MANUFACTURING METHODS & TECHNOLOGY

PROGRAM PLAN

CY 1981

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PREPARED BY

MANUFACTURING TECHNOLOGY DIVISION
U S ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS  61299

MAY 1981
This document briefly summarizes the technical work being executed or planned in the MMT Program for fiscal years 81 through 85.
SUBJECT: 1981 DARCOM MMT Program Plan

SEE DISTRIBUTION (Appendix D)


2. The subject document submitted IAW reference in paragraph 1, describes the DARCOM Manufacturing Methods and Technology (MMT) Program for the period FY81-85. This plan was compiled by amending planning data submitted during January-February 1981. The amendments take into account subsequent programming actions taken since February; namely, FY81 project approvals and FY82 apportionment submissions.

3. Because of the dynamic nature of military materiel 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.

FRIDRICK J. MICHEL
Acting Chief, Office of Manufacturing Technology

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CY1981 DARCOM MMT Program Plan
FOREWARD

This document presents information for the DARCOM Manufacturing Methods and Technology (MMT) Program for Fiscal Years 1981-1985. 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.
## INDEX

### I. INTRODUCTION

<table>
<thead>
<tr>
<th>The MMT Program Plan</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization of the MMT Program</td>
<td>1</td>
</tr>
<tr>
<td>Industry Guide</td>
<td>1</td>
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### II. PROGRAM IMPACT

<table>
<thead>
<tr>
<th>The MMT Program</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need for MT</td>
<td>2</td>
</tr>
<tr>
<td>New Systems</td>
<td>4</td>
</tr>
<tr>
<td>MT Thrusts</td>
<td>6</td>
</tr>
</tbody>
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### III. SUMMARY

<table>
<thead>
<tr>
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### IV. COMMAND PLANS

<table>
<thead>
<tr>
<th>US Army Armament Materiel Readiness Command &amp; US Army Armament Research and Development Command</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammunition Program</td>
<td>13</td>
</tr>
<tr>
<td>Weapons Program</td>
<td>69</td>
</tr>
<tr>
<td>US Army Aviation Research and Development Command</td>
<td>103</td>
</tr>
<tr>
<td>US Army Communications &amp; Electronics Command</td>
<td>129</td>
</tr>
<tr>
<td>US Army Electronics Research and Development Command</td>
<td>139</td>
</tr>
<tr>
<td>US Army Materials and Mechanics Research Center</td>
<td>161</td>
</tr>
<tr>
<td>US Army Mobility Equipment Research and Development Command</td>
<td>169</td>
</tr>
<tr>
<td>US Army Missile Command</td>
<td>177</td>
</tr>
<tr>
<td>US Army Tank-Automotive Command</td>
<td>205</td>
</tr>
<tr>
<td>US Army Test and Evaluation Command</td>
<td>225</td>
</tr>
</tbody>
</table>

### V. APPENDICES

<table>
<thead>
<tr>
<th>Industry Guide</th>
<th>Page</th>
</tr>
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<tbody>
<tr>
<td>MMT Points of Contact</td>
<td>A1</td>
</tr>
<tr>
<td>IBEA Points of Contact</td>
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<tr>
<td>Distribution List for Five Year Plan</td>
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INTRODUCTION

The MMT Program Plan

The MMT Program Plan, CY 1981, provides within a single source a summary of current and near-term efforts (FY81-FY85) 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 81-85 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 in a period of low productivity growth with accompanying increased 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 DARCOM.

Excerpt from the Overview Statement by the Under Secretary of Defense Research and Engineering to the 96th Congress, Second Session, 1980:

"Technology is being used as a tool to achieve major cost reductions in manufacturing complex weapons systems and high-quality production hardware in several important ways: improvements in productivity and yield (e.g., computer-aided manufacturing), conservation of strategic materials resulting in reduced production lead times and costs (e.g., "near net shape" fabrication methods and substitution with less critical materials and composites); greater productivity (e.g., improvements in safety, pollution abatement, and energy use); and reliability through improved inspection and quality assurance methods. The Manufacturing Technology Program, a top priority program for increasing the introduction of innovation in the defense industrial procurement program, is funded at 150 million in FY81, representing approximately 0.4 percent of the defense procurement program."

Excerpts from the "Department of Defense Statement on the Science and Technology Program" by the Deputy Under Secretary of Defense for Research and Advanced Technology before the Research and Development Subcommittee of the Committee on Armed Services of the US Senate 96th Congress, Second Session, 5 March 1980:

1. "In addition to multiplying our force effectiveness through improved performance, new technology is required to address defense costs, acquisition barriers, and readiness. Requirements that must be addressed by technical solutions include: improved reliability (which is "designed-in")"
and "manufactured-in" not just "tested-in"); life extension and durability of costly military hardware; conservation, substitution, and recycling technologies for critical materials; increased productivity and reduced manufacturing cost in our defense industrial base; the capability to substitute synthetic fuels for petroleum-based fuels; and improved human engineering to better match operational demands of new equipment to training and readiness levels. Advanced Technology Developments and the Manufacturing Technology Program provide great potential for meeting these requirements and accordingly deserve stronger emphasis in the future than is represented in our FY 1981 budget request. I intend to continue to give strong emphasis to these important elements of the S&T Program as well as . . ."

2. "Much attention has been given to the lack of increased productivity and innovation within US industry. Probably the single most effective program within the DOD to attack this problem and to improve our defense industrial preparedness is the Manufacturing Technology Program. We are working very closely with the military departments and with industry to further strengthen the program. We are striving to provide better visibility for active and completed projects to better articulate the cost savings and productivity improvements which accrue to the DOD (and to the American industry in general)."

3. "The Manufacturing Technology Program (MTP) is an aggressive DOD initiative to exploit innovative manufacturing concepts which show potential to reduce material acquisition costs and to improve industrial productivity . . ."

Excerpts from, "The Department of Defense Statement on Industrial Readiness" by the Under Secretary of Defense for Research and Engineering, before the Defense Industrial Base Panel of the Committee on Armed Services, United States House of Representatives 96th Congress, Second Session, 3 December 1980:

1. "The DOD Manufacturing Technology Program is clearly an extremely important vehicle for improving the health of industry, and one which I fully support . . ."

2. "I consider that my principle proposal as a manager in a defense program is to focus emphasis, to focus priority on the issues that I think are most important. And in the Technology Base I have chosen to focus those on three areas. One of them which you are well familiar with is the very high-speed integrated circuits. A second is the manufacturing technology program which GEN Slay described to you. And the third, which I pull out as a separate item, although it is part of manufacturing technology, is this rapid-solidification technology . . ."

"In this latter regard, I would like to comment on two points which were raised by the Defense Science Board last summer and which I believe Dr. Fuhrman addressed in his testimony before the panel in September.

"The first point concerns service Manufacturing Technology (MANTECH) Programs. In his statement, Dr. Fuhrman said that the DSB recommended that a reasonable portion of each service's procurement budget be devoted to MANTECH Programs. Although he did not specify a percentage, the DSB, in its report, called for annually funding MANTECH to 1% of each service's procurement budget.

"While I understand and support the thrust of the DSB's effort to index MANTECH to procurement expenditures, I suggest that a 1% level may be inadequate. Based on the potential benefits and merits of the project proposals submitted to us on the opportunities we envision, I would be quite willing to see the funding level rise to some 2%, or possibly higher when special opportunities arise and are fully justified.

"Further whatever base percentage is finally agreed upon, I believe that figure should represent a floor which should not be breached by DOD or any other services: . . ."

This strong emphasis was reiterated by General Guthrie during an appearance before the Industrial Preparedness Panel of the House Armed Services Committee, First Session, 97th Congress on 30 April 1981.

New Systems

An expanded MMT program is necessary to support the production base being established for the new systems of the 1980's required to modernize our forces and improve readiness. These systems will run the gamut from tanks to helicopters to ammunition, missiles and vehicles. A new tank, the M-1, is now coming off the assembly line. In addition, the Army will have a new fighting vehicle for infantry. Two new helicopters, one devastating against armor and the other vital to our mobility and logistics, will be built. The latter, the Blackhawk, has already been fielded. Also developed in the last few years and entering into production is a laser-homing artillery shell capable of first round hits against moving targets at 15km. The Artillery will be receiving its first multiple rocket launcher capability in 30 years. The Airborne and Air Mobile Forces are being given the first new Howitzer, the M198, since World War II.

In the area of air defense, development has been completed and fielding of the Patriot missile system has begun. Another new air defense system that will be fielded is the Roland. Also under development is the Division Air Defense Gun.
Command Systems include an integrated Army tactical communications objective system (INTACS) which consists primarily of equipment systems developed under TAC-TAC, TACSAT, SINCGARS, and associated COMSEC programs that will provide for responsive, secure, jam-resistant, mobile and highly automated tactical communications. The Army Helicopter Improvement Program (AdIP) is in support of intelligence, surveillance and target acquisitions. This program is looking at the OH-6 and OH-58 as candidates for an interim Scout helicopter. Following the AdIP Program, if cost justifiable, the advance Scout helicopter will be pursued with a new air frame designed specifically for the Scout mission. Also, currently being developed is a remotely piloted vehicle to provide surveillance and target designation behind enemy lines. The Army is fielding its firefighter radar systems which are capable of detecting incoming mortar artillery and free rockets and provide instant target data on point of origin before the incoming rounds hit. In the air, the stand-off target acquisition system (SOTAS) mounted on a Blackhawk helicopter will be able to detect and locate moving targets, targets which are miles behind enemy lines, from a relatively safe position behind our lines.

The combat support mission area planning trends in the engineering area include: a "combat excavator" for rapid field fortification construction; soil stabilization system; logistic-over-the-shore (LOTS) operation; rapidly placed water storage bladders and hoselines; mobile welldrilling equipment; waste water reuse equipment and improved filtering of saline and NBC contaminated water; new wet-and dry-gap bridges; and rapid crossing sites access/egress systems.

In the mine/countermine area, Army is developing a family of scatterable mines (FASCA), which allows rapid delivery of massive amounts of antitank and antipersonnel mines by artillery, aircraft, or ground distribution. In the countermine area, Army is developing a surface-launched fuel air explosive, that uses the devastating shock of fuel air explosive to rapidly clear paths in the minefields. A mine clearing roller has just been fielded which attaches to the point of the main battle tank and is capable of safely detonating and clearing any known pressure-sensitive mine.

In the area of night vision, Army is in the third generation of passive night vision devices, popularly known as starlight scopes. The size and weight has been reduced and the blooming problem caused by sudden bright light such as flares or muzzle flashes has been reduced. Developments in the night observation area will include: development of third generation light amplification devices, focal plane arrays for thermal imaging, millimeter wave radars and CO2 laser for target acquisition and fire control.
Procurement of various size generators has continued to provide general purpose power sources for field units. In addition, the DOD family of standard generators and associated equipment will be utilized to provide power sources for PATRIOT, CHAPARRAL, TACFIRE, HAWK, and a variety of other missile and air defense systems. Initial procurement of the silent lightweight electrical energy plant (SLEEP) model begins in FY84, and continues with the 3 kW, 5 kW, and 10 kW during the next 10 years.

