTURE TO PRODUCE RADAR SIGNAL PROCESSORS USING VLSI (VERY HIGH SPEED INTEGRATED CIRCUITS) DOES NOT EXIST. METHODS USING LSI (LARGE SCALE INTEGRATED) CHIPS ARE INADEQUATE. HOWEVER, SOME TECHNIQUES MAY BE TRANSLATABLE TO VLSI.

SOLUTION - THIS PROJECT WILL USE FOUR CHIPS DEVELOPED UNDER ANOTHER MMT PROGRAM TO ESTABLISH MANUFACTURING METHODS FOR THE QUIET RADAR SIGNAL PROCESSOR. PROJECT WILL REDUCE COST AND IMPROVE RELIABILITY AND MAINTAINABILITY.
COMPONENT -- CIRCUITRY
(3233) TITLE - COMPUTERIZED INTEGRATED MANUFACTURING SUPPORT (CAM)

PROBLEM - MANUFACTURING SYSTEMS MUST BECOME MORE PRODUCTIVE, FLEXIBLE AND PRECISE AND BETTER ABLE TO COPE WITH VARYING REQUIREMENTS.

SOLUTION - ESTABLISH A SYSTEM DESIGN RELATING INPUT, OUTPUTS, FORMATS, AND DATA TO MEET REQUIREMENTS OF THE TOTAL DESIGN TO USE PROGRESSION.

COMPONENT -- HYBRIDS

(1066) TITLE - ADDITIVE SINGLE AND MULTILAYER HYBRID CIRCUITRY

PROBLEM - THICK FILM CIRCUITRY USES THE SCREEN AND FIRE PROCESS ON CERAMIC SUBSTRATES. A SEMIADDITIVE FINE-LINE PROCESS, ELECTROLESS COPPER PLATING, USED ON FIBERGLASS AND CERAMIC SUBSTRATES WILL PROVIDE BETTER FINE-LINE AND A COST REDUCTION.

SOLUTION - LAMINATE SURFACE CONDITIONS AND ELECTROLESS COPPER CATALYST STRENGTHS WILL BE INVESTIGATED. VARIATIONS IN PROCESSING PARAMETERS WILL BE EVALUATED. SOFTWARE TECHNIQUES FOR AUTOMATION OF MANUFACTURING PROCESSES WILL BE DEVELOPED.

(1095) TITLE - AUTOMATIC SEALING OF HYBRIDS

PROBLEM - HYBRID CIRCUIT ASSEMBLIES FOR MILITARY USE REQUIRE HERMATIC SEALING WHICH IS ACCOMPLISHED BY SOLDERING OR WELDING. BOTH TECHNIQUES REQUIRE AN OPERATOR, INVOLVING LABOR INTENSIVE HANDLING AND SET UP ERRORS.

SOLUTION - ESTABLISH AN AUTOMATIC HERMETIC SEALING SYSTEM USING A COMPUTER OR MICROPROCESSOR BASE AND BY MODIFYING EXISTING HERMETIC SEALING EQUIPMENT.

COMPONENT -- INTEGRATED ELECTRONICS

(1067) TITLE - USE OF ELECTROLESS NICKEL BURL ON PWB CONNECTORS

PROBLEM - GOLD OVER NICKEL PLATING USED ON ONE PIECE CARD EDGE CONTACTS IS A MAJOR COST ITEM. THE COST CAN BE REDUCED BY REPLACING GOLD WITH A BASE METAL ALLOY.

SOLUTION - NICKEL BURL PROVIDES A SATISFACTORY CONTACT MATERIAL AND HAS AN INEXPENSIVE ELECTROLESS PLATING PROCESS. THE REMAINING PROBLEMS OF UNWANTED PLATING AND OCCASIONAL FAILURES TO STRIKE SEEM TO HAVE A HIGH PROBABILITY FOR SOLUTION.
COMPONENT — INTEGRATED ELECTRONICS

(1072) TITLE — MULTIPLE HIGH RELIABILITY/LOW VOLUME LSI MFG

PROBLEM — LOW VOLUME PURCHASE OF LSI CHIPS DOES NOT LEND ITSELF TO CIRCUIT VARIATIONS. LARGER THAN NEEDED NUMBERS OF CHIPS MUST BE ORDERED TO GET THE PRODUCER'S ATTENTION. A LOW-VOLUME CHIP CAPABILITY IS NEEDED.

SOLUTION — ANALYZE ALL LSI RESEARCH RESULTS AND SINGLE OUT NEW PROCESSING TECHNIQUES, ESTABLISH A MILITARY CAPTIVE DESIGN AND PRODUCTION LINE, DEVELOP SOFTWARE FOR CAD OF LSI CIRCUITS. PRODUCE VARIATIONS OF SEVERAL CIRCUIT FAMILIES.

(1084) TITLE — ELIMINATE GOLD ON CABLE CONNECTOR PINS

PROBLEM — GUILD FLASH OVER NICKEL PLATE IS STANDARD FOR PINS IN MILITARY CONNECTORS. GUILD IS EXPENSIVE AND A SUBSTITUTE IS NEEDED.

SOLUTION — EVALUATE PALLADIUM, TIN-NICKEL, AND NICKEL WITH OR WITHOUT TIN OR INDIUM AS A LUBRICANT. SET UP PULSE PLATING AND OTHER PROCESSES FOR APPLYING THE NEW METALS. COORDINATE WITH APFL.

(1093) TITLE — PRODUCTION METHODS FOR A MILLIMETER MODULAR TRANSPONDER

PROBLEM — TRANSPONDER NOW REQUIRE MUCH HAND FABRICATION LABOR AND ARE HIGH COST. THEY ARE USED ONLY ONCE. THEY MUST RECEIVE A GUIDANCE RADAR SIGNAL, DECODE IT, FORM A CODED REPLY AND TRANSMIT IT TO THE GUIDANCE RADAR. MUST WITHSTAND A HIGH-G ENVIRONMENT.

SOLUTION — REDUCE CONFIGURATION TO A FORM THAT MINIMIZES MFG COST. MODULARIZE TRANSPONDER BY FUNCTION ANTENNA MODULE, RECEIVER MODULE, DECODING MODULE, ENCODING MODULE, TRANSMITTER MODULE, POWER SUPPLY MODULE. BUILD MODULES TO FIT IN A FOUR INCH HIGH LSI.

(1103) TITLE — STABLE MATERIALS? MANUFACTURING FOR MULTILAYER PCB

PROBLEM — MATERIAL FAILURE AND INTERLAYER MIS-REGISTRATION IN MULTILAYER CIRCUIT BOARDS INCREASES WITH THINNER BASE LAMINATES. SPECIFICATIONS FOR RAW MATERIALS AND CONTROL ON LAMINATES THAT WILL REDUCE BOARD STRESSES INTRODUCED BY BONDING ARE REQUIRED.

SOLUTION — ESTABLISH A RELATIONSHIP BETWEEN MATERIAL VARIABLES AND DIMENSIONAL STABILITY. APPLY DATA TO FOSTER MATERIALS AND BOARD FABRICATION METHODS THAT REDUCE FREQUENCY OF MISREGISTERED BOARDS AND BOARD FAILURE DUE TO MATERIAL FAILURE.

(3164) TITLE — COMPONENT SIDE PRINTED CIRCUIT BOARD SOLDERING

PROBLEM — THERE IS NO KNOWN METHOD FOR HOLDING COMPONENTS IN ALIGNMENT FOR MOUNTING.

SOLUTION — REFINE PROCESS FOR FOIL SIDE MOUNTING OF COMPONENTS TO ACCOMMODATE FLEXIBLE CIRCUITS.

FUNDING ($000)

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COMPONENT -- INTEGRATED ELECTRONICS (CONTINUED)

(3184) TITLE -- SCREEN PRINTING PROCESSES FOR PTH ON PLASTIC PCB’S

PROBLEM -- SET UP AND RUN TIME FOR ELECTROLESS COPPER PLATED THRU HOLES (PTH) IS APPROXIMATELY 3.75 MIN PER BOARD WITHOUT INSPECTION OR MAINTENANCE.

SOLUTION -- SCREEN PRINTING COULD ACCOMPLISH THE SAME JOB IN APPROXIMATELY .48 MIN PER BOARD. INVESTIGATE CURING CYCLE, SCREEN PREPARATION TIME, AND Paste THEOLOGY FOR OPTIMUM FLUX THRU HOLES.

(3411) TITLE -- MANUFACTURE OF NON PLANAR PRINTED CIRCUIT BOARDS

PROBLEM -- USE OF FLAT CIRCUIT BOARDS RESULTS IN COMPLEX AND EXPENSIVE INTERCONNECTIONS WITH LOWERED RELIABILITY.

SOLUTION -- DEVELOP THE PROCESSES TO PRODUCE NON-PLANAR CIRCUIT BOARDS SHAPED TO FIT THE AVAILABLE COMPARTMENTS. CIRCUIT PATTERNS WILL BE EXPOSED ON THE INSIDE WITH A PROJECTION MECHANISM OR WITH SOFT X-RAYS. A METHOD OF MASS SOLDERING WILL BE DEVELOPED.

COMPONENT -- OPTICS

(1069) TITLE -- MANUFACTURE OF GRADIENT INDEX LENSES

PROBLEM -- MILITARY OPTICAL SYSTEMS ARE HEAVY, ARKWARD, EXPENSIVE AND DIFFICULT TO MAINTAIN ALIGNMENT. ASPHERIC LENSES HAVE COMPLEX SHAPES REQUIRING SPECIAL POLISHING TECHNIQUES WHICH CAUSE THE LENSES TO BE COSTLY.

SOLUTION -- ESTABLISH MANUFACTURING PROCESS FOR THE PRODUCTION OF OPTICAL QUALITY GRADIENT INDEX LENSES.

COMPONENT -- RADOMES

(1122) TITLE -- PRODUCTION OF HIGH PERFORMANCE LOW COST CERAMIC IR DOMES

PROBLEM -- OPTICAL GUIDANCE SYSTEMS FOR HIGH PERFORMANCE MISSILE SYSTEMS WILL REQUIRE CERAMIC DOMES. THE ONLY MATERIAL CURRENTLY AVAILABLE, SINGLE CRYSTAL SAPPHIRE, REQUIRES SPECIAL PROCESSING FACILITIES AND EXPENSIVE SECONDARY OPERATIONS.