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
### SUBMACOM SUBMISSION TO MNT PROGRAM
#### BY COMMAND (Thousands of Dollars)

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### ANALYSIS OF PREVIOUS PLANNING DATA

| CY of Plan | Period Covered* | Percent of Submission
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<td>1980</td>
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This chart shows the percentage of projects currently in the review cycle which were planned in previous years' long range plans.

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

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

(291.1) TITLE - BACKGROUND: DRUG AGENT CONTAINERS

PROBLEM - CURRENT METALLIC DECON AGENT CONTAINERS CORRODE BEFORE THE REQUIRED
SHIELD 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.

(291.2) TITLE - MFG TECH FOR CLUTCHING DECONTAMINATION SYSTEM

PROBLEM - PRODUCTION PROCESS ENGINEERING PROBLEMS ARE BEING IDENTIFIED DURING
DEVELOPMENT, UTILIZING PP/PEF FIBERS. PROCESS TECHNOLOGY REQUIRED UNDER
PRODUCTION CONDITIONS FOR COMPRESS AIR ARE MACH ACCOMPLISHED TO INSURE
ECONOMIC AND BROAD BASE PRODUCTION.

SOLUTION - ESTABLISH MINIMUM PILOT FACILITIES AND PROVE OUT THE MASS
PRODUCTION FEASIBILITY OF COMPOUND PROCESS AND FABRICATION. PROVIDE
DESCRIPTIVE OF MANUFACTURE AND IN-PROCESS TEST TOOLING DESIGN DATA FOR THE
PROCESSES AND/OR COMPONENTS INVOLVED.

(291.3) TITLE - MFG TECH FOR INTERIOR SUFFACE DECONTAMINATION SYSTEM

PROBLEM - PROCESS AND METHODS TECHNOLOGY REQUIRED UNDER PRODUCTION CONDITIONS
FOR COMPLEX AREAS WILL HAVE TO BE ACCOMPLISHED AS THE BASIS FOR PRODUCTION
LINE DESIGN TO INSURE ECONOMIC AND BROAD BASE PRODUCTION.

SOLUTION - AS A RESULT OF PEP, ESTABLISH MINIMUM PILOT FACILITIES AND PROVE
OUT THE MASS PRODUCTION FEASIBILITY OF COMPOUND PROCESS AND/OR FABRICATION.
PROVIDE DESCRIPTION OF MANUFACTURE AND IN-PROCESS TEST TOOLING DESIGN DATA
FOR THE PROCESSES.

(291.4) TITLE - MFG TECH FOR OUTER DECONTAMINATION APPARATUS

PROBLEM - PRODUCTION PROCESS ENGINEERING PROBLEMS MUST BE IDENTIFIED DURING
DEVELOPMENT, UTILIZING PP/PEF FIBERS. PROCESS TECHNOLOGY REQUIRED UNDER
PRODUCTION CONDITIONS FOR COMPLEX AREAS WILL HAVE TO BE ACCOMPLISHED TO
INSURE ECONOMIC AND BROAD BASE PRODUCTION.

SOLUTION - AS A RESULT OF PEP, ESTABLISH MINIMUM PILOT FACILITIES AND PROVE
OUT THE MASS PRODUCTION FEASIBILITY OF COMPOUND PROCESS AND/OR FABRICATION.
PROVIDE DESCRIPTION OF MANUFACTURE AND IN-PROCESS TEST TOOLING DESIGN DATA.
TITLE: CHEMICAL REMOTE SENSING SYSTEMS

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

SOLUTION - IN ORDER TO PRODUCE TO LEARN AS SOON AS POSSIBLE IT IS
Necessary That APPROPRIATE MANUFACTURING TECHNOLOGY START BEING DEVELOPED
NOW. CONTRACTORS WHOSE NECESSARY EXPERIENCE WILL BE UTILIZED TO EMBRACE
SOLUTIONS, ETC., FOR QUANTITY MANUFACTURING.

TITLE: MFG TECH FOR CMI AGENT ALPH, ICM2

PROBLEM - PRODUCTION PROCESS ENGINEERING PROBLEMS MUST BE IDENTIFIED DURING
DEVELOPMENT, UTILIZING ERP 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 FACILITIES AND PROVE
OUT THE PRODUCTION FEASIBILITY OF COMPLEX PROCESSES AND FABRICATION.
PROVIDE DESCRIPTION OF MANUFACTURE AND IN-PROCESS TEST TOOLING DESIGN DATA.

TITLE: MFG TECH, AUTOMATIC LIQUID AGENT DETECTOR

PROBLEM - PRODUCTION PROCESS ENGINEERING PROBLEMS MUST BE IDENTIFIED DURING
DEVELOPMENT, UTILIZING ERP 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 FACILITIES AND PROVE
OUT THE PRODUCTION FEASIBILITY OF COMPLEX PROCESSES AND/OR FABRICATION.
PROVIDE DESCRIPTION OF MANUFACTURE AND IN-HOUSE TEST TOOLING DESIGN DATA.

TITLE: MFG TECH FOR LMC RECON VEHICLE III

PROBLEM - PROCESS TECHNOLOGY REQUIRED UNDER PRODUCTION CONDITIONS FOR COMPLEX
AND CRITICAL COMPONENTS MUST BE ESTABLISHED. TWO CRITICAL COMPONENTS
ARE THE MICRO-PROCESSOR AND MASS SPECTROMETER.

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

4965) TITLE - MANUFACTURE OF IMPREGNATED CHARCOAL (WHEATIERITE)

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

SOLUTION - THIS PROJECT WILL DEVELOP A PROCESS TO MANUFACTURE IMPREGNATED CHARCOAL. THIS PROCESS WILL USE HETEROGENEOUS CATALYSIS TO IMPREGNATE CHARCOAL. THE RESULTS WILL BE AS SIMPLE AS POSSIBLE.

4967) TITLE - DISPOSABLE FILTER SCRUBBER

PROBLEM - ALL EFFLUENTS FROM TEST EQUIPMENT MUST BE COMPLETELY SCRUBBED OF ALL TOXIC MATERIALS. FOR HIGH FLOW RATES, STANDARD FILTERS ARE TOO SMALL TO BE ECONOMICAL. CHARCOAL SCRUBBERS MUST BE EMPTIED ONCE A DAY WHICH IS A SERIOUS HAZARD TO THE OPERATOR.

SOLUTION - THIS PROJECT WILL DEVELOP A DISPOSABLE SCRUBBER WHICH WILL BE ECONOMICAL AT HIGH FLOW RATES. IT WILL CONSERVE TEST TIME AND ELIMINATE SAFETY HAZARDS. DESIGN WILL BE AS SIMPLE AS POSSIBLE. CONNECTOR WILL BE LEAK PROOF AND RAPIDLY SET UP.

4910) TITLE - POLLUTION ABATEMENT FOR WHEATIERITE CHARCOAL

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

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

COMPONENT -- PROCESSES

1344) TITLE - SUPER TROPICAL BLOOD

PROBLEM - THERE IS A MAJOR SHORTFALL BETWEEN THE FY71 REQUIREMENTS FOR THIS ITEM AND THE QUANTITY OF IMPORTED CYLINDRICAL LIME KNOWN TO BE AVAILABLE.

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

1715) TITLE - MACHINABLE RECOVERY PROCESSING EVALUATIONS

PROBLEM - A MILLION LB Stockpile of unused/available munitions contain 1.41 MILLION LBS. OF HD, STOCKPILE WILL SHRINK BY 560,000 POUNDS PER YEAR. ENVIRONMENTAL REQUIREMENTS IF HD IS NOT RECOVERED.

SOLUTION - EXPLOIT EXISTING TECHNOLOGY TO RECOVER HD FROM STOCKPILE. RECOVERED HD WILL PROVIDE 44 PERCENT OF HD REQUIREMENT. PROCESS WILL BE USEFUL IN PROCESSING SURPLUS MUNITIONS AS WELL.
COMPONENT -- PROCESSES

(Continued)

4374) TITLE -- TECHNOLOGY DATA BASE FOR CX

PROBLEM -- NOT AVAILABLE COMMERCIALILY OR AT GOVERNMENT PLANTS TO SUPPORT DMU OF IT'S USE IN THE LINE IN VEA MUNITIONS PROGRAM. THE TECH DATA BASE IS RESTRICTED TO LABORATORY TECHNOLOGY.

SOLUTION -- ESTABLISH OPTIMUM PROCESSUES AND OPERATIONAL MODES FOR SCALE-UP TO GOVERNMENT PRODUCTION FACILITIES.

4375) TITLE -- TECHNOLOGY DATA BASE FOR CX

PROBLEM -- THE DATA BASE FOR DMU IS RESTRICTED TO LABORATORY DATA. PILOTING DATA IS LACKING AND INFORMATION FOR DESIGNED 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.

4475) TITLE -- MANUFACTURING TECHNIQUES FOR CR (CONTROL AGENT)

PROBLEM -- DMU PRODUCTION SOURCE NO LONGER EXISTS. THERE IS NO US SOURCE FOR OR NO PRODUCTION TECHNIQUES EXISTS WITHIN THE US.

SOLUTION -- DMU IS TO ESTABLISH A PILOT PLANT CAPABLE OF EXISTING PRODUCTION. CRPLANT WILL BE ADDED TO DMU PRODUCTION EQUIPMENT. THE PROCESS WILL BE FINE-TUNED OPERATING PARAMETERS ESTABLISHED, AND A PROOF OF CONCEPT.

4475) TITLE -- TECHNOLOGY DATA BASE FOR FINACOLYL ALCOHOL

PROBLEM -- FINACOLYL ALCOHOL IS NOT CURRENTLY AVAILABLE COMMERCIALILY IN PRODUCTION QUANTITIES AND THEREFORE THE ARMY HAS NO AVAILABLE SUPPLY TO SUPPORT PRODUCTION OF HIGH QUALITY LINEAR IVA CHEMICAL MUNITIONS.

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

4475) TITLE -- TECHNICAL DATA BASE FOR ASSA (AGENT)

PROBLEM -- DMU IS NOT USING TECHNICAL DATA BASES.

SOLUTION -- DEVELOP NEXT GENERATION TECHNICAL DATA BASE.
COMPONENT -- PROTECTIVE GEAR

(6924) TITLE - AUTOMATED AGENT PERMEATION TESTER

PROBLEM - WMT PROJECT 5 75 1314 DEVELOPED INSTRUMENTATION FOR AN IMPROVED PERMEATION TESTER. HOWEVER, BECAUSE OF COST ($5,000 PER TEST UNIT) AN ARTIFICIAL 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 (6 HOURS OR MORE). FLOW CONTROLS INCLUDE SOLENOID VALVES.

(6912) TITLE - PRODUCTION PROCESS FOR PROTECTIVE MASK CANISTER BODIES

PROBLEM - THE CURRENT FIVE-STEP LAY-UP-DRY PROCESS IS TIME CONSUMING, THE PROCESS HARDS HELM MATERIAL ARE MADE IT SUBJECT TO CRACKING.

SOLUTION - ESTABLISH A PROCESS WHEREBY THE CANISTERS WILL BE FORMED ON A PROGRESSIVE DIES MACHINERY.

(6934) TITLE - AUTOMATIC FINISHING OF MASK COMPONENTS

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

SOLUTION - DEVELOP TECHNIQUE IN A PYROLYTIC ENVIRONMENT AS AN AUTOMATED PROCESS TO REMOVE FLASH.

(6979) TITLE - MFG TECH FOR NEW PROTECTIVE MASK

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

SOLUTION - DEVELOP MANUFACTURING PROCESS TO ALLEVIATE PRODUCTION PROBLEMS DEFINED BY R&D EFFORT.

COMPONENT -- PYROTECHNIK

(4512) TITLE - ADAPTATION OF CLUGGING TECHNOLOGY TO HC SMOKE AND CS RIOT

PROBLEM - FIELD SMOKE GRENADE CLUGGING CONCEPT IS NOT ADAPTED TO HC AND CS SMOKE GRENADES. CURRENT HALL ARE HEAVY OPERATIONS ARE LABOR INTENSIVE. INDUSTRIAL PRACTICE IS FEAS.

SOLUTION - ADAPT CLUGGING TECHNOLOGY TO HC AND CS MISTS, IMPROVE INDUSTRIAL PRACTICE.

FUNDING ($000)

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PET FIVE YEAR PLAN
HCS. GREAT 176
## Component -- Pyrotechnics

### (41-1) Title - HECO Tech For Fed. of H1 => Improv Smoke Mkn

**Problem:** A requirement exists for applying the improved smoke concept to filling the HECO for the 111 MV MARKAR.

**Solution:** Conduct processing technique studies for premix, fill, close and lap minimizing production process data.

### (44-17) Title - Use of Red Phosphorus in Smoke Pot Applications

**Problem:** Smoke produced from HC has led to some injuries and is suspected of being a carcinogen. R&D work is being done to develop a red phosphorus mix to replace HC. However, no large-scale preparation facility currently exist.

**Solution:** Develop the technology and establish a prototype facility which will on a large scale prepare for leading the FF formulation which is developed in R&D.

### (45-0) 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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### Category

- **Energy Conservation**

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### Component -- General

### (2710) Title - Utilization of Heat Generated in TNT Manufacture

**Problem:** No effective use is being made of the heat removed by cooling water during the nitration stages in the manufacture of TNT.

**Solution:** Install heat transfer equipment to recover the heat generated by the nitration reactions for use in the TNT purification operations.

### (27-2) Title - Heat Recovery From Cyclohexanone Vapor

**Problem:** Cyclohexanone in TNT is dissolved in water/cyclohexanone solution which of steam heat. It is then recrystallized to obtain desired crystalline size. The heat from this evaporation process is energy-intensive.

**Solution:** This process involves use of heat available from the cyclohexanone vapor to achieve dissolution of the hexahydro crystals thereby reducing the requirement for steam.

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(374) TITLE - CONTINUOUS PROCESS FOR CERAMIC COMPOSITION P

PROBLEM - THE INCREASED FLOTATION OF REAGENTS IN THE SLURRY ALLOWS ONLY A LIMITED CONTROL OF FLOTATION.

SOLUTION - LEVEL P AND USE A CONTINUOUS PROCESS TO PRODUCE CERAMIC COMPOSITION P.
(4444) TITLE - IMPROVE RECOVERY OF ACETIC ACID IN RDX MANUFACTURING

PROBLEM - FORMIC ACID IN THE "A" AREA AZEOT STILL AT KSAP CAUSES PROBLEMS. FIRST THE STILL MUST BE MADE OF HASTALLOY VS STAINLESS AND SIDE REACTIONS CAUSE STEEP USAGE TO GO UP 140 EFFICIENT AND THE ENTRAINING TO BE REPLACED TWICE A YEAR.

SOLUTION - NEUTRALIZE THE FORMIC ACID PRIOR TO ITS INTRODUCTION TO THE AZEOT STILL.

(4466) TITLE - IMPROVE YIELD OF HMX DURING RDX NITRILYSIS

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

SOLUTION - THE CURRENT BUCHMANN PROCESS WILL BE MODIFIED TO INCREASE THE HMX YIELD BEYOND 90 PERCENT.

(4469) TITLE - PROCESS IMPROVEMENT FOR COMPOSITION C-9

PROBLEM - THE EXISTING FACILITIES WHICH ARE COMMON TO THE MANUFACTURE OF RDX AND THE OTHER RDX COMPOSITIONS WOULD LIMIT THE AVAILABILITY OF THESE ITEMS BELOW THEIR primary REQUIREMENTS.

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

(4415) TITLE - HMX MANUFACTURING AND SOLUTION PREPARATION

PROBLEM - THERE IS INSUFFICIENT SUPPLY OF HMX TO PRODUCE RDX AND HMX GROUNDS REQUIREMENTS. MUCH OF THE TECHNOLOGY IS AVAILABLE TO PERMIT MANUFACTURE ON-SITE. THE PREPARATION OF AN ACETIC ACID-HMX SOLUTION FROM AQUEOUS HMX REQUIRES FUTURE. SOLUTION - VERIFY DISTILLATION ASSUMPTIONS ON SMALL SCALE PRIOR TO PROCEEDING WITH FULL-SCALE DESIGN.

(4405) TITLE - PRODUCTION OF HMX FROM A MODIFIED RDX PROCESS

PROBLEM - HMX IS CURRENTLY BEING PRODUCED AT A RATE OF 1/3 OF RDX. THIS HAS CONTRIBUTED TO THE HIGH PRODUCTION COST OF HMX.

SOLUTION - MODIFIED A CONTINUOUS FERMENTATION REACTOR AND VARY THE REACTION PARAMETERS TO PRODUCE HMX AT A MUCH EXPANDED PRODUCTION RATE (AT LEAST TWO TO FOURFOLD).
COMPONENT: PROCESS CONTROL

4.9) TITLE: HY CONTINUOUS CAS FOR PLANTING LOADING

PROBLEM: AVOID USE OF CASTABLE ELEC TROLY VAPOR EXPLOSIVES WILL CREATE PRODUCTION SHORTFALLS. MEX B2 CAN NOT BE USED IN PRESENT MELT/CAST EQUIPMENT. PX PRODUCTION IS NOT COOL AT 2 NAVY PLANTS WHICH COULD NOT HANDLE LOADING OF CASTABLE PX IN MEX.

SOLUTION: ESTABLISH HIGH PRODUCTION RATE CONTINUOUS PROCESS FOR MEX AND CAST OF VARIOUS PX FORMULATIONS. IDENTIFY & EVALUATE EQUIPMENT & PROCESSES, SELECT & TEST EQUIPMENT. INTEGRATE ACCEPTABLE ITEMS INTO AN OPERATING PX PROCESSING PILOT PLANT.

4.17) TITLE: PROCESS FOR MANUFACTURE OF ETHYLENE DIAMINE TETRACRITATE (ELAN)

PROBLEM: NO PROBLEM PRODUCED.

SOLUTION: NO SOLUTION PROVIDED.

COMPONENT: THT

4.16) TITLE: EVAL INDUSTRIAL CAPABILITY FOR COMMERCIAL EXPLO-HIGH USE MUNIT

PROBLEM: DURING MOBILIZATION THERE CAN BE A SHORTFALL IN AVAILABILITY OF MILITARY EXPLOSIVES. INDUSTRY HAS MANY SAFETY EXPLOSION FORMULATIONS. THEIR APPLICABILITY TO MILITARY USES IS UNKNOWN. INDUSTRIAL CAPABILITY FOR MILITARY USES OF THESE EXP IS UNKNOWN.

SOLUTION: CONDUCT A PROGRAM TO IDENTIFY THE QUANTITIES AND TYPES OF COMMERCIAL AVAILABLE EXPLOSIVES THAT COULD BE USED TO SUPPLEMENT THE ARMS PRODUCTION. CAPACITIES DURING DEFICIENCY PRODUCTION PERIODS. EVALUATE THE PERFORMANCE OF MUNITIONS PRODUCED THIS WAY.

4.1) TITLE: THT CRYSTALLIZATION FOR LANCE FALIERS

PROBLEM: THT MELT LOADING REQUIRE TO OPTIMUM RATIO OF MOLTEN AND SOLID THT IN THE EXPLOSIVE MIX AT THE TIME OF FUSION. THE FUSION IS OBTAINED BY THE ADDITION OF MOLTEN THT TO A QUANTITY OF MOLTEN THT BASED ON OPERATOR JUDGMENT.

SOLUTION: DE V A DEVICE WHICH UTILIZES MOLTEN THT TO G5 A SOLID CONSISTENCY THROUGH PARTIAL CONTROLLING STATE/STATE CRYSTALLIZATION. BY CLOSE CONTROL OF THT FLOW RATE AND THERMAL PARAMETERS A CONTINUOUS FINE GRAINED SOLID MIX OF FUSED THT WOULD RESULT.

4.57) TITLE: CONTINUOUS THT PROCESS EXAMINING

PROBLEM: CONTINUE THERM PROCESS RESULTS, PROCESS AND SAFETY IMPROVEMENTS.

SOLUTION: PRIE ARE HOLD A CEL LION IN THER PROCESS IMPROVEMENTS.
**COMPONENT -- TNT (CONTINUED)**

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<tr>
<th>TITLE</th>
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<tr>
<td>INSTRU IN-PROCESS MEASUREMENTS OF SOLID LIQUID TNT</td>
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**Problems:**

- **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.

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**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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**Problem:** When TNT does not solidify on flaker drum it falls into hopper where it solidifies and stops the flow of TNT flakes. Operations must be stopped until the hazardous removal of TNT from hopper by pneumatic or rapping is completed.

**Solution:** A molten TNT detector will be developed to detect presence of molten TNT on flaker drum and stop the flaking operation. This will prevent molten TNT from entering the hopper.

**Category:**

- Electronics
- Fuzes

<table>
<thead>
<tr>
<th>TITLE</th>
<th>FUNDING ($000)</th>
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<tbody>
<tr>
<td>SUPERSIGHTING OF SFF W/IR SENSOR</td>
<td>200</td>
</tr>
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</table>

**Problem:** No production process exists to super sight storm warhead to IR sensor. Present hand process requires several hours and is unreliable.