SOLUTION -- BASED ON THE RESULTS OF ONGOING RESEARCH ACTIVITY, A MATERIAL WILL BE SELECTED FOR FABRICATION USING FORM TO SHAPE PROCESSES.
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<td><strong>(1203)</strong> TITLE - IMP FGR PROC F/F or 12 IN DIAMETER FOCAL PLANE ARRAY SEEKERS</td>
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<td>PROBLEM - STARRING FOCAL PLANE ARRAY DETECTORS MAKE REDUCTION IN INFRARED SEEKER MECHANICAL COMPLEXITY AND SIZE NOT PREVIOUSLY POSSIBLE. ACHIEVING HIGH PRODUCTION RATE WITH HIGH YIELD IN FABRICATION OF THIS NEW TYPE SEEKERHEAD IS A PROBLEM</td>
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<td>SOLUTION - ESTABLISH MANUFACTURING PROCEDURES FOR LARGE VOLUME HIGH YIELD PRODUCTION OF STARRING FOCAL PLANE ARRAY DETECTORS AND SMALL DIAMETER SEEKERHEADS.</td>
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<td><strong>(1223)</strong> TITLE - IMPROVED MFG PROCESSES STARRING FOCAL PLANE ARRAY DETECTORS</td>
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<td>PROBLEM - THERE IS NO METHOD FOR MAKING A STARRING 128X128 FOCAL PLANE ARRAY FOR SEEKERS THAT INCLUDES THE SIGNAL PROCESSING AND DEWAR ASSEMBLY. PRESENTLY, UNITS ARE HAND-MADE WITH ATTENDANT HIGH COSTS. LONGER LIFE DEWARS ARE NEEDED.</td>
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<tr>
<td>SOLUTION - THE DETECTOR MATERIAL WILL BE MADE IN 10 MICRON THICK WAFERS BY THE LIQUID PHASE EPITAXY PROCESS. A METHOD WILL BE DEVELOPED TO FORM THE ARRAY AND ATTACH IT TO THE PROCESSING CHIPS AND DEWAR ASSEMBLY.</td>
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<td><strong>(1224)</strong> TITLE - IMPROVED MFG PROC F/8-10 MICRON SCANNING TDI FPA DETECTORS</td>
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<td>PROBLEM - THERE IS NO PRODUCTION METHOD FOR MAKING A SCANNING FOCAL PLANE ARRAY FOR SEEKERS THAT INCLUDES THE SIGNAL PROCESSING AND DEWAR ASSEMBLY. PRESENTLY, UNITS ARE HAND-MADE WITH ATTENDANT HIGH COSTS. LONGER LIFE DEWARS ARE NEEDED.</td>
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<tr>
<td>SOLUTION - THE DETECTOR MATERIAL WILL BE MADE IN 10 MICRON THICK WAFERS BY THE LIQUID PHASE EPITAXY PROCESS. A METHOD WILL BE DEVELOPED TO FORM THE ARRAY AND ATTACH IT TO THE PROCESSING CHIPS AND DEWAR ASSEMBLY.</td>
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<td><strong>(1231)</strong> TITLE - AN INTEGRATED 94 GHZ SUBMINITIONS TRANSCEIVER</td>
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<td>PROBLEM - THE TRANSCEIVER IS VERY EXPENSIVE DUE TO THE LABOR REQUIRED TO MATCH, ALIGN AND TEST COMPONENTS AND TO INTEGRATE THESE COMPONENTS INTO A TRANSCEIVER WHICH HAS THE REQUIRED PERFORMANCE.</td>
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<td>SOLUTION - EQUIPMENT FOR A DEPOSITION PROCESS DEVELOPED AT EARAIO WILL BE ASSEMBLED TO PLACE TRANSMISSION MEDIA AND DEVICES ON A SUBSTRATE BASE. THIS EQUIPMENT AND THE PROCEDURES FOR IT WILL CONTROL THE CRITICAL TOLERANCES REQUIRED.</td>
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<td><strong>(3178)</strong> TITLE - IMPROVED MANUFACTURING PROCESSES FOR LASER IR/OPTICAL SEEKER</td>
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<td>PROBLEM - FIBER OPTICS FIXTURE ARE DIFFICULT AND EXPENSIVE TO MAKE.</td>
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<td>SOLUTION - REDUCE FIBER OPTICS FIXTURE DIFFICULTIES BY DEVISING METHODS TO REDUCE HANDLING OF FIBER FIXTURE AND DETECTOR ARRAY.</td>
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COMPONENT — SEEKERS

(3186) TITLE - IMPROVED MANUFACTURE OF INFRARED SUBMISSILE SEEKERS

PROBLEM - LOW YIELD OF SEEKER COMPONENTS IS DUE TO HANDLING AND CHECKOUT OF
GYRO OPTICS.

SOLUTION - PROVIDE LOWER COST SPHERICAL ELEMENTS TO REPLACE THE ASPHERICS.
PROVIDE A FIBER OPTIC CUTTING METHOD THAT WILL ELIMINATE THE NEED TO POLISH
THE FIBER INDS. OPTIMIZE THE FIBER OPTIC MATERIALS TO EXTEND THE OPERATING
RANGE TO LONGER WAVELENGTHS.

COMPONENT — SENSORS

(1079) TITLE - WIDE AREA MERCURY-CADMIUM-TELLURIDE QUADRENT DETECTORS

PROBLEM - LARGE AREA MERCURY-CADMIUM-TELLURIDE QUADRENT DETECTORS FOR IR
SEEKERS ARE EXPENSIVE BECAUSE OF HIGH MATERIAL COST AND LOW YIELD. THE
MATERIAL IS HARD TO GROW TO THE RIGHT CHEMICAL BALANCE. SLICING, ION
IMPLANTATION AND/OR DIFFUSION ARE TOUCHY.

SOLUTION - FIND THE EXACT CHEMISTRY FOR GOOD DETECTOR OUTPUT. LOOK AT CLOSED
LOOP COMPUTER CONTROL OF CRYSTAL PULLING. OPTIMIZE X-RAY CHARACTERIZATION,
SAWING, POLISHING, ION IMPLANTATION, AND TESTING.

(1090) TITLE - ION IMPLANTED THIN FILM TRANSISTORS

PROBLEM - PROCESSES FOR MANUFACTURING THIN FILM TRANSISTORS PRODUCE
INCONSISTENT RESULTS DUE TO INABILITY TO CONTROL THE GEOMETRIES AND
ELECTRICAL PROPERTIES OF THE MATERIAL.

SOLUTION - ESTABLISH ION IMPLANT TECHNOLOGY APPLICABLE TO THE DESIGN AND
FABRICATION OF THIN FILM ACTIVE DEVICES.

(1094) TITLE - PROD METH F/MILLIMTR MONOPULSE ANTENNA F/DIR FIRE APPL

PROBLEM - SENSOR ANTENNA SYSTEM NEEDS RELATIVE ALIGNMENT FACTORS BETWEEN
DIELECTRIC LENS, MOBILE REFLECTOR AND ACTIVE ANTENNA ELEMENT REQUIRING
ANTENNA FEED UNITS BUILT BY HAND.

SOLUTION - ESTABLISH METHODOLOGY FOR CONSTRUCTING MONOPULSE ANTENNA INTO A
COMPATIBLE PACKAGE WITH A 5 MILLIRADIAN BEAM WIDTH AT 94 GHZ.

(1098) TITLE - LARGE DIAMETER SILICON

PROBLEM - MILITARY REQUIREMENTS FOR DETECTORS ARE EXCEEDING STANDARD SIZES.
SPECIAL TOOLING AND REPLACEMENT PARTS CREATE A PREMIUM ON COST AND TIME
DELAYS.

SOLUTION - INVESTIGATE ETCHING, ULTRASONIC CAVITATION, LASER SCRIBING, SAWING
AND TREPANNING FOR CUTTING .8 IN DISCS FROM 3 IN WAFERS. REDUCE STRESS AND
PREVENT FAILURES.
### MMT FIVE YEAR PLAN

**RCS DRMT 126**

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<td>(1109) TITLE — MFG METH AND TECH F/PIN DIODES AT MILLIMETER WAVE FREQUENCY</td>
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<td>PROBLEM — CURRENT MANUFACTURE TECHNIQUES FOR DIODES ARE LIMITED BY WAFER SIZE AND BONDING. OTHER PROBLEMS INCLUDE METAL SYSTEMS WITH BONDING AND ETCHING, SAWING, LAPPING AND POLISHING FOR PRECISE DIMENSIONS.</td>
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<td>SOLUTION — ESTABLISH METHODS FOR WAFER SAWING, STACKING AND BONDING, AND FOR STACK SAWING, LAPPING, AND POLISHING IN ORDER TO OBTAIN A THREE DIMENSIONAL DIODE STRUCTURE. THEN FIT AND ATTACH POLISHED STACKS TO WAVEGUIDE WALL. ALSO SET UP A HIGH TEMP METAL SYS.</td>
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<td>(1104) TITLE — IMPROVED SANDWICH DETECTOR FABRICATION FOR INFRARED SEEKERS</td>
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<td>PROBLEM — FABRICATING TWO DETECTORS INTO A SANDWICH CAUSES LOWER SENSITIVITY, CROSS TALK, PUDDLE TRANSMISSION, AND PROVIDES A DETECTOR TO THICK FOR A COMMON FOCUS.</td>
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<td>SOLUTION — ESTABLISH METHODOLOGY FOR PRODUCING DETECTOR OPERATING IN TWO SPECTRAL BANDS FROM ONE PIECE OF MATERIAL.</td>
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<td>(1120) TITLE — DETECTOR GRADE CADMIUM SULFIDE (CYS)</td>
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<td>PROBLEM — CURRENTLY AVAILABLE PROCESSES FOR PRODUCING CADMIUM SULFIDE CRYSTALS OFTEN RESULT IN SMALL BOULE SIZES THAT LOSE CRYSTALLINITY, LARGE RESISTIVITY VARIATIONS, AND HIGH DENSITY OF CRYSTALINE FLAWS.</td>
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<td>SOLUTION — SEEK IMPROVEMENTS IN THE CURRENT PROCESS AND DEVELOP NEW PROCESSES.</td>
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<td>(1128) TITLE — IMPROVED MANUF PROC F/P CO2 BEAMRIDER MISSILE RECEIVERS</td>
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<td>PROBLEM — THE COST OF THE R&amp;D PROTOTYPE RECEIVER MODELS IS FROM $20K TO $60K. FABRICATION IS HIGHLY LABOR INTENSIVE AND THE YIELD RATE IS LOW. TO BE CONSIDERED FOR IMPLEMENTATION, COSTS MUST BE BROUGHT DOWN TO $700.00 OR LESS.</td>
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<td>SOLUTION — IMPROVED PRODUCTION TEST AND ASSEMBLY PROCEDURES WILL BE DEVELOPED FOR THE FABRICATION OF INEXPENSIVE, COST EFFECTIVE AND RELIABLE RECEIVERS.</td>
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<td>(3117) TITLE — MANUFACTURING PROCESSES FOR SOLID STATE IMAGING SENSORS</td>
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<td>PROBLEM — EXISTING PROCESSES ARE LOW YIELD AND NON-UNIFORM, MECHANICAL VAPOR DEPOSITION MUST BE OPTIMIZED.</td>
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<td>SOLUTION — ESTABLISH THE PROCESSES CIRCUMVENTING PRESENT PROBLEMS ON WIRE BONDING, TWEAKING, TESTING, ETC.</td>
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**COMPONENT -- WINDOWS/RADOMES**

**(1108) TITLE -- RF AND LASER HARDENING OF MISSILE DOMES**

**PROBLEM -- CURRENT RADOMES ARE SUSCEPTIBLE TO DAMAGE BY LASER ENERGY AND ALSO PERMIT LASER AND RADIO FREQUENCY ENERGY TO DAMAGE THE DETECTOR.**

**SOLUTION -- DEVELOP RF SPUTTERING METHODS TO APPLY INOUM OXIDE, TIN OXIDE AND ANOTHER MATERIAL TO THE INSIDE OF THE GLASS OR PLASTIC RADOME. USE COATINGS THAT PASS ONLY .8 TO 1.5 MICRON WAVELENGTHS.**

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**COMPONENT -- CIRCUITRY**

**(1109) TITLE -- LOW MASS FIBER CONDUCTOR**

**PROBLEM -- PRESENT CHIP AND WIRE TECHNOLOGY USES 1 MIL GOLD OR ALUMINUM WIRE FOR INTERCONNECTING IC CHIPS TO HYBRID SUBSTRATES. A 1 MIL SYNTHETIC FIBER WOULD PRECLUDE MOST BOND INTERFACE FAILURES. FIBER RESISTIVITY, DIA? COMPATIBLE EPUXIES ARE PROBLEMS.**

**SOLUTION -- VARIOUS SYNTHETIC FIBERS, CONDUCTIVE EPOXY BONDING, ? METALLIC PLATING WILL BE EVALUATED. SUITABLE BONDING EQUIPMENT WILL BE ESTABLISHED? COORDINATED WITH OPTIMUM FIBER CONDUCTOR.**

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**COMPONENT -- AIRFRAMES-COMPOSITES**

**(1102) TITLE -- MFG PROCESSES FOR FUSED SILICA FIBERS**

**PROBLEM -- THERE IS NO COMMERCIAL SOURCE FOR HIGH PURITY FUSED SILICA FIBERS.**

**SOLUTION -- SCALE-UP PROCEDURES USED FOR FIBER OPTICS APPLICATIONS AND SET UP A PILOT PRODUCTION LINE TO PRODUCE FUSED FIBERS OF STRUCTURAL QUALITY**

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COMPONENT -- AIRFRAMES-COMPOSITES  (CONTINUED)

(1080) TITLE -- LOW COST CARBON/CARBON NOSETIPS

PROBLEM -- THE WEAVING PROCESS TO FABRICATE CARBON/CARBON NOSETIP PREFORMS IS LABOR INTENSIVE BECAUSE OF THE FINEWEAVE CENTER-TO-CENTER YARN SPACINGS. IN ADDITION, PREFORMS USE EXPENSIVE GRAPHITE YARN AND REQUIRE LONG IMPREGNATION CYCLES.