**Solution:** Develop equipment to automate process.
COMPONENT -- ELECTRONICS

427(c) TITLE -- SENSORS TECHNOLOGY

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

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

COMPONENT -- LIF

425(a) TITLE -- M226 FUZE PACK OUT

PROBLEM -- M226 CURRENTLY UNDER CONTRACT TO AUTO ASSEMBLE M226 FUZE AT MINIMUM RATE OF 56 ASSEMBLIES PER MINUTE. MANUFACTURE OF M226 FUZE INTO SHIP & STORAGE CONTAINERS AT HIGH PRODUCTION RATE WOULD BE A HIGH LABOR INTENSIVE TASK UP TO 566 ASSEMBLIES PER MINUTE.

SOLUTION -- DEVELOP AN AUTOMATED PACK OUT LINE TO MATE WITH THE AUTOMATIC ASSEMBLY EQUIPMENT.

COMPONENT -- METAL PARTS

227(c) TITLE -- POWDER METALLURGY FUZE COMPONENTS

PROBLEM -- MACHINE FUZE METAL PARTS FROM HAP STOCK IS TIME CONSUMING AND GENERATES A LARGE AMOUNT OF SCRAP. THERE IS A NEED TO DEV ALTERNATE PROCESS FOR FABRICATING FUZE PARTS THAT ARE MACHINED FROM BAR STOCK.

SOLUTION -- DEVELOP ALTERNATE PROCESSES FOR FABRICATING FUZE PARTS THAT ARE MACHINED FROM HAP STOCK.

227(c) TITLE -- CHEMICAL MACHINING OF PRECISION COMPONENTS

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

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

44(c) TITLE -- HOT FORMING + COLD HEADING LARGE LUZ COMPONENTS

PROBLEM -- MULTISPINDLE BAR MACHINES NOT USED IN LARGE VOLUMES. THEY HAVE LOW PRODUCTIVITY, DO NOT MEET OSHA REQUIREMENTS FOR CARBIDE TOOLS, NO SPARE PARTS.

SOLUTION -- APPLY MOD TECH SUCH AS HOT FUZEL AND COLD HEADING TO OBTAIN SHAPE + REDUCE MACHINING AND STAMP. THIS ALLOWS SHORTER CHUCKERS FOR FINISH MACHINING.
COMPONENT -- METAL PARTS

(447) TITLE -- MSS PRECISION GEAR HOBS

PROBLEM -- THE FUZE PRODUCTION BASE UTILIZES SOLID CARBIDE HOBS FOR MFG.
PINIONS. THERE IS NO DOMESTIC MFG OF THESE HOBS. THEY ARE IMPORTED FROM
FOREIGN SOURCES. LEAD TIME IS 11 TO 14 WEEKS. A SURVEY SHOWED A LACK OF
TECH. SKILLS & INTEREST IN MFG.

SOLUTION -- DEVELOP IMPROVED HIGH SPEED STEEL HOBS USING HIGH STRENGTH STEEL TO
IMPROVE WEAR LIFE AND PROVIDE A BACKUP FOR MGB AND LEADTIME REDUCTION USING
U.S. AVAILABLE TECHNOLOGY.

(450) TITLE -- MFG, TEST, AND INSP EQPT FOR M763, 105MM FUZE

PROBLEM -- NO PROBLEM PROVIDED.

SOLUTION -- NO SOLUTION PROVIDED.

COMPONENT -- POWER SUPPLIES

(1001) TITLE -- PILOT LINE FOR FUZE FLUIDIC POWER SUPPLIES

PROBLEM -- FLUIDIC GENERATORS ARE COMPLEX AND COSTLY TO PRODUCE IN
PRODUCTION, CLOSE TOLERANCES ARE SMALL PART ASSEMBLY ARE REFLECTED IN HIGH
COST AND LOW YIELD.

SOLUTION -- IDENTIFY AND ADOPT THE MOST ECONOMICAL MFG PROCESSES AND TECHNIQUES
TO ESTABLISH A MECHANIZED PILOT LINE FOR ASSEMBLY OF FLUIDIC POWER SUPPLIES.

(457) TITLE -- MANUFACTURING, INSPECTION AND TEST EQUIP FOR MAG PWR SUPPLY

PROBLEM -- PIEZOELECTRIC POWER SUPPLIES USED IN HEAT AMMO HAVE UNDESIRABLE
VOLTAGE GENERATION IMPRESSED ON THE ELECTRICAL CIRCUITS OF THE ROUND DUE TO
SHOCK VIBRATIONS RESULTING DURING FLIGHT WHICH MAY CAUSE PREMATURES.

SOLUTION -- MOVE THE POWER SUPPLY FROM THE NOSE OF THE ROUND TO INSIDE THE PIBO
FUZE HOUSING AND CHANGE IT TO A MAGNETIC PULSE GENERATING TYPE POWER SUPPLY
WHICH IS UNAFFECTED BY THE PROBLEM OF SHOCK VIBRATIONS.

COMPONENT -- GA/TESTING

(4002) TITLE -- IN PROCESS INSPECTION OF ENCAPSULANT MATERIAL

PROBLEM -- PROCESS TECHNOLOGY FOR PLASTIC ENCAPSULANTS WAS DEVELOPED UNDER 578
39007, HOWEVER INSPECTION TECHNIQUES FOR THOSE ENCAPSULANTS WERE NOT
DEVELOPED.

SOLUTION -- DEVELOP A NON-DESTRUCTIVE INSPECTION TECHNIQUE TO DETERMINE IF
VOIDS EXIST IN THE MATERIAL. THIS WILL INCREASE YIELDS AS WELL AS PROVIDE
100% INSPECTION CAPABILITY.
COMPONENT -- MECHEILLAGE

(175) TITLE - TEST FORT AND PROCESSES FOR VAPOR ELECTRONIC FUSE

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

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

(475) TITLE - IMPROVE (3-D) VIBRATION ACCEPT TEST HMS SW M724

PROBLEM - CURRENT METHODS ARE COSTLY AND TIME CONSUMING, RARELY EXPOSE THE TEST ITEM TO TRUE SERVICE ENVIRONMENTS, AND REQUIRE THREE TESTS TO ACCOUNT FOR ALL TEST AXES.

SOLUTION - USE OF COMPUTORIZED THREE VIBRATION SHAKE TESTING AS AN ACCEPTANCE TOOL SOLVES TECHNICAL & ECONOMIC TEST DEFICIENCIES. TEST TIME IS REDUCED.

(515) TITLE - HIGH PRECISION DIMENSIONAL TEST OF FUSE COMPONENTS

PROBLEM - FUZE PRECISION PLATES FIFTY INSPECTED BY SAMPLING AND MANUAL METHODS.

SOLUTION - PROVIDE NINE PERCENT HIGHER IMPROVED ACCEPTANCE RATES. AUTOMATION CAN BE RECUSED FOR PROCESS CONTROL.

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CATEGORY

GENERAL

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COMPONENT -- MISCELLANEOUS

(625) TITLE - INSPECTION FOR CONDUIT MUSEUM DETONATOR

PROBLEM - CONDUCTIVE MUSEUM DETONATORS HAVE NOT BEEN MANUFACTURED IN PRODUCTION QUANTITIES.

SOLUTION - A NEW VERSION OF THE GERMANY CONDUCTIVE MUSEUM DETONATOR WILL BE FABRICATED USING THE LATEST TECHNIQUES. THE PROJECT WILL PROVIDE THE MECHANIZATION NEEDED FOR INCREASED SAFETY AS WELL AS INCREASED PRODUCTION AT A LOWER COST.

(645) TITLE - FUSE IN PLACE MUNITION FOR M744

PROBLEM - DEVELOP PROCESS TO ENCAPSULATE MAJOR MUNITION COMPONENTS WHERE INTERNAL STRESSES WOULD NOT BE DISTURBED AND ANOTHER WOULD BE COMPATIBLE WITH EXPLOSIVES AND OTHER TEMPERATURE SENSITIVE COMPONENTS.

SOLUTION - DETERMINE OPTIMUM COMBINATION OF FUSE IN-PLACE MATERIALS AND COMPONENT ALIGNMENT PROCESS TO ALLOW FOR FACILITATION OF INTERNAL COMPONENTS FOR M744.
COMPONENT -- ASSEMBLY

(276) TITLE - AUTOMATIC PROCESSING OF PARACHUTE ASSEMBLIES

PROBLEM - PARACHUTE ASSEMBLY AT PRESENT IS HAND OPERATED AND COSTLY PROCESS REQUIRING EXPERIENCE AND DEXTERITY PERSONNEL.

SOLUTION - AUTOMATICALLY PROCESS PARACHUTE ASSEMBLIES FOR ECONOMICAL, RELIABLE, HIGH-RATE PRODUCTION.

FUNDING ($000) 215

(2712) TITLE - MODIFICATION OF LINE FEED OF UK PROPULSING CHARGE

PROBLEM - HAND LINE LOADING/ASSEMBLY OF UK CHARGE WHEN ADOPTED WOULD BE REQUIRED WITH THE RESULTING HIGH COST, GREATER EXPOSURE OF PERSONNEL TO FLAMMABLE EXPLOSIVE MATERIALS AND LESS RELIABLE PRODUCT.

SOLUTION - AUTOMATICALLY PROCESS REQUIREMENTS FOR AUTOMATICALLY LOADING/ASSEMBLY UK CHARGE ON THE AUTOMATED LAY LINE FOR US M7A1/M205 PROPELLING CHARGE.

FUNDING ($000) 700

(2717) TITLE - CLOSURE/SEALING TECH FOR M131/M132 DISPENSER

PROBLEM - THE HOT GAS WELD TECHNIQUE USED TO SEAL THE M131/M132 DISPENSER COVERS IS TIME CONSUMING AND ITS QUALITY IS HIGHLY DEPENDENT ON OPERATOR SKILLS.

SOLUTION - AUTOMATICALLY PROCESS REQUIREMENTS FOR AUTOMATIC CLOSURE/SEALING TECH SUCH AS ULTRASONIC WELDING, INDUCTION WELDING, HOT WIRE WELDING. SEALS/CLOSURES WILL BE DESIGNED TO MAKE IT EASIER TO AUTOMATE CLOSURE/SEALING OPERATIONS.

FUNDING ($000) 170

(3011) TITLE - AUTO ASSY OF M21 FLASH SIMULATOR

PROBLEM - ITEM IS BEING MANUFACTURED IN WEST GERMANY AT A COST. CURRENT PLAN FOR PROCUREMENT IN US WOULD RESULT IN LABOR INTENSIVE OPERATION CURRENTLY PLANNED FOR LONGMAN.

SOLUTION - AUTOMATICALLY PROCESS REQUIREMENTS FOR AUTOMATIC ALMACHINES WHICH WILL REDUCE LABOR TO AUTOMATE MANUFACTURING.

FUNDING ($000) 900

(4000) TITLE - AUTO M55 DETONATOR PRODUCTION EQUIPMENT

PROBLEM - THE M55 DETONATOR IS LABOR INTENSIVE AND PERSONNEL EXPOSURE IS EXTREMELY HIGH.