SOLUTION -- DEVELOP OPTIMAL FABRICATING PROCEDURES FROM LOWER COST MATERIALS, PITCH RESIN AND T-300 CARBON FIBERS. UTILIZATION OF SHORTER OENSIFICATION CYCLES PREFORMS, AND FIBER SPACINGS WILL PROVIDE THE MEANS FOR REDUCING CYCLE TIMES.

(1082) TITLE -- HIGH ANGLE TAPE WRAPPED HEATSHIELDS

PROBLEM -- DATA HAS SHOWN THAT THE EROSION PERFORMANCE OF TAPE WRAPPED HEATSHIELDS IMPROVES AS THE SHINGLE ANGLE INCREASES ABOVE 30 DEGREES. CURRENT MFG TECHNIQUES DO NOT LENI THEMSELVES TO HIGH WRAP-ANGLE HEATSHIELDS.

SOLUTION -- DEVELOP IMPROVED WRAPPING TECHNIQUES TO CURRENT TAPE WRAPPING EQUIPMENT AND PROCESSING TECHNOLOGY.

COMPONENT -- COMPONENTS

(1073) TITLE -- REAL TIME ULTRASONIC IMAGING

PROBLEM -- EXISTING ACUOSTICAL Holography INSPECTION SYSTEM PRODUCES UNSATISFACTORY VIDEO IMAGES DUE TO POOR RESOLUTION, SIGNAL NOISE AND LOW SPATIAL FREQUENCY ABERRATIONS.

SOLUTION -- A 3 CHANNEL PIPELINE PROCESSOR WITH ASSOCIATED 512X512X8 MEMORIES WITH A 30 FRAMES/SEC DISPLAY CAPABILITY. THIS SYS WOULD ELIMINATE ABERRATION, IMPROVE CONTRAST, AND REDUCE SIGNAL NOISE.

(3288) TITLE -- MANUFACTURING TECHNOLOGY FOR DIE CASTING

PROBLEM -- WEIGHT AND SPACE CONSTRAINTS HAVE RESULTED IN COMPLEX AND HIGH DENSITY CONFIGURATIONS OF METAL PARTS WHICH ARE MACHINE.

SOLUTION -- ESTABLISH AND PROVE-OUT DIE CASTING TECHNIQUES FOR THESE COMPLEX CONFIGURATIONS.

COMPONENT -- MACHINING

(3302) TITLE -- ELECTRO DISCHARGE MACHINING PROCEDURE

PROBLEM -- THERE ARE MANY FABRICATION PROBLEMS DUE TO TIGHT TOLERANCE REQUIREMENTS IN FABRICATING MOUNTING HOLES FOR ARRAY ELEMENTS OF THE RADAR ANTENNAS.

SOLUTION -- ESTABLISH TOOLING AND TECHNIQUES FOR FURNING HOLES IN FULL-SIZE ARRAY ELEMENT SUPPORT PLATES BY ELECTRO DISCHARGE MACHINING.
**CATEGORY**

**MOTORIZATION SYSTEM**

**COMPONENT — MOTOR CASES**

**(1088) TITLE — OPTIMIZED MANUFACTURE AND UTILIZATION F/CMP MOTOR CASES**

**PROBLEM** — Optimizing production procedures to obtain lowest unit cost while maintaining reliability in fabrication.

**SOLUTION** — Establish production procedures and production rates for manurel fabrication. This will provide production engineering data essential to current and future motor component requirements.

**(1089) TITLE — INTEGRAL ROCKET MOTOR COMPOSITE POLE PIECES AND ATTACHMENTS**

**PROBLEM** — Current filament wound composite rocket motor cases require forged metal pole pieces, nozzle closure attachment rings, and other attachment rings. These components are expensive, and require long lead time procurement.

**SOLUTION** — Establish a filament winding production process for fabricating composite motor cases with integral pole pieces, aft attachment rings, and forward and aft dome sections.

**(3343) TITLE — FABRICATION OF INTEGRATED CASE AND GRAIN**

**PROBLEM** — Considerable labor is required to manufacture, assemble, and finish propulsion systems.

**SOLUTION** — Develop strip wound integrated case and grain process to integrate manufacture, assembly, and finishing in low cost automatic production line.

**(3419) TITLE — THERMOMECHANICAL METHODS FOR HIGH STRENGTH STEL R&T MTR CASES**

**PROBLEM** — The manufacturing processes for high strength rocket motor cases for the MLRS (Formerly GSR) result in a residual stress pattern (radial) that does not take full advantage of the material properties.

**SOLUTION** — This program would develop automated procedures to perform thermomechanical fabrication of the steel motor cases. This process will produce a more desirable stress pattern for increased performance.

**COMPONENT — MOTOR COMPONENTS**

**(1050) TITLE — LOW COST BRAIDED ROCKET MOTOR COMPONENTS**

**PROBLEM** — Rocket motor costs to meet design-to-cost production goals have dictated reevaluation of materials and processes. Missile cases comprise 1/2 of propulsion system cost. Emphasis must be placed on establishing new component mfg processes.

**SOLUTION** — Optimize the production procedures and rates for integrally braided case/nozzle components to provide production engineering data essential to future motor component requirements.
COMPONENT -- MOTOR COMPONENTS

(1051) TITLE - REPLACEMENT OF ASBESTOS IN ROCKET MOTOR INSULATIONS

PROBLEM - PRESENT ASPEROS CONTAINING INSULATORS CAN NO LONGER BE MANUFACTURED AFTER 1981 DUE ITS BEING IDENTIFIED AS A CARCINOGEN. THUS THE GOVT HAS LOST THE CAPABILITY OF USING INSULATING MATERIALS THAT HAS PROVEN TO BE AN EXCELLENT THERMAL BARRIER.

SOLUTION - FILLER MATERIALS OTHER THAN ASPEROS ARE AVAILABLE. FIBER GLASS AND SILICA HAVE BEEN USED IN SPECIALIZED APPLICATIONS AND MULLASTONE LOOKS PROMISING. MATERIALS SPECS AND MOTOR TEST VERIFICATION MUST BE DONE BEFORE A SUBSTITUTE MATERIAL CAN BE USED.

(1086) TITLE - COBALT REPLACEMENT IN MARAGING STEEL F/ROCKET MOTOR COMP

PROBLEM - CURRENT HIGH PERFORMANCE ROCKET MOTOR COMPONENTS UTILIZE MARAGING STEELS IN LARGE QUANTITIES. COBALT, ONE OF THE KEY INGREDIENTS COMES FROM POLITICALLY SENSITIVE AREAS AND IS BECOMING DIFFICULT TO OBTAIN.

SOLUTION - OPTIMIZE MILL PROCEDURES AND EVALUATE IN A ROCKET MOTOR THE NEW COBALT FREE MARAGING STEEL ALLOYS.

(1087) TITLE - APPLICATION OF COMMERCIAL GRADE KEVLAR TO ROCKET MOTOR COMP

PROBLEM - CURRENT MILITARY ROCKET MOTOR COMPONENTS USE KEVLAR 49 FIBER IN LARGE QUANTITIES. THIS AEROSPACE GRADE IS VERY COSTLY.

SOLUTION - OPTIMIZE MILL PROCEDURES AND MOTOR COMPONENT PROCESSING METHODOLOGY FOR COMMERCIAL GRADE KEVLAR AND EVALUATE THE PERFORMANCE IN A ROCKET MOTOR COMPONENT ENVIRONMENT.

COMPONENT -- NOZZLES

(3423) TITLE - LOW COST/HIGH PERFORMANCE FIBRIOUS GRAPHITE ROCKET NOZZLES

PROBLEM - ROCKET SYSTEM USING HIGH PERFORMANCE CARBON/CARBON OR PYROLYTIC GRAPHITE NOZZLES INCREASE HIGH COMPONENT COST.

SOLUTION - THIS PROJECT WILL SCALE UP THE FIBRIOUS GRAPHITE PROCESS TO MAKE FULL-SCALE NOZZLE COMPONENTS AND WILL EXTEND NOZZLE TEST DATA.

COMPONENT -- PROPELLANTS

(1044) TITLE - CONTINUOUS PROCESS FOR PROPELLENT MANUFACTURE

PROBLEM - PROPELLENT MANUFACTURE IS GENERALLY A BATCH PROCESS WITH INHERENT PROBLEMS. CURE ACCELERATORS MUST BE AVOIDED SINCE THEY SHORTEN POT LIFE. THE PROCESS HAS HIGH LABOR REQUIREMENTS. HIGH VISCOSITIES RESULT IN DISCARDING THE BATCH.

SOLUTION - A CONTINUOUS MIXING AND MOTOR LOADING PROCESS WILL REDUCE PRODUCTION LABOR AND FACILITIES, AND IMPROVE PROPELLENT QUALITY AND RELIABILITY. SAFETY PROBLEMS RELATED TO QUANTITY DISTANCES CAN BE MINIMIZED.
### COMPONENT — PROPELLANTS

**(3317) TITLE — CASTING OF PROPELLANTS**

**PROBLEM** — THE END BURNING SUSTAINER GRAIN FOR STINGER IS PRESENTLY CAST AND CURED, MACHINED, INHIBITED WITH BOAT WHICH IS BONDED TO EXTERIOR OF GRAIN.

**SOLUTION** — DEVELOP CAST-ON-BOOT PROCESS TO CAST GRAIN DIRECTLY INTO INHIBITOR BOOT.

**Funding ($000)**

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**(3320) TITLE — NON-DESTRUCTIVE TESTING (NDT) OF PROPELLANTS**

**PROBLEM** — THE FULL COMPLEMENT ON NDT TEST BY CURRENT METHODS IS TOO EXPENSIVE TO BE USED.

**SOLUTION** — DEVELOP A COMPUTERIZED SYSTEM FOR THE ASSESSMENT OF NDT DATA.

**Funding ($000)**

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**(3447) TITLE — SCALE UP AND DEMO FOR THE RECOVERY OF CARBONATE FROM WASTE PROP**

**PROBLEM** — THE PRODUCTION OF N-HEXYLCARBONATE (NHNC) RESULTS IN UP TO 10 PCT REJECTED MATERIAL BECAUSE IT WILL NOT MEET BALLISTIC RATE REQUIREMENTS.

**SOLUTION** — THE SCRAP PROPELLANT CAN BE DISSOLVED IN PENTANE, DRIED AND DISTILLED TO PURIFY IT. THE NHNC THAT WOULD BE SCRAPPED IS THUS RECOVERABLE. THIS PROJECT WILL SCALE UP THE LABORATORY PROCESS SUCH THAT THE TOTAL PROCESS CAN BE DEMONSTRATED.

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**(3449) TITLE — OPTIONAL PROPELLANT INGREDIENTS**

**PROBLEM** — A NUMBER OF CHEMICAL INGREDIENTS USED IN SOLID ROCKET PROPELLANTS HAVE BECOME UNAVAILABLE BECAUSE SOME OF THE REAGENTS ARE HAZARDOUS.

**SOLUTION** — STUDIES SHOW THAT ISOPHORONE DIISOCYANATE (IPDI) CAN BE MADE IN A BATCH PROCESS WITHOUT USING PHOSGENE. THIS LABORATORY PROCESS WILL BE SCALED UP.