SOLUTION - AUTOMATICALLY PROCESS REQUIREMENTS FOR AUTOMATIC PRODUCTION OF NON-ELECTRIC DETONATORS TO REDUCE COST AND IMPROVE SAFETY.

FUNDING ($000) 6712

(4040) TITLE - AUTO MFG SUPPORT FOR M95 INERTIUM CONTAINERS

PROBLEM - MANUFACTURING AND ASSEMBLY OF M95 PRODUCTION INERT CONTAINERS IS LABOR INTENSIVE AND COST NOT MEET PRODUCTION REQUIREMENTS.

SOLUTION - AUTOMATICALLY PROCESS REQUIREMENTS FOR AUTOMATIC MFG SUPPORT MATERIALS TO REDUCE COSTS, INCREASE PRODUCTION RATES, AND IMPROVE QUALITY.

FUNDING ($000) 1391
MFT FIVE YEAR PLAN
RCS DRMC 126

CONTINUED

1. TITLE - EQUIPMENT FOR AUTO PROCESSING OF ADDITIVE LINERS

PROBLEM - PIP IS BEING EXECUTED TO ELIMINATE THE SEWING OF THE PROTECTIVE FILM TO ADDITION LINERS. ANOTHER TASK IS THE DEV OF AN ABLATIVE TYPE WEAR REDUCER (SILICON GREASE DAGGED IN MYLAR FLM) FFG EQUIP IS REQUIRED F/EITHER GUN TUBE WEAR REDUCER.

SOLUTION - AUTOMATED EQUIPMENT WILL BE DEVELOPED IN THE CASE OF SEWING ELIMINATION OF THE MYLAR FILM. AUTOMATED EQUIPMENT WILL BE DEVELOPED FOR METERING AND PACKAGING THE NEW ABLATIVE TYPE GUN TUBE WEAR REDUCER.

2. TITLE - AUTOMATED LWP OF STICK-PROPELLANT CHARGES

PROBLEM - STICK PROPELLANT CHARGES HAVE NO LAP PROCESSING PRECEDENT. CURRENT MANUAL METHODS OF PRODUCTION ARE INEFFECTIVE IF ACHIEVING SATISFACTORY LEVELS OF QUALITY, COST, SAFETY AND PRODUCTION REALINESS.

SOLUTION - EFFICIENT HIGH-SPEED AUTO LAP EQUIPMENT WILL BE DEVELOPED FOR 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.

3. TITLE - AUTO PROG EQUIP FOR LAP OF XM 692 MINE DISPENSING SYSTEM

PROBLEM - PRESENT PRODUCTION FACILITY TO LAP THE XM692 MINE DISPENSING SYSTEM IS LIMITED TO A MANUAL/ASSIST OPERATION WITH ATTENDANT PRODUCTION UNIT COSTS AND HIGH PERSONNEL EXPOSURE.

SOLUTION - PROJECT WILL PROVIDE EQUIPMENT DESIGNS AND PROTOTYPE EQUIPMENT TO AUTOMATEedly LOAD AND ASSEMBLE THE XM67 MINE, THEREBY REDUCING PERSONNEL HAZARDS AND PRODUCTION COSTS WHILE PROVIDING A MORE RELIABLE ITEM.

4. TITLE - NEW AUTOMATED LWP FOR SEALING SS5 DETONATORS

PROBLEM - CURR SS5 DETS ARE BEING LAPPED. 2 APPROACHES TO SEALING ARE BEING INVESTIGATED. 1 USED FOIL PRECURED W/ADHESIVE + THE OTHER WELDS THE DET CUP TO FOIL. BOTH CAN BE PERFORMED ADEQUATELY IN A HANDLING LINE WILL REDUCE COST OF DET.

SOLUTION - OVERLAP 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 SS5 DETONATOR.

5. TITLE - MICH OF ASSY. OPERATION OF HAZ. CORP IDENTIFIES

PROBLEM - CURRENT TECHNIQUES TO ASSEMBLE THE CLOTH FILTER ASSEMBLY TO THE FILTER-TUBE ASSEMBLY FOR LARGE NUMBERS OF OPERATOR HANDLING HIGHLY HAZARDOUS MEDIUM.

SOLUTION - THIS PROJECT WILL DEVELOP EQUIPMENT TO MECHANICALLY ASSEMBLE THIS ASSEMBLY QUICKLY. THIS WILL REDUCE THE NUMBER OF PERSONNEL IN HAZARDOUS OPERATIONS.
COMPONENT -- ASSEMBLY

(45.5) TITLE -- ADHESIVE BOND OF IGNITER AND FLASH REDUCER BAGS OR COMPONENT

PROBLEM -- PIP NO. 1-82-09-7715 WILL PROVIDE AN ALTERNATIVE TO SEWING CLOTH ENCLOSED IGNITER AND FLASH REDUCER COMPARTMENTS ON PROPELLANT CHARGES.

SOLUTION -- DEVELOP PRODUCTION EQUIPMENT TO APPLY ADHESIVE AND PROVIDE A QUALITY CLOTH-TO-CLOTH BOND.

(45.5) TITLE -- AUTOMATIC GRENADE DECARTONIZING

PROBLEM -- GRENADES ARE NOT ARRIVE IN BOXES OR BUNDLED PALLETS. THE PALLETS ARE OPENED AND DISTRIBUTED TO THREE UNPACKING STATIONS. GRENADES ARE REMOVED FROM THE BOXES AND PUT ON THE CONVEYORS. AN OPERATOR DISCARDS THE EMPTY BOXES.

SOLUTION -- AUTOMATE THE OPERATION FROM LOADING TO PLACEMENT OF THE GRENADES ON THREE CONVEYORS. BOXES WILL BE OPENED AND GRENADES REMOVED. THE GRENADES WILL THEN BE PLACED ON CONVEYORS. THE WORKER WILL HAVE TO HANDLE BOTH M47/48 AT THE RATE OF 300 PER MINUTE.

(45.5) TITLE -- RAPID MOISTURE ANALYSIS OF EXPLOSIVE MIXES

PROBLEM -- PRESENT MOISTURE ANALYSIS TECHNIQUE REQUIRE SOME 3 1/2 HOURS FOR EACH SAMPLE. IN AN AUTOMATED FIVE LINES, THIS IS TOO LONG A PERIOD TO WAIT RELATIVE TO AN ACCEPTANCE/REJECTION DECISION FOR THE BATCH.

SOLUTION -- INVESTIGATE THREE KNOWN TECHNIQUES FOR RAPID MOISTURE ANALYSIS AND PROCEED WITH THE OPTIMUM TO THE FIVE LINES.

(45.5) TITLE -- PRESS LOADING BLUAS BOMBS & ACM MUNITIONS

PROBLEM -- CASE LOADING PROCESSES FOR TONS PER YEAR RESULT IN EXCESSIVE LOADING COSTS BECAUSE NOBLET TO TRIPLE THE AMOUNT OF EXPLOSIVE IS NEEDED TO PROVIDE THE RESULTING WIDER SCRAP. NICE SCRAP REPROCESSING COSTS ARE ALSO INCURRED.

SOLUTION -- PRESS LOADING CAN BE USED WITH EXISTING LOADING EQUIPMENT. SMALL MUNITION ITEMS CAN BE PACKED UP WITH A SUPPORT FIXTURE TO WITHSTAND THE HIGH COMPACTION PRESSURES. STATIC FIRE TESTS ON LIVE MUNITION ITEMS WILL BE DONE TO CHECK OUT PERFORMANCE.
COMPONENT -- GENERAL

(4711) TITLE - IMPROVE CONTROLS AND SEWING OF 2-H SEWING SYSTEM

PROBLEM - LUGGAGE SEWING REAL EFFICIENT SHUTDOWN OF EPOU TO CHANGE BOBBINS
DEFICIENT - OBSOLETE CONTROL SYS CAUSES FREQUENCY DOWN TIME INADEQUATE CONTROL OF CLOTH MOVEMENTAINSIN STANDBY NUMBERS OF OUT-OF-TOLERANCE BAGS

SOLUTION - PRIVIDE FOR AUTOMATIC LUGGAGE REWINDING AND INSERTION REPLACE CONTROL SYSTEM REPLACE PRESENT CLOTH FEED TENSION CONTROL AND LUGGAGE CONTROL SYSTEMS

(4211) TITLE - AUTO CLUTCH FOR LUGGAGE FOR M445 AND M600 PROJECTILES

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

SOLUTION - DEV AUTO LUGGAGE

(4213) TITLE - AUTO CARRIER CLEANING STATION FOR DEF PACT

PROBLEM - CARRERS 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 AUTOMATED FEWER REMOVAL AND CLEANING STATION FOR THE AUTOMATED DADDY SYSTEM IN THE AAF MODERNIZED PACT FADILITY

(4013) TITLE - AUTO ASSY OF M22 FLASH SIMULATOR

PROBLEM - ITEM MANUFACTURED IN TEST QUANTITIES ONLY. PLANS ARE TO PRODUCE FROM LONGHORN APOR HARD LINE WHICH IS EXPECTED TO RESULT IN A LABOR INTENSIVE OPERATION.

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

COMPONENT -- LOAD

(4013) TITLE - 10MM SMOKE PEARL FACTORY IMPROVE SMOKE MUNITION

PROBLEM - A FAMILY OF NEW IMPROVED 10MM SMOKE PEARL IS BEING DEVELOPED. FUTURE PRODUCTION IS DEPENDENT ON THE AVAILABILITY OF NEW TECHNOLOGY AND PRODUCTION EQUIPMENT.

SOLUTION - DEVELOP TECHNOLOGY REQUIRED TO DESIGN FIRST EQUIMENT FOR FILLING IMPROVED SMOKE PEARL MUNITION INCORPORATING CHEMICAL WITH MATERIAL WITH WP.

(3393) TITLE - PRESS/INJECTION LOADING IS LABOR INTENSIVE

PROBLEM - NO PROBLEM PROVIDED.

SOLUTION - NO SOLUTION PROVIDED.
PRODUCT - LOAN

(Cont.)

(475-4) TITLE - DEVELOP IMPROVED FILLING METHOD FOR A74 ROCKET

PROBLEM - THE FILLING method is time-consuming and causes inefficient operation.

SOLUTION - Evaluate and select optimum fill equipment to reduce filling time.

(475-4) TITLE - VACUUMIZATION OF TRACER LEADING

PROBLEM - Current tracer leading technology utilizes considerable labor, slow cyclical operating type pressing machines.

SOLUTION - Develop modern automatic multiple item loading equipment, high production, low maintenance, economical and reliable; equipment adaptable to new suit tracer items will result.

(475-7) TITLE - DEVELOP MFG TECHNOLOGY FOR MVN OR GO ROCKET

PROBLEM - Never produced at PRA, mobilization requirement.

SOLUTION - develop MFG technology, provide design criteria for IFF.