**Funding ($000)**

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### COMPONENT — ELECTRICAL TEST EQUIPMENT

**(3115) TITLE — ENGINEERING FOR CALIBRATION EQUIPMENT**

**PROBLEM** — MEASUREMENT SCIENCES OR METROLOGY MUST BE CONTINUALLY ADVANCED IN RELEVANT TECHNOLOGY AREAS TO KEEP PACE WITH MANY ARMY PROGRAMS.

**SOLUTION** — ADVANCEMENTS MUST BE MADE BY DERIVING NEW TYPES OF STANDARDS.

**Funding ($000)**

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COMPONENT -- ELECTRONIC COMPONENTS

(ID60) TITLE -- ELECTRICAL TEST AND SCREENING OF CHIPS

Problem - One unreliable chip in military electronic assemblies causes rejection or destruction of the entire package. Present means for determining chip reliability or integrity is a probe testing technique which is time consuming and destructive.

SOLUTION - Place a monolithic chip testing device at the point just before the chip is bonded to the substrate. Include on the probe a non-destructive point and a method for oxide removal.

(ID76) TITLE -- AUTOMATIC RECOGNITION OF CHIPS

Problem - Inability to recognize the topography of more than six to seven chips on a hybrid substrate, military hybrid circuits carry ten to fifteen type active components.

SOLUTION - Modify existing optical pattern recognition equipment for component and bond pad alignment to recognize an average 30 to 35 different devices per substrate.

(ID92) TITLE -- AUTOMATIC TESTING OF SUBSTRATES

Problem - Multilayer hybrid substrate test methods are mechanical, using a microfine probe. The test method is technically difficult, time consuming and contributes to yield loss.

SOLUTION - Establish a process using an electron beam scanner. Use computer-aided devices and a complete scanning system with a defect library developed to increase yield in substrate fabrication.

(ID243) TITLE -- ANALOG FAULT ISOLATION OF PRINTED CIRCUIT BOARDS

Problem - Manual fault isolation and trouble shooting methods are slow.

SOLUTION - Establish automatic fault isolation and trouble shooting methods for analog circuit assemblies.

COMPONENT -- X-RAY AND N-RAY

(ID241) TITLE -- AUTOMATIC X-RAY READER TEST EQUIPMENT FOR 3D X-RAYS

Problem - X-ray is limited to a two dimensional format and is dependent on the training and judgment of the inspector.

SOLUTION - Automate the analysis of X-ray results, and provide depth perspective by parallel or holographic techniques.
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MERADCOM, located at Fort Belvoir, VA, conducts a widely diversified program to improve the Army's combat readiness in four major areas: barrier and counterbarrier systems; countersurveillance systems; energy and environmental systems; and supply distribution and construction equipment systems.

Procurements for items under MERADCOM's cognizance are placed with the private sector, and much of MERADCOM's MMT effort is accomplished by the private sector.

To address the problem of increased system acquisition costs, MERADCOM has identified major problem areas where improved manufacturing technology is needed. Major problem areas confronting MERADCOM include:

a. **Limitations of High Temperature Super Alloy Components of Gas Turbine Engines.** A limiting factor in the life and performance of gas turbines is the ability of the components to withstand the abrasive and corrosive environment at peak operating temperatures. Super alloy metals utilizing strategic materials are limited to 1750°F operating temperature and are subject to catastrophic failure when subjected to high dust concentrations or corrosive atmosphere such as salt. Thermal efficiency can be improved by increasing peak cycle temperature currently limited by maximum operating temperature of materials of the burner, turbine inlet nozzle, and turbine wheel. The most critical component for damage due to wear and corrosion is the turbine nozzle. Materials are needed which have increased operating temperature limits and improved resistance to corrosion and abrasive wear at a reasonable cost.

b. **Providing Military Bridges at Moderate Cost, Which Have High Mobility and High Emplacement Speeds While Retaining The Ability to Withstand the Abusive Treatment Inherent in the Battlefield Environment.** High strength, low density composite materials offer great promise for solutions to this problem. Increased production of high strength fiber materials has reduced materials cost. Techniques for the fabrication and installation of these materials into usable bridge components is the area in which large cost reductions are possible. The reduction of presently used labor intensive methods, through the application of automated processes, will reduce component costs. Initial design in these materials offer improved performance due to the flexibility possible in material configuration.

c. **Military Quality Power Conditioners.** The development of lightweight, military power conditioners depends on the availability of reliable, lightweight, compact electronic components. The power stages of these conditioners employ an important class of these components - power semiconducting devices. The mass, bulk, and inadequate reliability of currently available devices in the required ratings often prevent application to the power stages of military power conditioners under development. Recognizing the limitations of today's power semiconducting devices, MERADCOM has been developing reliable, lightweight, compact power semiconducting devices.
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COMPONENT — REINFORCEMENT

(3802) TITLE — HIGH STABILITY TRUSS CHORD

PROBLEM — PRODUCE A HIGH STIFFNESS, HIGH STRENGTH, LIGHTWEIGHT, LOW COST, TUBULAR TRUSS ELEMENT WHOSE DESIGN IS CONTROLLED BY ITS SLENDER CONFIGURATION AND PHYSICAL PROPERTIES TO MAINTAIN LOCAL AND GLOBAL STABILITY.

SOLUTION — USE THE CONTINUOUS WINDING OF EPOXY NETTED HIGH MODULUS GRAPHITE FIBER TO FORM MULTIPLE STACKED LOOPS WHICH CAN BE PROPORTIONED AND CONFINED TO PROVIDE THE REQUIRED GEOMETRY.

(3803) TITLE — ACCESS/EGRESS HAT PANELS

PROBLEM — TO PRODUCE AN INEXPENSIVE, LIGHTWEIGHT, METAL PANEL WITH REQUIRED STRENGTH AND SHAPE CHARACTERISTICS USING AN EFFICIENT PRODUCTION METHOD. THE PROVEN PANEL DESIGN FOR ACCESS/EGRESS AT RIVER CROSSINGS IS HAND FABRICATED.

SOLUTION — A ROLL FORMING PROCESS COMBINED WITH OPTIMUM SHEET SIZING PRIOR TO BENDING ARE REQUIRED TO PRODUCE THE REINFORCED, CORRUGATED SHAPE. THIS WILL ELIMINATE THE TIME CONSUMING BREAK PRESS AND HAND WELDING OPERATIONS.

COMPONENT — STRUCTURAL MEMBERS

(3706) TITLE — MULTI HOLLOW SHEAR WEB MODULE

PROBLEM — TO PROVIDE A LIGHTWEIGHT SINGLE PIECE WEB MEMBER WHICH CAN BE EASILY ATTACHED TO TOP AND BOTTOM CHORD MEMBERS.

SOLUTION — WIND THE WEB MODULE ON A LARGE INFLATED CYLINDRICAL MANDREL USING GRAPHITE EPOXY. AFTER WINDING IN UNCURLED STATE DEFLECT MANDBEL AND FORCE WOUND MEMBER INTO MOLD HAVING DESIRED WEB SHAPE AND CURE.

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COMPONENT — HOSES

(3800) TITLE — NON-GUM ELASTOMER HOSES

PROBLEM — HOSE MANUFACTURING HAS CHANGED VERY LITTLE IN 50 YRS. THEY USE GUM RUBBERS, ARE HAND-BUILT AND RESIST AUTOMATION. DESPITE BEING EXPENSIVE PERFORMANCE IS LIMITED IN (1) LOW TEMPERATURE AND (2) COMPATIBILITY WITH A WIDE RANGE OF FLUIDS.

SOLUTION — NEW MATERIALS OFFER IMPROVED PERFORMANCE BUT REQUIRE NEW FABRICATION TECHNIQUES. NEW MANUFACTURING METHODS SHOWN TO BE FEASIBLE UNDER PRIOR R&D. THIS PROJECT PROPOSES TO USE THE NEW MATERIALS, SCALE-UP, OPTIMIZE NEW TECHNIQUES WITH AUTOMATION.

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**COMPONENT — MISCELLANEOUS**

(3710) **TITLE** - ADVANCED MFG TECH FOR PRODUCING AIR CYCLE ECU COMPONENTS

**PROBLEM** - TO REDUCE COST OF COMPRESSOR/EXPANDER PARTS FOR THE ENVIRONMENTAL CONTROL UNIT (ECU) AND TO MEET THE REQUIRED SCHEDULE, A MASS PRODUCTION CAPABILITY MUST BE ESTABLISHED. THIS WORK SUPPORTS AIR CYCLE DEVELOPMENT EFFORTS.

**SOLUTION** - ESTABLISH AN AUTOMATED PROCESS TO REDUCE COMPLEXITY OF THE SEGMENTED COMPRESSOR AND EXPANDER ROTORS. DEVELOP A TECHNIQUE TO CONTROL THE CONCENTRICITY OF THE COMPRESSOR/EXPANDER STATOR AND THE CAM TRACKS IN THE END PLATES.

**COMPONENT — NEUTRALIZERS**

(3796) **TITLE** - COMBAT VEHICLE DETEERING PRODUCTION FACILITY

**PROBLEM** - PRESENT DESIGN AND FABRICATION TECHNIQUES FOR VEHICLES RESULT IN A SIGNIFICANT MAGNETIC SIGNATURE. THIS MAGNETIC SIGNATURE CAN BE USED TO FUZE LAND MINES TO ATTACK THE VEHICLE UNDERCARRIAGE.

**SOLUTION** - CONSTRUCT A PILOT DETEERING PRODUCTION FACILITY THAT WILL ALLOW DEVELOPMENT OF A DEGAUSSING TECHNIQUE FOR US ARMORED VEHICLES

**COMPONENT — MISCELLANEOUS**

(3772) **TITLE** - INTEGRATED POWER SWITCH

**PROBLEM** - HIGH DENSITY PACKING OF POWER SEMICONDUCTORS IN THE SWITCH CONCENTRATES THE HEAT SOURCE. ON A CONVENTIONAL HEAT SINK THIS CAUSES HIGH LOCAL TEMPERATURES WITH CONCOMITANT REDUCED RELIABILITY OF SEMICONDUCTOR DEVICES.

**SOLUTION** - DEVELOP PROCESSES FOR LARGE AREA (3.5 X 7 TO 3.5 X 15 INCH), FLAT SURFACE HEAT PIPE COOLING MODULES TO HANDLE 400 TO 800 WATTS. ELECTRONIC PCB CARD HEAT PIPES HAVE MUCH LESS POWER HANDLING CAPABILITY AND ARE NOT MECHANICALLY ADEQUATE.
COMPONENT -- MISCELLANEOUS

(3785) TITLE - SENSING AND CONTROL MODULE

PROBLEM - TRANSFORMERLESS INVERTERS UTILIZE MANY DISCRETE SEMICONDUCTORS INTERCONNECTED TO INTEGRATE CIRCUITS IN LIEU OF TRANSFORMERS BUT RESULTING HEAT DISSIPATION REQUIRES A BULKY PACKAGE WITH REDUCED RELIABILITY.

SOLUTION - DEVELOP MANUFACTURING PROCESS FOR MODULES INCORPORATING INTEGRATED CIRCUITS AND OTHER ELECTRONIC COMPONENTS WITH A LARGE SCALE INTEGRATED CIRCUIT REPLACING DISCRETE DEVICES. MODULES ARE TO INCLUDE SATISFACTORY COOLING DEVICE SUCH AS A HEAT PIPE.

COMPONENT -- TURBINES

(3719) TITLE - HEAT EXCHANGER FOR 10-30 KW REGEN CYCLE GAS TURBINE

PROBLEM - GAS TURBINE REGENERATORS AND RECUPERATORS SIGNIFICANTLY INCREASE UNIT COST, SIZE AND WEIGHT WHICH OFFSETS BENEFIT OF SIGNIFICANTLY REDUCED FUEL CONSUMPTION.