(475-7) TITLE - SILK TRANSFER OF CHEMICAL MATERIALS

PROBLEM - Current technique for retrieval weighing and transporting pyrophoric chemical constituents are accomplished by labor intensive operations and are unstable.

SOLUTION - A more efficient materials handling system will be surveyed and developed so that special safety requirements will be met.

(475-7) TITLE - VAC METOCES OR GEL FUEL BFC FOR COM RSL-500A AND RSL-9140

PROBLEM - a process to produce large quantities of pyrophoric fuel containing propylene oxide does not exist. The fuel, due to its flammability and pyrophoric properties, presents major problems in the areas of mixing, storage, handling, loading.

SOLUTION - Determine process and manufacturing techniques suitable for mass producing, transporting, and utilizing pyrophoric gel containing propylene oxide fuel and evaluate available processing equipment.

(475-9) TITLE - COLD PRESSING OF EXPLOSIVE

PROBLEM - LOAD OF WYP EXPLOSIVES INTO SHAPED CHARGES - PRESSED AMMO - PRESSING PERCENTAGE OF GLOW + TOTALLY DUE TO HEAT, VACUUM + NOT PRESSING REGULAR EXPLOSIVE TO OVRNEE TATURAL EXPLOSION - LOW DENSITY CHARGE PROBLEMS - SHAPED CHARGES CANNOT BE EXPLODED.

SOLUTION - New explosive has still flow which has AMMO at its base, properties to load - LAMINATING EXPLOSIVE - CAN BE COLD PRESS - AUTOMATIC COLD PRESSINGPAY WYP WILL EXPLODE THE QTY's WILL DECREASE COST DRAMATICALLY - ELIM POTTENTIAL FOR EXPLOSION.
<table>
<thead>
<tr>
<th>COMPONENT -- LOAD</th>
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<tr>
<td>(27.7) TITLE -- IMPROVED PROCESS FOR HE CAVITY FORMING</td>
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<tr>
<td>PROBLEM -- CURRENT METHODS 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 HE FURRING FRAME TO MILL MACHINING. THIS WILL DRASTICALLY REDUCE COST AS NO BARRICADE IS REQUIRED. EXPLOSIVE MACHINERY/MAINT IS ELIMINATED AND SUPPORTING LABOR IS REDUCED.</td>
<td>650</td>
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<tr>
<td>(31.8) TITLE -- IMPROVED PROCESS TECHNOLOGY FOR CASTABLE FOR EXPLOSIVE</td>
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<td>PROBLEM -- LARGE SHAPE CHARGE WARHEADS UTILIZE PRESS EXPLOSIVES WHICH REQUIRE LARGE CAPACITY PRESSES AND LENGTHY PRESS CYCLE AND ANNEALING TIMES. COSTS ARE RELATIVELY HIGH AND QUANTITIES CANNOT BE INCREASED WITHOUT A LARGE INVESTMENT IN PRESS CAPACITY.</td>
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<tr>
<td>SOLUTION -- CASTABLE FOR EXPLOSIVES ARE BEING DEVELOPED FOR HIGH PERFORMANCE WARHEADS. THE NAVY WILL EVALUATE THE MOST ADVANCED COMPOSITIONS AND LOADING EXISTING SHAPE CHARGE WARHEADS TO DETERMINE REQUIRED PROCESSING CONDITIONS AND TO EVALUATE PERFORMANCE.</td>
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<tr>
<td>(47.7) TITLE -- INCREASED SAFETY PLEASIBILITY AND PRODUCTIVITY OF EXIST MELT FOU</td>
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<tr>
<td>PROBLEM -- SIGNIFICANT IMPROVEMENT OF MELT FOUNTAIN FACILITIES IS NOT BEING REALIZED BECAUSE DESIGN APPROACHES FOR COST-EFFECTIVE INTERMEDIATE UPGRADING ARE NOT AVAILABLE.</td>
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<td>SOLUTION -- DEVELOP A SERIES OF EXCELLENT DESIGN CONCEPTS TO IMPROVE SAFETY, REDUCE EXPLOSIVE QUANTITIES, REMOVE PERSONNEL FROM HAZARDOUS AREAS, INCREASE EFFICIENCY AND REDUCE PRODUCT COSTS. PROVIDE MODULAR DESIGN PACKS, FAVORABLE PROCESSES AND UPGRADE LEVELS.</td>
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<td>(47.6) TITLE -- PERFORATION EXPLOSIVE FUSE ARE INEL SCRAP</td>
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<td>PROBLEM -- FINELY DIVIDED EXPLOSIVE SCRAP OPERATES IN CAVITY DRILLING AND AFTER CHARGING OPERATIONS IS CURRENTLY TREATED AS WASTE. IT CANNOT BE RE-DEPOSITED IN ITS UNDISTURBED STATE DUE TO MELTING PROBLEMS AND CONSEQUENTLY HAS INTRODUCED INTO MELT SYSTEM.</td>
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<tr>
<td>SOLUTION -- EXPRESS A WAY TO SIZE, DISTRIBUTE, AND WARM THE FINELY DIVIDED EXPLOSIVE SCRAP IN THE MELT SYSTEM, EASILY TRANSPORTED AND DUELLY INJECTED INTO MELT FOUNTAIN SYSTEM.</td>
<td>621</td>
</tr>
</tbody>
</table>
COMPONENT - LOAD (CONTINUED)

(419) TITLE - AUTO LOADING OF CENTER CORE IGNITERS
PROBLEM - LOADING OF THE LONG SLABBER CLOTH BAG IS AN AREA WHICH requires
HIGH LABOR COSTS AND SUBJECTS A LARGE NUMBER OF PERSONNEL TO HAZARDOUS
OPERATIONS.
SOLUTION - DEVELOP A LOADING STATION TO WEIGH AND LOAD BOTH THE CENTER CORE
BAG AND THE BASE PAD.

(457) 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 - EVALUATE 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.

(447) TITLE - HANDLING EQUIPMENT FOR ADAM OVERLAYS
PROBLEM - THE ADAM PROPELLANT OVERLAY IS MANUALLY CONVEYED BETWEEN SIX
MODULES. THE CURRENT 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.

(457) TITLE - LV PROCESS FOR PRESS LOADING 105MM HEAT-ME-T, XMB15 PROJ
PROBLEM - THE 105MM XMB15 WILL BE THE FIRST TANK ROUND TO USE A PRESS
SHAPED CHARGE. A PRODUCTION PROCESS FOR PRESS LOADING MUST BE ESTABLISHED
EVALUATING SEVERAL CANDIDATE EXPLOSIVES AND ESTABLISHING TOOLING DESIGN AND
PRESSING FIXMENTS.
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.

(474) TITLE - LOW VOLUME AUTO POUR EQUIP FOR LOADING SMALL AP MINE
PROBLEM - CURRENT DEPLOYMENT OF SMALL AP MINE IS ACHIEVED BY HIGHLY
EFFECTIVE OPERATIONS. LARGE VOLUME TECHNIQUES ARE NOT APPLICABLE
HAVING OF SMALL VOLUME PRODUCTION QUANTITIES.
SOLUTION - DEVELOP A NEW UNIT - LOW VOLUME AUTOMATIC INJECTION MOLDING SYSTEM
FOR SMALL AP MINE.
COMPONENT -- PACK

(421.3) TITLE - AUTO HIGH RATE UNPACK EQUIP FOR MORTAR PROPP CHGS

PROBLEM - MANPACKING ON THE MORTAR PROPELLING CHARGES M204 AND 205 LAP LINE
RESULTS IN UNSAFE CONDITIONS AND DAMAGE TO PARTS.
SOLUTION - DEVELOP AUTOMATED EQUIPMENT TO REPLACE MANPACKING.

(4516) TITLE - AUTO CARTONING OPERATIONS F/105MM

PROBLEM - THE PACKOUT OF 105MM TANK ROUNDS INTO FIBER CONTAINERS WITH THE
FILLER MATERIALS AND MARKINGS IS A LABOR INTENSIVE OPERATION WITH HIGH
EXPOSURE OF PERSONNEL TO LIVE AMMUNITION.
SOLUTION - DEVELOP AUTOMATED EQUIPMENT TO PACKOUT THESE 105MM ROUNDS.

***************

** CATEGORY **

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COMPONENT -- CARTRIDGE CASES

(4024) TITLE - SPIRAL WRAP CARTRIDGE CASE FOR 105MM-TANK AMM

PROBLEM - PID PROJECT 1-75-09-004H IS CURRENTLY WORKING OUT QUALITY PROBLEMS
WITH THE USE OF A SPIRAL WRAPPED CARTRIDGE CASE. THIS CASE WILL REPLACE THE
DEEP DRAWN CARTRIDGE CASE WHICH IS CURRENTLY MASS PRODUCED.
SOLUTION - DEVELOP TECHNIQUES TO RELIABLY AND EFFICIENTLY HANDLE MATERIAL AND
MANUFACTURE CARTRIDGE CASES USING SPIRAL WRAPPING.

(4492) 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

(4024) TITLE - ALTERNATE ASSY FOR SOLDERED AND BRAZED JOINTS

PROBLEM - BRAZING AND SOLDERING OPERATIONS REQUIRE PRECISE CONTROL OF
CLEARANCES, THERMOPRUES AND FLUXES IN ORDER TO OBTAIN ACCEPTABLE JOINTS.
SOLUTION - ALTERNATE METHOD OF JOINING COMPONENTS WILL BE INVESTIGATED TO
REDUCE COST AND ENHANCE RELIABILITY.

FUNDING ($000)

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COMPONENT -- FORMING/MACHINING

(Continued)

(1007) TITLE -- ADAPTIVE CONTROL OF DIMENSIONS OF METAL COMPONENTS

PROBLEM -- WEAR OF CUTTING TOOLS AND GRINDING WHEELS EVENTUALLY PRODUCES OUT OF TOLERANCE DIMENSIONS.

SOLUTION -- UTILIZE SENSING DEVICES AND ADAPTIVE CONTROLS TO AUTOMATICALLY COMPENSATE FOR TOOL AND WHEEL WEAR.

(1211) TITLE -- ANTI-ARMOR WGM LINES F/7x14

PROBLEM -- COSTLY AND TIME CONSUMING MANUFACTURING PROCESS FOR MASS PRODUCING SELF-FORGING FRAGMENT LINERS WITH VARYING WALL THICKNESS.

SOLUTION -- DETERMINE OPTIMUM PROCESS SUCH AS HYDROFORMING, ELECTROPLATING AND/OR MACHINING, PROVE Q/J PROCESS.

(1242) TITLE -- N/C EQUIPMENT METAL PARTS PRODUCTION

PROBLEM -- N/C EQUIPMENT HAS BEEN USED IN ARMED PON LINES BUT ITS INHERENT ACCURACY AND REPEATABILITY IN MACHINING NEW COMPONENTS HAS NOT BEEN ASSESSED.