SOLUTION - DETERMINE METHODS AND TECHNIQUES TO REDUCE FABRICATION COSTS FOR ADVANCED HEAT EXCHANGER-CORE AND HEADER MATERIALS SUITABLE FOR OPERATING IN ADVANCED GAS TURBINE HIGH TEMPERATURE ENVIRONMENT.
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The US Army Tank and Automotive Command is located in Warren, MI, and has the mission of developing, acquiring, and fielding tracked and wheeled military combat, tactical, and general purpose vehicles. The mission is worldwide in scope and includes among its customers all of the US military services, and friendly foreign nations. The production base for mission items is made up of both private and government-owned contractor-operated facilities. MMT efforts are accomplished partially in-house and partially out-of-house. The TACOM MMT program is separated into six categories: armor, general, drive system, track, suspension, and vehicle body.

The main requirements in the field of armor are to increase the ballistic tolerance of conventional armor while reducing its overall weight, and develop new lightweight armor for the high speed, high survivability vehicles which are currently being evaluated in field tests. To meet these requirements, the Command is emphasizing Electro-Slag Remelt (ESR) steel armor and combination type armor to reduce the overall ballistic threat. To pursue these new armor developments, it will be necessary to have commercially available joining processes so that these new armors can be used cost effectively in production. TACOM has established several MMT projects covering joining ESR steel armor, welding complex alloys and shapes by laser, identifying electron beam welding applications, and optimizing both welding procedures and ultrasonic inspection of welds.

The major requirements for propulsion and track are to develop production techniques to manufacture propulsion and drive systems for the M1 and future tracked and non-tracked combat and tactical vehicles. Fabrication and joining are of major concern. TACOM is actively pursuing production development of compliant joints to join metals and non-metals and automated laser machining of complex machine alloys. Life cycle costs for various tactical and combat vehicles can be significantly decreased by eliminating premature failure or extending service life of components by reducing corrosion and deterioration. To support this area, TACOM is endeavoring to bring on line ceramic reinforced combustors.

The track and suspension category is constantly caught in the technical dilemma of producing more advanced systems to meet the ever increasing demands of higher performance in more adverse terrains while maintaining the overall reliability and maintainability of the system at or near current system costs. To achieve these objectives, the track area, as with the other categories, has been sub-divided into major thrust areas for better visibility and management control. These areas
are roadwheels, springs, torsion bar and tube, wheels, rubber pads, and shoes. In these areas the general thrusts have been to introduce production techniques for metal matrix composites, non-metallic matrix composites, advanced rubber compounds, advance elastomeric compounds, lightweight castings, hard surface coatings and powder metallurgy.

In body/frame, the main thrusts are the conservation of fuel and material. To meet these requirements the objective is to reduce the overall weight of the vehicle, to increase its payload, and lower the life cycle cost of the systems by reducing the corrosion and degradation of the materials of construction. Here the main areas of concern are coatings, lightweight/composite structures, miscellaneous components, structural members, and fuel tanks. Within these areas, work will be accomplished in plastic cab tops, maintenance free batteries with high impact resistance, and non-corrosive, lightweight non-structural tactical vehicle components.
<table>
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<tr>
<th>CATEGORY</th>
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<td>(5065) TITLE</td>
<td>ADVANCED TECHNOLOGY SURVEILLANCE COUNTERMEASURES MATERIALS</td>
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<td>PROBLEM</td>
<td>USE OF MATERIALS WHICH WILL DEFEAT SURVEILLANCE MEASURES HAS NOT</td>
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<td>BEEN EXPLOITED IN PRODUCTION.</td>
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<td>(5088) TITLE</td>
<td>HIGH-POWER ELECTRON BEAM WELDING IN AIR</td>
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<td></td>
<td>ECONOMICAL JOINING OF ARMOR MATERIALS.</td>
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<td>(5094) TITLE</td>
<td>ALLOY AND ARMOR STEELS TREATED WITH RARE EARTH ADDITIVES</td>
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<td>PROBLEM</td>
<td>ARMOR STEELS UTILIZED CONVENTIONAL PEGOXCIDIZING AND SCAVENGING</td>
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<td>PROCESSES IN STEEL MAKING.</td>
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<td>THE PRESENT USE OF OIL AS THE QUENCHING MEDIUM IN HEAT TREAT PLANTS</td>
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<td></td>
<td>INCREASES THE PROBABILITY OF QUENCH FIRES, AND IT EMITS</td>
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<td>CONSIDERABLE AMOUNTS OF SMOKE AND FUMES.</td>
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<td>AVOID FIRE AND POLLUTION PROBLEMS.</td>
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<td>(6038) TITLE</td>
<td>HIGH DEPOSITION WELDING PROCESSES FOR ARMOR</td>
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<td>WELDING IS LABOR INTENSIVE AND HIGH COST IT IS A MAJOR COST DRIVER</td>
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<td>IN ARMOR VEHICLE MANUFACTURE.</td>
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<tr>
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<td>HIGH DEPOSITION WELDING PROCESSES WILL PERMIT WELDING TO BE</td>
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<td>ACCOMPLISHED MORE RAPIDLY SO AS REDUCING MANPOWER REQUIREMENTS AND</td>
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<td>INCREASING PRODUCTIVITY.</td>
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<td>(6057) TITLE</td>
<td>M-1 COMBAT VEHICLE-MFG TECHNOLOGY</td>
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<td>PROBLEM</td>
<td>MATERIALS AND MANUFACTURING PROCESSES EMPLOYED IN THE MFG OF THE</td>
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<td>XMI CAN BE IMPROVED BY INCORPORATING NEW TECHNOLOGIES TO THE CURRENT</td>
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<td>SYSTEM THIS WILL ENABLE THE XMI TO BE MANUFACTURED MORE ECONOMICALLY.</td>
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<tr>
<td>SOLUTION</td>
<td>IMPROVE PROCESSES FOR XMI MFG. THESE INCLUDE THERMAL CUTTING,</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>AUTOMATED METALLIZING, BI-CAST HP TURBINE NOZZLES, RSR NICKEL BASE SUPER</td>
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<td></td>
<td>ALLOYS, MONOCRYSTAL ALLOYS, CERAMIC COMBUSTORS, THERMALLY ASSISTED</td>
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<td></td>
<td>MACHINING, ETC.</td>
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</tbody>
</table>
MMT FIVE YEAR PLAN  
RCS DRCMNT 126

COMPONENT — GENERAL  

(6059) TITLE - FVS COMBAT VEHICLE-MFG TECHNOLOGY

PROBLEM - MATERIALS AND MANUFACTURING PROCESSES EMPLOYED IN THE MFG OF THE FVS CAN BE IMPROVED BY INCORPORATING NEW TECHNOLOGIES TO THE CURRENT SYSTEM. THIS WILL ENABLE THE FVS TO BE MANUFACTURED MORE ECONOMICALLY.

SOLUTION - IMPROVE PROCESSES FOR FVS MFG. THESE INCLUDE CAST ALUM COMPONENTS, LASER HEAT TREAT, SELF THREADING FASTNERS, ADHESIVE BONDING, PLASMA ARC WELDING, ETC.

COMPONENT — HULL/BODY

(5014) TITLE - FOUNDRY CASTING PROCESSES USING FLUID FLOW + THERM ANALYS

PROBLEM - FOUNDRY CASTING PROCESSES ARE WASTEFUL OF RAW MATERIALS AND ENERGY.

SOLUTION - OPTIMIZE CASTING PROCESSES BY DIGITAL COMPUTER ANALYSIS OF ADVANCED FLUID FLOW AND THERMAL ACTIVITY.

(5091) TITLE - HEAVY ALUMINUM PLATE FABRICATION

PROBLEM - MANY COMBAT AND TACTICAL VEHICLE HULLS AND THEIR COMPONENTS ARE FABRICATED FROM HEAVY ALUMINUM PLATE. CUTTING THIS HEAVY ALUMINUM PLATE TO SPECIFIED CONTOURS AND WELDING THE PIECES TOGETHER REQUIRES A GREAT DEAL OF MANUAL LABOR.

SOLUTION - ESTABLISH THE CAPABILITY TO CUT HEAVY ALUMINUM PLATE RAPIDLY USING PLASMA ARC WITH NUMERICAL CONTROL. PROCESS PARAMETERS WILL BE ESTABLISHED FOR HIGH DEPOSITION WELDING PROCESSES.

(6053) TITLE - WELDING SYSTEMS INTEGRATION

PROBLEM - OF ALL METAL WORKING PROCESSES EMPLOYED IN TRACKED COMBAT VEHICLES MANUFACTURING, WELDING IS THE MOST LABOR INTENSIVE AND AFTER MACHINING, THE MOST COSTLY. AUTOMATION WHICH COULD REDUCE THESE COSTS IS AS YET AN UNACHIEVED GOAL.

SOLUTION - UNDERTAKE A COORDINATED PROGRAM TO INTEGRATE EXISTING EXPERTISE AND TECHNOLOGY TO ADDRESS ONE APPLICATION (M1 HULL). EXPERTISE WILL BE IN AREAS OF WELDING PROCESS CONTROL, SENSORY TECHNOLOGY, STRESS ANALYSIS, AND COMPUTER CONTROL.

(6073) TITLE - ADAPTION AND AUTOMATION OF ACOUSTIC EMISSION WELD MONITORING

PROBLEM - IN PROCESSES OF HEAVY WELDING SUCH AS WITH ARMOR, RADIOGRAPHIC INSPECTION METHODS ARE CUSTLY AND NOT TOTALLY RELIABLE

SOLUTION - ACOUSTIC SENSORS, USED WITH THE WELDING EQUIPMENT, MONITOR WELD QUALITY AS THE WELD IS MADE. REPAIRS MAY BE MADE IMMEDIATELY.
(5D68) TITLE - NEW ANTI-CORROSIVE MATERIALS AND TECHNIQUES

PROBLEM - METALLIC COMPONENTS ARE DETERIORATED BY THE ENVIRONMENT.

SOLUTION - ESTABLISH TECHNIQUES OF ECONOMICALLY APPLYING ANTI-CORROSIVE MATERIAL COATINGS TO THE COMPONENTS OF THE TACTICAL VEHICLE FLEET.

COMPONENT -- COMPOSITE STRUCTURES

(8042) TITLE - MANUFACTURING TECHNIQUES FOR NON-METALLIC TOTAL VEHICLES

PROBLEM - CURRENT VEHICLE COMPONENTS ARE MADE FROM METALS AND ARE EXCESSIVE IN WEIGHT AND TEND TO CORRODE. NEW NON-METALLIC MATERIALS ARE AVAILABLE AND COULD BE ADAPTED.

SOLUTION - VALIDATE FEASIBILITY OF MOLDING VEHICLE COMPONENTS FROM NON-METALLIC MATERIAL USING A MINIMUM OF PARTS AND ESTABLISH PRODUCTION TECHNIQUES.

(8058) TITLE - EXPLOSIVE BONDING OF COMPOSITE MATERIALS

PROBLEM - REQUIREMENTS TO BOND ALTERNATE PLYS OF STEEL AND ALUMINIUM MAY BE MET ONLY BY CUMBERSOME, EXPENSIVE AND SLOW PROCESSES.

SOLUTION - EXPLOSIVE BONDING BONE STEEL AND ALUMINIUM QUICKLY, RELIABLY, AND CAN BE APPLIED TO ARMOR FABRICATION.

COMPONENT -- FUEL TANKS

(8064) TITLE - LIGHTWEIGHT SADDLE TANK

PROBLEM - FABRICATE AN ECONOMICAL HIGH IMPACT NON-METALLIC FUEL TANK.

SOLUTION - ESTABLISH PROCEDURES AND METHODS TO PRODUCE A LEAK-PROOF FUEL TANK.

COMPONENT -- LIGHTWEIGHT/COMPOSITE STRUCTURES

(4D01) TITLE - MANUFACTURING FOR CORROSION PREVENTION IN TACTICAL VEHICLES

PROBLEM - CURRENTLY THE ARMY HAS SEVERE CORROSION PROBLEMS WITH ITS TACTICAL TRUCK FLEET. ACHIEVING CORROSION RESISTANCE THROUGH THE APPLICATION OF RUSTPROOFING COMPOUNDS CONTRADICTS THE NBC REQUIREMENT FOR VEHICLES WITH CHEMICAL AGENT RESISTANT COATINGS.

SOLUTION - REINFORCED COMPPOSITE MATERIALS CAN REDUCE CORROSION AND WEIGHT AND SIMPLIFY MFG. TECHNOLOGY REQUIREMENTS AND PRODUCTION PARAMETERS FOR VARIOUS COMPONENTS, FROM SMALL PARTS TO COMPLETE TRUCK CABS, WILL BE DETERMINED.
COMPONENT -- MISC COMPONENTS

(4019) TITLE - TACTICAL VEHICLE STORAGE BATTERY

PROBLEM - THE MAJOR CAUSE OF TACTICAL VEHICLE BATTERY FAILURE IS BATTERY CONTAINER BREAKAGE.

SOLUTION - PROVIDE NEW HIGH IMPACT PLASTIC CONTAINER TO INCREASE FIELD PERFORMANCE REQUIREMENTS AND TO ACCOMMODATE THE MAINTENANCE FREE CONCEPT ALREADY RELEASED IN LARGER MILITARY BATTERY SIZES.

COMPONENT -- STRUCTURAL MEMBERS

(4579) TITLE - INDUSTRIAL PRACTICES FOR WELDING CONSTRUCTIONAL ALLOY STEELS

PROBLEM - A WIDE VARIETY OF HIGH STRENGTH CONSTRUCTIONAL ALLOYS STILL WILL BE USED IN GREATER QUANTITIES TO MEET WEIGHT REQUIREMENTS.

SOLUTION - DOCUMENT RECOMMENDED WELDING PRACTICES AND PROCEDURES TO IDENTIFY SIGNIFICANT FACTORS AFFECTING PRODUCTION QUALITY FOR THE VARIOUS MATERIALS AND EQUIPMENT.

(6067) TITLE - AUTOMATED PROTOTYPE FRAME WELDING

PROBLEM - THE WELDING OF SPECIALIZED TRUCK AND TRAILER FRAMES BY THE MANUAL METHOD IS TIME CONSUMING AND COSTLY.

SOLUTION - ESTABLISH A UNIVERSAL FIXTURE THAT WILL USE AUTOMATIC WELDING PROCEDURES.

COMPONENT -- ENGINE

(5053) TITLE - MANUFACTURE OF ENGINE COMPONENTS OF CERAMIC

PROBLEM - FABRICATION OF HIGH EFFICIENCY, HIGH TEMPERATURE DIESEL ENGINES REQUIRES ADVANCED MATERIALS. ENGINES FABRICATED WITH CERAMIC COMPONENTS HAVE BEEN DEMONSTRATED IN R&D BUT MANUFACTURING METHODS FOR SERIAL PRODUCTION COMPONENTS ARE LACKING.

SOLUTION - RECENT RESEARCH EFFORTS INDICATE THAT ENGINE COMPONENTS FROM HIGH STRENGTH STRUCTURAL CERAMICS (SILICON NITRIDE, SILICON CARBIDE) ARE FEASIBLE. THIS EFFORT WILL ESTABLISH QUANTITY PRODUCTION OF CERAMIC COMPONENTS OF CONSISTENT QUALITY.
(6008) TITLE - AUTOMATED COMPUTER CONTROL LASER MACHINING
PROBLEM - CONVENTIONAL MACHINING OF DIFFICULT TO MACHINE MATERIALS IS VERY EXPENSIVE. RAPID TOOL WEAR AND LOCALIZED HEATING OF THE WORKPIECE IMPACT REMOVAL RATES AND METALLURGICAL CHARACTERISTICS.
SOLUTION - THIS PROGRAM WILL DEVELOP TECHNIQUES FOR LASER MACHINING BY NUMERICAL CONTROL.

(6018) TITLE - JOINING OF ATTACHMENTS TO CERAMICS
PROBLEM - CURRENT METHOD OF JOINING METALS TO CERAMIC JOINTS ARE NOT RELIABLE AND HAVE POOR LIFE.
SOLUTION - INVESTIGATE USE OF JOINTS THAT ARE COMPLIANT OR USE INTERMEDIATE CONNECTING PHASE.

(6019) TITLE - GRAIN BOUNDARY IMPROVEMENT PROCESSING FOR CERAMICS
PROBLEM - EFFECT OF HIGH TEMPERATURE ON CERAMICS GRAIN BOUNDARIES LIMIT THEIR APPLICATION.
SOLUTION - UPSCALE DEVELOPED TECHNIQUES FOR DEVELOPING A NONGLASS BOUNDARY OR ELIMINATE THE GRAIN BOUNDARY PHASE.

(6028) TITLE - PRODUCTION QUALITY CONTROL BY AUTO INSPECTION EQUIPMENT (CAM)
PROBLEM - THE INCREASED COMPLEXITY OF COMBAT VEHICLES HAS RESULTED IN EXCESSIVE TIME AND HIGH SKILL LEVEL REQUIREMENTS FOR INSPECTION AND TEST.
SOLUTION - DEVELOP AUTOMATED DIAGNOSTIC EQUIPMENT TO REDUCE TIME AND LOWER SKILL REQUIREMENTS. AUTOMATION OF WIRING HARNESS AND ENG. WILL BE ACCOMPLISHED. AUTOMATION OF INSPECTION RECORDS WILL BE ACCOMPLISHED.

(6079) TITLE - AGT-1500 ENGINE
PROBLEM - THE NEED TO REDUCE COST AND IMPROVE PERFORMANCE OF THE AGT-1500 TURBINE ENGINE REQUIRES NEWER AND MORE INNOVATIVE MANUFACTURING TECHNOLOGY.
SOLUTION - INCORPORATE NEW PROCESSES AND TECHNOLOGY INTO THE AGT-1500 MANUFACTURING METHODS.

COMPONENT --- TRANSMISSION

(5005) TITLE - COLD FORGED GEARS TO DRAWING TOLERANCES
PROBLEM - MACHINING AND OTHER PROCESSES ADD COST TO THE FINISHED COMPONENT.
SOLUTION - ESTABLISH A MFG PROCESS TO RESULT IN A FINISHED GEAR TO DRAWING TOLERANCES FROM BAR STOCK AT AMBIENT TEMPERATURES.
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<th>COMPONENT -- TRANSMISSION (CONTINUED)</th>
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<tr>
<td><strong>(9D24) TITLE -- GEAR DIE DESIGN AND MFG UTILIZING COMPUTER TECHNOLOGY (CAM)</strong></td>
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<tr>
<td>PROBLEM -- THE CONTROL OF DIMENSIONAL TOLERANCES OF FORGED BEVEL GEARS PRESENTS A UNIQUE PROBLEM SINCE THESE GEARS ARE NOT MFG. TO THEORETICAL EQUATIONS. THE BEVEL GEAR IS NOT DEFINED DIMENSIONALY BUT IS PRESENTED AS REQUIREMENTS FOR TOOTH BEARING PATTERNS.</td>
</tr>
<tr>
<td>SOLUTION -- THIS PROGRAM WILL ELIMINATE THE CURRENT TRIAL AND ERROR METHODS BY UTILIZING CAD/CAM METHODS AND INTERACTIVE GRAPHICS TECHNIQUES. EXCESSIVE SCRAP, UNEXPECTED DIE WEAR AND BREAKAGE, AND THE HIGH COST OF FURGING DIES WILL BE ADDRESSED.</td>
</tr>
<tr>
<td><strong>(9083) TITLE -- UPGRADE OF INVESTMENT CASTING MACHINES</strong></td>
</tr>
<tr>
<td>PROBLEM -- MACHINES HAVE NOT BEEN UTILIZED IN LARGE COMPONENTS</td>
</tr>
<tr>
<td>SOLUTION -- MACHINES WHICH PRODUCE HIGH DENSITY HIGH STRENGTH LARGE COMPLEX SHAPES.</td>
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**CATEGORY**

**FACTORY MODERNIZATION**

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<tr>
<td><strong>(6D89) TITLE -- ABRAMS TANK PRODUCTIVITY IMPROVEMENT (PHASE I)</strong></td>
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<tr>
<td>PROBLEM -- LIMA TANK PLANT, PRESENTLY THE ONLY ABRAMS TANK PRODUCING FACILITY, HAS PROBLEMS WITH EQUIPMENT, FIXTURED, PROCESSING, INSPECT TECHNIQUES RESULTING IN EXCESSIVE MANUFACTURING COSTS, LOW DELIVERY SCHEDULES. WARREN PLANT WILL BE USED FOR ABRAMS AROUND MID 85.</td>
</tr>
<tr>
<td>SOLUTION -- ANALYZE LIMA, WARREN TANK PLANTS FOCUSING ON PRODUCTIVITY, COST SAVINGS, MODERNIZATION. DEVELOP A MFG ENVIORNMENT TO REDUCE COSTS TO ARMY, IMPROVE PRODUCTIVITY, INSURE TIMELY DELIVERIES.</td>
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<tr>
<td><strong>(6D90) TITLE -- VEHICLE MFG PRODUCTIVITY IMPROVEMENT PROGRAM</strong></td>
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<tr>
<td>PROBLEM -- THE AGING FACILITY AND OUTDATED TECHNIQUES HAVE RESULTED IN AN INEFFECTIVE OPERATIONAL AND SLOW DELIVERIES.</td>
</tr>
<tr>
<td>SOLUTION -- DEVELOP AND DEFINE AN ENVIRONMENT AND IMPLEMENTATION PLAN TO IMPROVE PRODUCTIVITY, REDUCE REFURBISHING COSTS TO THE ARMY, AND INSURE TIMELY DELIVERY.</td>
</tr>
</tbody>
</table>
COMPONENT -- MISCELLANEOUS

(6095) TITLE - ABRAMS TRANSMISSION PRODUCTIVITY IMPROVEMENTS

PROBLEM - A NUMBER OF TECHNOLOGICAL AREAS HAVE BEEN IDENTIFIED WHICH CAN BE APPLIED AS COST REDUCING MEASURES OR AS A MEANS OF IMPROVING THE MANUFACTuring COST OF THE M1 ABRAMS TRANSMISSION.

SOLUTION - THE TECHNOLOGICAL AREAS WILL BE SEPARATED INTO 4 TASKS. A FINAL REPORT WILL BE GENERATED FOR EACH TASK ALONG WITH PILOT HARDWARE AND/OR CHANGES TO THE TECHNICAL DATA PACKAGE AS APPROPRIATE TO ACCOMMODATE IMPLEMENTATION.

* CATEGORY *
* GENERAL *

COMPONENT -- MISCELLANEOUS

(5082) TITLE - FLEXIBLE MACHINING SYSTEM PILOTLINE FOR TCV COMPONENT

PROBLEM - PARTS FOR TRACKED COMBAT VEHICLES ARE TYPICALLY NOT MANUFACTURED IN LARGE QUANTITIES. BECAUSE OF THIS, MASS PDN TECHNOLOGIES THAT RESULT IN LOWER PDN COSTS ARE NOT USED.

SOLUTION - THE ADVANTAGES OF MASS PDN CAN BE REALIZED IN PRODUCING MEDIUM QUANTITY SIZE LOTS BY A CONCEPT KNOWN AS, FLEXIBLE MACHINING SYSTEMS. THIS PROJECT WILL ADVANCE THE FMS TECHNOLOGY MAKING IT FEASIBLE TO UTILIZE FMS FOR THE MFG OF ARMY MATERIEL.

(5090) TITLE - IMPROVED AND COST EFFECTIVE MACHINING TECHNOLOGY

PROBLEM - MACHINE DATA ON NEWER MATERIALS AND NEW REMOVAL RATES ARE NOT ESTABLISHED.

SOLUTION - ESTABLISH DATA ON NEWER MATERIALS WHEREAS THE NEW MACHINING EQUIPMENT MAY BE UTILIZED WITH MAXIMUM EFFICIENCY.

(5093) TITLE - MANUFACTURING METHODS FOR HIGH SPEED MACHINING FERROUS ALLOYS

PROBLEM - FAST CHIP REMOVAL FOR ALUMINUM ALLOYS HAVE NOT BEEN ESTABLISHED FOR PRODUCTION.