SOLUTION -- USING A THREE-PHASE PROGRAM (1) STUDY FEASIBILITY OF ADAPTING AN N/C MACHINE TOOL W/SIMULTANEOUS CUTTING CAPABILITY (2) IF FEASIBLE, ADAPT AN N/C MACHINE TO TEST CONCEPT (3) PROVE CONCEPT IN PON ENVIRONMENT.

(1245) TITLE -- FORGING OF ALUMINUM COMPONENTS

PROBLEM -- FORGINGS FOR GREASE BOLTS AND ANCHORS ARE IMPACT EXTRUDED WITH LARGE AMOUNT OF MATERIAL LEFT THAT HAS TO BE MACHINED OFF.

SOLUTION -- INVESTIGATE USING NET SHAPE FORGING TO ELIMINATE MACHINING OPERATIONS AND MATERIAL WASTE.

(2046) TITLE -- ACOUSTIC EMISSIONS TO CONTROL METAL WORKING OPS

PROBLEM -- IN MANY INSTANCES DEFECTS THAT OCCUR IN THE MFG OF MUNITIONS MTS ARE NOT SCREENED OUT UNTIL INSPECTION AT THE END OF THE LINE RESULTS IN LOTS OF SCRAP REPORT PROBLEM IS DETECTED.

SOLUTION -- ACOUSTIC EMISSION FROM METAL WORKING OPERATIONS CAN BE MONITORED AND ANALYZED TO CONTROL SPECIFIC PROCESS VARIABLES. FOR EXAMPLE, ACOUSTIC EMISSIONS CAN DETECT GENERATION OF A DEFECT IN METAL WORKING OPERATIONS OR MOLD TOOL WEAR.

(2776) 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 PICK-AND-PLACE CONTROLLED LASER CUTTING EQUIPMENT TO PRODUCE CLOSE TOLERANCED JORDANITE CONFIGURATIONS IN HARDENED STRUCTURES.
COMPONENT — FORMING/MACHINING

(27.7) TITLE — PRECISION CONE LATHE FABRICATION

PROBLEM — THERE IS NO EFFECTIVE PROVISION FOR MACHINING PRECISION SHAPED CHARGE CONE LINERS IN MEDIUM RANGE PRODUCTION QUANTITIES. YEARLY PRODUCTION RATE OF COPPERHEAD FALLS IN THE MIL-RANGE CATEGORY.

SOLUTION — MODIFY A MACHINE TO PROVIDE A BROAD RANGE OF PRECISION SHAPED CHARGE LINERS AT MODERATE VOLUMES AND COMPARATIVELY LOWER COSTS.

(27.5) 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.

(36.5) TITLE — IUD FOR DU CCRES

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 ELECTROPLATING ARE NOT SATISFACTORY.

SOLUTION — INVESTIGATE ION VAPOR EVAPOSITION COATINGS. DETERMINE EQUIPMENT REQUIREMENTS, INFECTION AND TEST PROCEDURES, PRODUCE A PIECE OF PRODUCTION EQUIPMENT, AND ESTABLISH PROCESS PARAMETERS.

(32.6) TITLE — MANUFACTURING PROCESS FOR CALIBER .50-.30MM PENCATRERS

PROBLEM — CURRENT PROCESS GENERATES HIGH SCRAP RATES OF RADIOACTIVE CONTAMINANTS WHICH PRESENTS DISPOSAL PROBLEMS.

SOLUTION — DEFINE FULL PRODUCTION PROCESS AND EQUIPMENT FOR MANUFACTURE OF DU PENCATRERS BY DEVELOPING ROLL FORMING TECHNIQUES.

(37.3) TITLE — WASP SHAPED CHARGE LINER

PROBLEM — THE WASP HEAD (WASP) SHAPE 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 FIRST-YEAR DOLLARS.

SOLUTION — NO SOLUTION PROVIDED.
### Component: Machining/Machining (continued)

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| 571.5 | TITLE: IAM Advanced Material Lines 1983-85  
PROBLEM: Machining time currently represents a large portion of the warhead cost which would be prohibitive in mass production.  
SOLUTION: Alternate forming processes would need to be investigated which could economically produce the liners with the required precision. |
| 571.7 | TITLE: Production Base for Novel Shaped Charge Liners  
PROBLEM: New shaped charge materials being investigated to combine high mass and pyrophoric will have no production base because of the nature of the materials.  
SOLUTION: A combination of blowcasting the composite and pressure casting to remove excess low density material can produce shaped stock for further warm working. |
| 431.6 | TITLE: Improved Projectile Cavity Surface  
PROBLEM: The forming processes techniques currently used can cause defects in the cavity surface. This condition needs correction to prevent sensitivity problems that can occur with the composite explosive to be used in HE rounds.  
SOLUTION: Investigate the various methods such as nickel carbide billet separation, scale tool wear or oxides and foreign matter build-up. Determine test process changes. |
| 425.1 | 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. |
| 451.6 | TITLE: Improved Tool Stills for Projectile Manufacture  
SUBLIM: Selecting tool grade, heat-treat cycle and surface finish for tools operating at temperatures, pressures and friction conditions is a problem for projectile manufacturers. The problem leads to poor surface quality of projectile cavities.  
SOLUTION: An evaluation of new tool steel and hard facing materials for metal forming is needed to establish tool steel grades and/or hard facing parameters to meet the severe conditions encountered in projectile manufacturing operations. |

### Funding ($000)

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**COMPONENT -- FORMING/MACHINING**

(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.

(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 TWO PIECE NOSE FOR HEAT PROJECTILE

**PROBLEM** - THE FUTURE GENERATION HEAT PROJECTILES NOW IN DEVELOPMENT EMPLOY TWO-PIECE CONICAL NOSE. THE TOLERANCES REQUIRED FOR THE LOW-DRAG OUTER PROFILE AND FOR THE GAP BETWEEN INNER AND OUTER CONES PRESENT A PRODUCTION PROBLEM.

**SOLUTION** - EVALUATE TWO ALTERNATE METHODS OF PRODUCTION, I.E., SHEAR FORMING VS DRAW/ANNEAL. PHASE ONE WOULD TEST 50 PROJECTILES PRODUCED BY EACH CANDIDATE PROCESS. PHASE TWO WOULD FABRICATE 100 PROJECTILES BY THE PRODUCTION PROCESS CHOSEN DURING PHASE ONE.

(4530) **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 MBIS LINER REQUIRES PRECISION AN ORDER OF MAGNITUDE GREATER (.0005").

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

(6716) **TITLE** - DEV COMP-AID MODEL OF FORMING OPERATIONS FOR ARTILLERY MPTs

**PROBLEM** - TRIAL AND ERROR METHODS AND THE ABSENCE OF PROVEN AUTOMATED DESIGN TECHNIQUES FOR TOOLING CAUSE UNEXPECTED FAILURES IN FORMING OPERATIONS AND DELAYS IN STARTUP OF AMMUNITION PRODUCTION LINES.

**SOLUTION** - DEVELOP ANALYTICAL MODELS AND AUTOMATED TOOL DESIGN METHODS OF CRITICAL METAL FORMING OPERATIONS. TOOL DESIGNS THUS GENERATED WILL BE TESTED IN A PRODUCTION SETTING TO VERIFY THE COMPUTER MODELS. PROVEN MODELS ARE APPLICABLE TO CURRENT AND FUTURE ITE
COMPONENT -- PROJECTILES

(0006) TITLE - AUTOMATED MATERIAL HANDLING

PROBLEM - MATERIAL HANDLING IN MunITIONS METAL PARTS PROCESSING IS A
SIGNIFICANT ELEMENT OF COST.

SOLUTION - NEW AUTOMATIC HANDLING DEVICES SUCH AS PROGRAMMABLE ROBOTS WILL BE
INVESTIGATED FOR APPLICABILITY TO MunITIONS COST REDUCTION.

(0111) TITLE - PILLET NICKING IMPROVEMENT

PROBLEM - PRESENT PRACTICE OF TORCH NICKING OF STEEL PILLETS FOR PROJECTILE
FORGING PRODUCES A PERCENTAGE OF NON-UNIFORM BURRS THAT RESULT IN FORGING
REWORK OR SCRAP.

SOLUTION - INVESTIGATE OTHER FORMS OF NICKING SUCH AS PLASMA ARC, ELECTRON
BEAM AND LASER TO IMPROVE QUALITY OF BURRS.

(0112) TITLE - IMPROVED SWAGING OF ROTATING FANLS

PROBLEM - WEST TIRE SETTER BANDING MACHINES ARE COMMONLY USED FOR SWAGING
ROTATING FANLS TO PROJECTILE HUBS. THE COMPANY IS NO LONGER IN BUSINESS
AND PARTS ARE NOT AVAILABLE FOR REPLACEMENT. NEW AUTOMATIONS AT SCRANTON AND
LOUISIANA ARE NOT OPERATIONAL.

SOLUTION - INVESTIGATE NEW EQUIPMENT DESIGNS TO REPLACE WEST TIRE SETTERS.

(0116) TITLE - SINTERED IRON FORGING BAND FOR 20MM M221/M246

PROBLEM - UNDER FIP P-FO-04-3005 AN ALTERNATE MATERIAL, SINTERED IRON, IS TO
BE QUALIFIED TO REPLACE THE STANDARD COPPER BAND ON AUTOMATIC CANNON
AMMUNITION. CURRENT MANUFACTURING TECHNIQUES PROVIDES FOR EMPLACEMENT OF A
COPPER BAND.

SOLUTION - DEVELOP THE NECESSARY MANUFACTURING TECHNIQUES WHICH TAKES INTO
ACCOUNT THE SINTERED IRON BAND MATERIAL.

(0119) TITLE - COLLE SPEARING OF ALUMINUM PLUGS FOR FORGING

PROBLEM - CURRENTLY ALUMINUM PILLETS ARE SAWED TO PROVIDE PLUGS FOR FORGING.
THE NET LOSS IS APPROXIMATELY 1.34% PER SLUG.

SOLUTION - ADVANCING THE STATE-OF-THE-ART OF COLD SPEARING AND POTENTIAL
COST SAVINGS WARRANTS INVESTIGATION OF COLD SPEARING ALUMINUM PLUGS FOR
FORGING.

(1571) TITLE - AUTO FACING FOR 5-INCH PROJECTILE

PROBLEM - CURRENT INSPECTION IS INADEQUATE TO MEET 5-INCH PROJECTILE PORTES
REQUIREMENT AND IMPROVE DESIGN CHANGES.

SOLUTION - DEVELOP AUTOMATED ACCEPTANCE INSPECTION SYSTEM FOR 5-INCH 5P AND 6-
INCH 5A CALIBER PROJECTILE HOLE.
COMPONENT -- PROJECTILES (CONTINUED)

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

(411) TITLE - HIGH FRAGMENTATION STEEL PRODUCTION PROCESS

PROBLEM - THE CURRENT PRODUCTION PROCESS FOR MANUFACTURING M11 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 MATERIAL; 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 TITANIUM MACHINING CHIPS

PROBLEM - TITANIUM CHIPS ARE PYREXIC AND MUST BE DISPERSED IN AN INERT
MATERIAL TO BE DISPOSED OF BY EURIAL AS A RADIOACTIVE MATERIAL. RECYCLING
INTO USEABLE METAL WOULD SOLVE DISPOSAL PROBLEMS.