SOLUTION - ESTABLISH FAST CHIP REMOVAL FOR PRODUCTION CONDITIONS.

(6025) TITLE - MANUFACTURING LASER FACILITY

PROBLEM - THE FEASIBILITY OF USING LASERS FOR METAL PROCESSING IS ESTABLISHED. IMPLEMENTATION IS IMPEDED BY THE COST OF FACILITIZATION.

SOLUTION - ESTABLISH A FACILITY TO IMPLEMENT LASER TECHNOLOGY IN PRODUCTION.
## MMT Five Year Plan

**RCS ORLMT 126**

### Component — Miscellaneous (Continued)

<table>
<thead>
<tr>
<th>Component</th>
<th>Title</th>
<th>Funding ($000)</th>
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<tbody>
<tr>
<td>(6054)</td>
<td>Advanced Metrology Systems Integration</td>
<td>50 500 500 500 300</td>
</tr>
</tbody>
</table>

**Problem** — The metrology methods used in military vehicle manufacture, in general, employs contact gauges manually employed. This represents a substantial part of the cost of our military vehicles.

**Solution** — Non-contact, in-process gauging (electro-optical and laser) will be adapted to a vehicle machining operation. Solid photography will be adapted to meet the measuring requirements of components such as turbine blades.

---

### Component — Road Wheels

<table>
<thead>
<tr>
<th>Component</th>
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<tbody>
<tr>
<td>(4559)</td>
<td>Pressure Casting Techniques for Aluminum Components</td>
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</table>

**Problem** — Aluminum castings require gating and risers which utilize large amounts of material which have to be removed from the castings and used as scrap remelt. This contributes to increased costs of cost items.

**Solution** — Establish manufacturing processes utilizing low pressure casting techniques, thereby eliminating the need for excess gating and totally eliminating risers.

---

### Component — Springs

<table>
<thead>
<tr>
<th>Component</th>
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<tbody>
<tr>
<td>(6011)</td>
<td>Springs from Carbon-Fiber Plastic-Composites</td>
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</table>

**Problem** — Steel springs for tactical vehicles are heavy and subject to failure from fatigue. Carbon fiber composites are lighter and have excellent fatigue resistance.

**Solution** — The technology is known to manufacture leaf springs from carbon-fiber plastic composites, however the techniques for mass production need to be developed.

---

### Component — Torsion Bar/Tube

<table>
<thead>
<tr>
<th>Component</th>
<th>Title</th>
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<tbody>
<tr>
<td>(5002)</td>
<td>Fabricating Torsion Bar Springs from High Strength Steel</td>
<td>150 77</td>
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</tbody>
</table>

**Problem** — Engineering alloy steels can be heat treated to a maximum working hardness which requires large diameter bars thereby interfering with design fits and increasing weight.

**Solution** — Establish methods of fabricating torsion bars utilizing 300000 minimum yield materials.
## MMT Five Year Plan

**RCS ORCM 126**

### Funding (S$000)

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<th>Prior</th>
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</table>

### Component — Torsion Bar/Tube

**Title** — Production Techniques for Combat Vehicle Suspension Systems

**Problem** — Suspension systems of combat vehicles are undergoing a large design change to provide increased mobility performance by utilizing newly developed components. Application of the advanced systems will increase acquisition costs.

**Solution** — Apply advanced manufacturing techniques to reduce or prevent increases in the acquisition costs.

### Component — Wheels

**Title** — Non-Pneumatic Combat Tire Fabrication Techniques

**Problem** — Pneumatic tires on tactical vehicles are subject to combat damage.

**Solution** — Establish processing techniques to assure reliable high mobility, non-pneumatic tires.

### Component — Rubber Pads

**Title** — Inserts and Friction Fillers for Track Rubber Pads

**Problem** — Track pads cut and chunk in rocky or frozen ground resulting in reduced pad life and increased costs and maintenance.

**Solution** — Establish process to incorporate filler friction materials in existing formulations which will reduce cutting and chunking.

**Title** — Rubber for Military Track

**Problem** — Track life is held at its present level by failure of rubber components such as bushings, pads and blocks.

**Solution** — Establish production processes for newly developed elastomer compounds for tracks.
<table>
<thead>
<tr>
<th>COMPONENT -- SHOES</th>
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<tbody>
<tr>
<td>(4513) TITLE -- HIGH DENSITY POWDER METAL PARTS FOR COMBAT VEHICLES</td>
<td></td>
</tr>
<tr>
<td>PROBLEM -- TRACK COMPONENTS WEAR EXCESSIVELY REQUIRING THE TRACK TO BE ADJUSTED AND/OR REPLACED FREQUENTLY.</td>
<td></td>
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<tr>
<td>SOLUTION -- FABRICATE COMPONENTS BY COMPACTING HIGH WEAR ALLOYS FROM POWDER.</td>
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<tr>
<td>(4514) TITLE -- HARD FACING OF TRACK SHOES</td>
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<tr>
<td>PROBLEM -- NO DEFINITE PROCEDURE AND HARD FACING MATERIALS HAVE BEEN ESTABLISHED AS THE MOST SATISFACTORY REPAIR COMBINATION FOR TRACK SHOES. PRIOR EFFORTS HAVE BEEN MADE IN BOTH THE USA AND EUROPE BUT NOTHING DEFINITE HAS RESULTED.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION -- THE TRACK SHOE GROUSERS WILL BE BUILT UP BY DEPOSITION USING A HARD FACING PROCESS. THE PROCESS WILL BE AUTOMATED AND TUNGSTEN WILL BE DESIGNED TO ALLOW THE EQUIPMENT TO FOLLOW THE CONTOURS OF THE TRACK SHOE GROUSERS.</td>
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<td>(5054) TITLE -- LASER SURFACE HARDENING COMBAT VEHICLE COMPONENTS</td>
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<tr>
<td>PROBLEM -- PRESENT METHODS OF SURFACE HARDENING INPUTS HEAT OVER LARGE SURFACE AREA.</td>
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<td>SOLUTION -- ESTABLISH LASER BEAM HARDENING PROCEDURES WITH ITS ATTENDANT FINE BEAM SMALL AREAS RAPID HEATING.</td>
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<td>(6107) TITLE -- IMPROVED M50 TRACK</td>
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<tr>
<td>PROBLEM -- INCREASED VEHICLE PERFORMANCE REQUIREMENTS NECESSITATE HIGHER PERFORMANCE TRACKS THAN THOSE AVAILABLE TODAY. TO IMPLEMENT NEW METAL COMPOSITE, HIGHER STRENGTH FERROUS ALLOYS, AND TITANIUM NEW MANUFACTURING PROCESSES MUST BE ESTABLISHED.</td>
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<tr>
<td>SOLUTION -- TO IMPLEMENT NEW MATERIAL TRACK SHOES AND PINS, INVESTMENT CASTING AND HUT MOLDING TECHNIQUES WILL BE ESTABLISHED FOR METAL MATRIX COMPOSITES.</td>
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FUNDING ($000)

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</table>
TECOM, with headquarters at Aberdeen Proving Ground, MD, is the primary developmental testing agency for the US Army. TECOM plans, conducts, and reports on development tests performed during the life cycle of Army materiel, and evaluates foreign materiel for possible US acquisition. Additional testing is performed as a service to the commodity commands upon their request. The testing organization consists of the aircraft development test activity, three environmental testing activities, five proving grounds (one of which serves as the third environmental activity), and a national missile range. Facilities are located in the continental United States, the Panama Canal Zone and Alaska.

Individual investigations into production test procedures and evaluation techniques are accomplished through TECOM's MMT program. In view of TECOM's mission and the intended results of the MMT efforts (to improve test procedures), the majority of the work is accomplished in-house.

TECOM's MMT efforts are grouped under two general headings: documentation and resource conservation. Individual efforts are funded from these "parent programs." Current funding constrains TECOM to an annual program that supports approximately one-half of their planned efforts.
## TECOM

**COMMAND FUNDING SUMMARY (THOUSANDS)**

<table>
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<th>CATEGORY</th>
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COMPONENT — DOCUMENTATION

(5072) TITLE - TECOM PRODUCTION TEST METHODOLOGY ENGINEERING MEASURES

PROBLEM - STANDARD TEST PROCEDURES ARE REQUIRED TO INSURE THAT TEST ACTIVITIES COLLECT DATA AND CONDUCT TESTS IN A UNIFORM MANNER TO SUPPORT THE OT EVALUATION PROCESS. ACCEPTANCE TEST PROCEDURES ARE REQUIRED TO VERIFY PRN HARDWARE SPECIFICATION COMPLIANCE.

SOLUTION - MAINTAIN TEST OPERATIONS PROCEDURES AND ACCEPTANCE TEST PROCEDURES TO TEST SYSTEMS FOR SPECIFICATION COMPLIANCE.

COMPONENT — RESOURCE CONSERVATION

(5071) TITLE - TECOM PRODUCTION METHODOLOGY ENGINEERING MEASURES

PROBLEM - ARTILLERY,VEHICLE AND ELECTRONIC CONVENTIONAL TEST CAPABILITIES NEED TO BE UPGRADED TO PROVIDE MORE TIMELY ACCURATE TEST DATA FOR THE TEST AND EVALUATION PROCESS.

SOLUTION - DEVELOP A PROGRAM TO UPGRADE CONVENTIONAL TEST CAPABILITIES AT THE TEST ACTIVITIES.

(5073) TITLE - TECOM PRODUCTION TEST METHODOLOGY ENGINEERING MEASURES

PROBLEM - FIELD TESTING COMPLEX WEAPON SYSTEMS IS COST PROHIBITIVE. SIM TECHNIQUES MUST BE DEVELOPED TO REDUCE THE COST AND MANPOWER REQUIRED TO PERFORM GVT TESTS ROUTINE. PUN TEST PROCESSES MUST BE AUTOMATED BECAUSE OF PERSONNEL REDUCTIONS AT TEST ACTIVITIES.

SOLUTION - DEVELOP SIMULATION TECHNIQUES TO TEST COMPLEX WEAPON SYSTEMS AND AUTOMATE PRODUCTION TEST PROCESSES.
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>PAGE</th>
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<tr>
<td>Factory Modernization</td>
<td>225</td>
</tr>
<tr>
<td>Turbine Engine</td>
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</table>
The US Army Troop Support and Aviation Materiel Readiness Command (TSARCOM) was established on 1 July 1977 in St. Louis, Missouri. TSARCOM's mission is to provide positive readiness support for 23 major categories of equipment to the entire Department of Defense and 80 foreign countries. The diverse mission ranges from fixed-wing and rotary-wing aircraft to a fleet of amphibians and watercraft, and field support items such as generators, bridges, water purifiers, camouflage, mine detectors, air conditioners and heaters, fuel storage and distribution equipment, compasses and surveying instruments.

The focal point of TSARCOM's technology effort is the manufacturing facilities for turbine engines. Stratford Army Engine Plant, operated by AVCO-Lycoming, is the subject of the Army's first factory modernization effort. The goal is to reduce the costs of the T-53, T-55, and AGT-1500 engines by modernizing the plant's management systems, manufacturing methods, processes, production equipment, and computer aided manufacturing systems.
<table>
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<tr>
<th>CATEGORY</th>
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**CATEGORY**

**FACTORY MODERNIZATION**

**COMPONENT -- GENERAL**

**(8192) TITLE -- TURBINE ENGINE PRODUCTIVITY IMPROVEMENT**

PROBLEM - THE STRATFORD ARMY ENGINE PLANT (SAEP) IS IN NEED OF MODERNIZATION. BOTH THE PLANT AND NEARLY 50 PERCENT OF TE EQUIPMENT IS OVER 25 YEARS OLD. A COMBINATION OF AGING MFG FACILITIES, METHODS, PROCESSES, ETC., HAVE RESULTED IN EXCESSIVE MFG COSTS.

SOLUTION - THE THRUST OF THIS PROJECT IS TO ANALYZE THE ENTIRE SAEP FACILITY WITH A FOCUS ON PRODUCTIVITY, COST SAVINGS AND PLANT MODERNIZATION. AREAS TO BE EVALUATED INCLUDE BOTH MGT AND BUSINESS SYSTEMS EG. MFG METHODS, PROCESSES, EQUIP, FACILITIES, AND CAM

**CATEGORY**

**TURBINE ENGINE**

**COMPONENT -- TURBINE BLADES**

**(8190) TITLE -- IMPROVED CUTTER LIFE, T-700 COMP BLISK/IMPELLER MILLING OPEK**

PROBLEM - MILLING CUTTER COST ASSOCIATED WITH THE BLISK AND IMPELLER FOR THE T-700 ENGINE IS AVERAGING $25K PER ENGINE AND IS CONSIDERED EXCESSIVELY HIGH.

SOLUTION - INVESTIGATE CUTTER PARAMETERS WHICH AFFECT CUTTER LIFE, SUCH AS FEEDS, SPEEDS, GEOMETRY, AND CUTTING FLUIDS AND THEREBY DEVELOP A MANUFACTURING TECHNOLOGY TO REDUCE CUTTER COSTS BY 50 PERCENT.
APPENDICES
This section of the MMT Program Plan explains the Army programming cycle for the MMT Program. The objective of the MMT Program is to develop new manufacturing methods and processes that will reduce the cost of producing weapon systems. The program consists of approximately 200 projects annually that concentrate on improving and/or developing manufacturing methods, techniques and processes.

Within the Army, the Directorate for Manufacturing Technology (DMT) has been established to provide overall program responsibility. Functional responsibility is at the commodity oriented, Major Subcommands (SUBMACOM'S). The SUBMACOM'S plan, formulate, budget, and execute individual projects. The Industrial Base Engineering Activity (IBEA) assists DMT on the technical aspects of the Manufacturing Technology Program. The organizational chart on the next page depicts this supporting framework.

Throughout the Program Plan reference is made to various appropriations. These appropriations are identified in the Army Management Structure (AR 37-100-FY) and are established by the US Congress as a standard accounting system. Most MMT efforts are funded through the Procurement Appropriations which include (1) Aircraft, (2) Missile, (3) Weapons and Tracked Combat Vehicles, (4) Ammunition, and (5) Other. A few projects receive funds from the Operations Maintenance, Army (OMA) appropriation.

Identification of manufacturing problems is the first step in developing an MMT Program. Problem areas are conceptualized and compiled into a planning document (the Program Plan). At the date of the publication, the Program Plan contains one funded year, two programmed years and two planned years. As the program cycle proceeds the concepts are refined and project proposals are developed. A diagram depicting this programming cycle is shown on page A-3. To fully understand the entire programming cycle one must realize that DOD budgets on a Fiscal Year (FY). The FY starts on 1 October and ends the last day of the following September. For example, on 1 October 1982, the Army will begin the first quarter of FY83.

The following programming cycle chart depicts the various activities and stages that MMT projects go through. Concepts are first identified in the five year plan according to the projected year funding is expected. Each year these concepts are reevaluated and move forward until they reach the budget phase. Industry has the opportunity to participate in the evaluation of these projects by voicing comments during the annual MTAG conference. At this gathering the current program, the latest budget project and the Program Plan are discussed.
Calender Year Activities
MMT Planning/Budgeting/Review Cycle

YEARLY ACTIVITIES

Program Plan (FY82-86)
FY84 Budget Submission/Review
FY83 MMT Funds Released
MTAG Annual Conference
FY84 Apportionment Submission/Review

The programming cycle shown above starts with the Program Plan. This document consolidates individual submissions from the SUBMACOM'S and develops the planned program. Because Army budget guidance provides "ceilings," potential projects must be prioritized which results in some being excluded or slipped. Inclusion in the Plan does not guarantee that the project will be funded. The level of funding is dependent upon Congressional appropriations.
As projects approach the start of the funding cycle specific objectives and work scopes are developed. These projects are documented in what is known as a P-16. A P-16 is simply the format that is utilized to document data elements such as estimated cost, economics, and description of work. (The P-16 format is described in AR 700-90).

The budget submission represents the first P-16 submitted for inclusion in the program. This submission is followed about nine months later by the more definite apportionment submission. Projects are then funded when the new fiscal year begins. Although this is the normal planning cycle, a project can enter the planning cycle at any point in time. Such a project would be known as a late start submission and funding is usually at the expense of another project.

Criteria for funding individual projects include technical, operational, and economical feasibility. Evaluation includes the potential for technical success, the means by which the results will be implemented, the potential payback or return on investment and the interrelationships that exist between these factors.

For a more comprehensive understanding of the MMT program, the following list of documents is provided for reference:

- DOD Instruction 4200.15, Manufacturing Technology Program
- AR 700-90, The Army Industrial Preparedness Program
- AR 37-100, The Army Management Structure
ARMY MMT PROGRAM REPRESENTATIVES

HQ, DARCOM
US Army Materiel Development and Readiness Command
ATTN: DRCMT
5001 Eisenhower Avenue
Alexandria, VA 22333
C: 202 274-8284/8298
AV: 284-8284/8298

AVRADCOM
US Army Aviation R&D Command
ATTN: DRDAV-EGX, Mr. Dan Haugan
4300 Goodfellow Blvd.
St. Louis, MO 63120
C: 314 263-1625
AV: 693-1625

CECOM
US Army Communications Electronics Command
ATTN: DRSEL-POD-P-G, Messr Feddeler/Esposito/Resnic
ATTN: DRSEL-PC-I-IP-1, Mr. Leon Field
Fort Monmouth, NJ 07703
C: 201 532-4035
AV: 992-4035

ERADCOM
US Army Electronics R&D Command
ATTN: DELET-R, Mr. Joseph Key
Fort Monmouth, NJ 07703
C: 201 544-4258
AV: 995-4258

MICOM
US Army Missile Command
ATTN: DRSMI-RST, Mr. Richard Kotler
Redstone Arsenal, AL 35898
C: 205 876-2065
AV: 746-2065

TACOM
US Army Tank-Automotive Command
ATTN: DRSTA-RCKM, Dr. Jim Chevalier
Warren, MI 48090
C: 313 573-6065/5814
AV: 786-6065/5814/6467

ARRCOM
US Army Armament Materiel Readiness Command
ATTN: DRSA-IRI-A, Mr. Dennis Dunlap
Rock Island Arsenal
Rock Island, IL 61299
C: 309 794-3666/4398
AV: 793-3666/4398

ARRADCOM
US Army Armament R&D Command
ATTN: DRDAR-PMP-P, Mr. Donald J. Fischer
Dover, NJ 07801
C: 201 328-2708
AV: 880-2708
TSARCOM
US Army Troop Support and Aviation Material Readiness Command
ATTN: DRSTS-PLE, Mr. Don G. Doll
4300 Goodfellow Blvd.
St. Louis, MO 63120
C: 314 263-2218
AV: 693-2218

MERADCOM
US Army Mobility Equipment R&D Command
ATTN: DRDME-UE, Mr. R. Goehner
Fort Belvoir, VA 22060
C: 703 664-4221
AV: 354-4221

NLABS
US Army Natick R&D Laboratories
ATTN: DRDNA-EZM, Mr. Frank Civilikas
Natick, MA 01760
C: 617 653-1000, X2793
AV: 955-2349/2351

TECOM
US Army Test & Evaluation Command
ATTN: DRSTE-AD-M, Mr. John Gehrig
Aberdeen Proving Ground, MD 21005
C: 301 278-3677
AV: 283-3677

AMMRC
US Army Materials & Mechanics Research Center
ATTN: DRXMR-PP, Mr. John Gassner
Watertown, MA 02172
C: 617 923-5521
AV: 955-5521

HDL
Harry Diamond Laboratories
ATTN: DELHD-PO-P, Mr. Julius Hoke
2800 Powder Mill Road
Adelphi, MD 20783
C: 202 394-1551
AV: 290-1551

RIA
Rock Island Arsenal
ATTN: SARRI-ENM, Mr. J. W. McGarvey
Rock Island, IL 61299
C: 309 794-4627/4584
AV: 793-4627/4584

WVA
Watervliet Arsenal
ATTN: SARWV-PFI, Mr. T. Wright
Watervliet, NY 12189
C: 518 266-5319
AV: 974-5319

MPBMA
US Army Munitions Production Base Modernization Agency
ATTN: SARPM-PBM-DP, Mr. Joseph Taglairino
Dover, NJ 07801
C: 201 328-6708
AV: 880-6708

AMRDL
US Army Applied Technology Laboratory
US Army Research Technology Lab (AVRADCOM)
ATTN: DAVDL-ATL-ATS, J. Waller
Fort Eustis, VA 23604
C: 804 878-2771/3073
AV: 927-2771/3073

DESCOM
US Army Depot System Command
ATTN: DRSDS-PE, Mr. Jim Shindle
Chambersburg, PA 17201
C: 717 263-6321
AV: 242-6321
IBEA
US Army Industrial Base Engineering Activity
ATTN:  DRXIB-MT, Mr. James Carstens  C:  309 794-5113
Rock Island, IL  61299  AV:  793-5113

DCSRDA (PA 1497, Aircraft)
ATTN:  DAMA-WSA, LTC Jay B. Bisbey  C:  202 695-1362
Room 3B454, The Pentagon  AV:  225-1362
Washington, DC  20310

DCSRDA (PA 2597, Missiles)
ATTN:  DAMA-WSM-A, Mr. John Doyle  C:  202 695-8740
Room 3B485, The Pentagon  AV:  224-8740
Washington, DC  20310

DCSRDA (PA 3297, Weapons; PA 3197, Tracked Combat Vehicles)
ATTN:  DAMA-WSW, LTC Raymond Roskowski  C:  202 697-0106
Room 3D455, The Pentagon  AV:  227-0106
Washington, DC  20310

DCSRDA (PA 5297, Communications/Electronics)
ATTN:  DAMA-CSC-BU, MAJ Paul Harvey  C:  202 695-1881
Room 3D440, The Pentagon  AV:  225-1881
Washington, DC  20310

DCSRDA (Other Procurement Activities:  PA 5197, Tactical and Support Vehicles)
ATTN:  DAMA-CSS-P, LTC L. R. Hawkins  C:  202 694-8720
Room 3D416, The Pentagon  AV:  224-8720
Washington, DC  20310

DCSRDA (Other Procurement Activities:  PA 5397, Other Support)
ATTN:  DAMA-CSS-P, LTC P. K. Linscott  C:  202 694-8720
Room 3D418, The Pentagon  AV:  224-8720
Washington, DC  20310

DCSRDA (PA 4950, Ammunition)
ATTN:  DAMA-CSM-DA, COL Jack King  C:  202 694-4330
Room 3C444, The Pentagon  AV:  224-4330
Washington, DC  20310

DCSRDA (PA 4950, Ammunition)
ATTN:  DAMA-CSM-P, Mr. John Mytryshyn  C:  202 694-4330
Room 3C444, The Pentagon  AV:  224-4330
Washington, DC  20310
INDUSTRIAL BASE ENGINEERING ACTIVITY (IBEA)
POINTS OF CONTACT
MANUFACTURING METHODS AND TECHNOLOGY

<table>
<thead>
<tr>
<th>Telephone Number*</th>
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<tbody>
<tr>
<td>Mr. James Gallaugher, Director (309) 794-5611</td>
</tr>
<tr>
<td>Mr. James Carstens, Chief, Manufacturing Technology Division (309) 794-5113</td>
</tr>
<tr>
<td>Mr. Gordon Ney, Chief, Manufacturing Branch (309) 794-6586</td>
</tr>
<tr>
<td>Mr. Mike Achord (309) 794-5235</td>
</tr>
<tr>
<td>Mr. Ferrel Anderson (309) 794-5235</td>
</tr>
<tr>
<td>Mr. Ken Bezaury (309) 794-6586</td>
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<tr>
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