SOLUTION - CONTINUE EFFORT INITIATED IN FY60 W/RERDIRECTED FY79 FUNDS. VARIOUS
APPROACHES TO CHIP RECYCLING ARE BEING EXPLORED. ONE APPROACH SHOWING MOST
ADVANTAGES WILL BE SELECTED FOR FURTHER OPTIMIZATION IN FY73.

(6756) TITLE - ULTRA-HIGH SPEED METAL REMOVAL, ARTILLERY SHELL

PROBLEM - DUE TO THE LOW METAL REMOVAL RATES OF THE CURRENT CONVENTIONAL
MACHINING OPERATIONS, A GREATER NUMBER OF MACHINES ARE REQUIRED TO PRODUCE
ARTILLERY PROJECTILES.

SOLUTION - TO ACHIEVE INCREASED METAL REMOVAL RATES ALSO TO REDUCE THE NUMBER
OF MACHINES CURRENTLY USED TO PRODUCE PROJECTILES.

COMPONENT -- TOOLING

(32)X TITLE - PRECISION TOOLING FOR SMALL CALIBER AMMUNITION

PROBLEM - COST OF TOOLS AND REPLACEMENT SETTING TIME ARE SIGNIFICANT FACTORS
IN THE COST OF AMMUNITION. WORK IN THE CAN INDUSTRY SHOWS THAT SIGNIFICANT
IMPROVEMENTS IN CALIBER TOLERANCES; IMPROVED GRINDING METHODS; AND TOOL LIFE
CAN BE ACHIEVED.

SOLUTION - INDUSTRY TECHNIQUES WILL BE EVALUATED. SAMPLES WILL BE PRODUCED AND
EVALUATED IN ACTUAL PRODUCTION ENVIRONMENTS. COST AND TOOL LIFE WILL BE
OPTIMIZED.
COMPONENT -- TOOLING (CONT.)

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

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

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

CATEGORY

POLLUTION ABATEMENT

COMPONENT -- CHEMICAL

(4116) TITLE - EST. CHEM PROD. FILL CLOSED + LAMP TECH F/X 2 Y 796

PROBLEM - THE PROCESS FOR WASTEWATER FOR LABORATORY MATERIALS RESULTS IN LARGE QUANTITIES OF WASTE, AND ORGANIC PHOSPHORUS COMPOUNDS. PRIOR PROCEDURES FOR DISPOSAL (GEOLOGICAL) ARE NO LONGER ACCEPTABLE. NEW TECHNIQUES ARE REQUIRED.

SOLUTION - ESTABLISH PROCEDURES TO REDUCE WASTE BY-PRODUCTS AND PROVIDE METHODS FOR DISPOSAL OF UNAVOIDABLE WASTE MATERIAL FROM PROCESS MFPG.

(420P) TITLE - EVALUATION OF DMA DISPOSAL ON HSAP E-LINE

PROBLEM - EFFLUENT FROM AMMONIA RECOVERY COLUMN CONTAINS SIGNIFICANT AMOUNTS OF DMA. DMA IS ONE OF THE EPA CONSENT DEGREE COMPOUNDS FOR WHICH WATER QUALITY CRITERIA MUST BE PROVIDED. EPA INSISTS ON LEVELS BELOW 0.3 PPM.

SOLUTION - EVALUATE UV PHOTOLYSIS, CATALYTIC HYDROGENATION, CARBON ADSORPTION, OR OTHER TECHNIQUES FOR ABATING DM DISPOSAL ON HSAP E-LINE.

COMPONENT -- GENERAL

(1554) TITLE - SLUDGE VOLUME REDUCTION AND DISPOSAL PROCESS STUDY

PROBLEM - MFPG POLLUTION ABATEMENT FACILITIES UNDER CONSTRUCTION AT PINE FLUFF ARSENAL DISCHARGE INTO A SETTLEMENT LAGOON HAVING A FIVE YEAR CAPACITY BUT NO CLEAN OUT OF SLUDGE DISPOSAL EQUIPMENT TO EXTEND LAGOON LIFE-SPAN, SLUDGE VOLUME MUST BE MINIMIZED.

SOLUTION - PROVIDE A PROCESS FOR LAGOON, SLUDGE CLEAN-OUT, + DEWATERING FOR LAGOON DISPOSAL. VOLUME WILL BE REDUCED BY PRELIMINARY CLARIFICATION + EQUALIZATION TO MINIMIZE CHEMICAL TREATMENT REQUIREMENTS. EVALUATE OTHER TREATMENT CHEMICALS TO REDUCE SLUDGE VOLUME.
COMPONENT -- GENERAL

(176) TITLE -- POLLUTION ABATEMENT CONSERVATION EVALUATIONS

Problem -- PES POLLUTION ADATE FAC MARE CONSUMER OF VALUABLE RESOURCES. FLOWS FROM PES AREAS ARE NOT CURRENTLY MONITORED NOR EQUILIZED PRIOR TO TREATMENT. CREATING SITUATION WHERE CHEM FEEDERS MUST BE SET A RATE TO TREAT PERIODIC SLUGS W/O NPDES.

Solution -- SURVEY OF WATER + CHEM UTIL IN POLLUTION AREAS FAC BE CONDUCTED IDENT CONTROL METHODS TO MINIMIZE FLOWS. CHEM UTIL + REDUCE SLUDGE GENERATION. EVAL OF USE OF CONTINUOUS MONITORS IN INFLUENT EQUAL BASIN COULD MINIMIZE/OPTIMIZE CHEM + WATER USAGE.

(4276) 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 AAF WASTEWATER EFFLUENT DISCHARGE STREAMS.

(4277) TITLE -- DISPOSAL OF WASTE WATER TREATMENT SLUDGE

Problem -- WASTEWATER TREATMENT FACILITIES OF AAFS GENERATE LARGE VOLUMES OF SLUDGE FOR WHICH LAND FILL DISPOSAL WILL BE PROHIBITED AND WHICH WILL REQUIRE COSTLY ALTERNATE DISPOSAL METHODS.

Solution -- ALTERNATE DISPOSAL TECHNIQUES WILL BE INVESTIGATED THAT WILL ELIMINATE PROPPELLANT CONTAMINANTS BY PHYSICAL CHEMICAL THERMAL DESTRUCTION AND RECLAIM HEAVY METALS AND COMPOUNDS FOR REUSE IN THE MANUFACTURING PROCESS.

(4278) TITLE -- IN-PLANT REUSE OF POLLUTION-RELATED WATER

Problem -- MORE STRINGENT STANDARDS FOR MILITARY UNIQUE POLLUTANTS. 1985 GOAL OF ZERO DISCHARGE. DEFENSE OF POLLUTION. CONTINUE THIS REUSE OF TREATED WTRP IN OTHER PROCESSES.

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

(4279) TITLE -- NOISE POLLUTION ABATEMENT F/F AND CAMP, IN LACAP

Problem -- NOISE LEVEL EXCEEDS R5 IFRS IN BOG 10 AT LACAP CITY AAF.

Solution -- INSTALL RECOMMENDED ONI'S SUBMODULE NOISE SUPPRESSION SYSTEM AND EVALUATE ALL OTHER SUBMODULES.
FIVE YEAR PLAN
LCG REPOY 196

COMPONENT -- GENERAL

(Continued)

TITLE -- PLACE FIGURE DISPOSAL TO WASTE MIXED WASTE SYSTEMS

PROBLEM -- Pits 3-5, 9, REQUIRES THAT WASTE DISCHARGES BE MONITORED TO ASSURE THAT
AQUEOUS LIFE ARE PROTECTED FROM TOXIC/Hazardous SUBSTANCES. IN ADDITION,
PHYSICOLOGICAL 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. EXPOSED CHEMICAL MONITORING MIGHT BE ELIMINATED.

COMPONENT -- PROPELLANTS/EXPLOSIVES

(4.2.3) TlELE -- RED WATER POLLUTION ABATEMENT SYSTEM

PROBLEM -- RED WATER PRODUCED IN VOLUME FROM THE PURIFICATION OF TNT IS A
POLLUTANT FOR WHICH A SATISFACTORY DISPOSAL METHOD DOES NOT EXIST.

SOLUTION -- THE FEASIBILITY OF THE SONOCO SULFITE RECOVERY PROCESS FOR THE
DISPOSAL OF RED WATER HAS BEEN DEMONSTRATED. THIS PROJECT OPTIMIZES
OPERATING PARAMETERS OF CRITICAL COMPONENTS TO SUPPORT AN HCA PROJECT FOR
REPORT ABC.

(4.2.9) 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 ADAPTED TO THE CURRENT SYSTEM.

(4.2.7) TITLE -- TERTIARY TREATMENT OF HOLLSON WASTE WATER

PROBLEM -- FACILITY PROJECT AT HOLLSON REQUIRES TERTIARY TREATMENT TO MEET
DISCHARGE STANDARDS FOR NITROGENATE. CARBON ADSORPTION OR A HYBRID TREATMENT
SYSTEM IS NEEDED.

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

(4.4.9) TITLE -- ADVANCED POLLUTION ABATEMENT FOR DARMON 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 HAP WASTEWATER, TO TREAT PINK WATER, AIR
EMISSION AND DEFOMATION WASTE, TO PROVIDE ENVIRONMENTAL IMPROVEMENTS FOR
WASTE FUELS.
COMPONENT -- PROPELLANTS/EXPLOSIVES

(4011) TITLE -- DISPOSAL OF FINAL SLUDGE FROM ACID RECOVERY OPERATIONS

PROBLEM - RECOVERY OF SODIUM NITRATE AFTER HM/AEX PHOS AT MSAP IS COSTLY AND CAUSES POLLUTION. SODIUM NITRATE RESULTS BECAUSE SODIUM HYDROXIDE IS USED IN THE ACID PLANT TO NEUTRALIZE RESIDUAL NITRIC ACID AND EXPLOSIVES IN THE SPENT ACID.

SOLUTION - USE AMMONIA. 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 SODIUM NITRATE.

COMPONENT -- RECYCLE

(4011) TITLE -- POLLUTION AWARE FOR RECYCLE OF MET-ILLUMINANTS

PROBLEM - SCRAP PYROTECHNIC COMPOSITION IS DISPOSED BY BURNING CAUSING AIR POLLUTION, ALSO POWDERED MANESITE IS LOST AND IT IS A CRITICAL MATERIAL IN SHOT SUPPLY.

SOLUTION - NAVY AT CRANE INDIANA HAS COMPLETED R&D WORK ON RECOVERING AND RECYCLING OF POWDERED MANESITE. SIGNIFICANT CEST SAVINGS ARE PROJECTED. THIS PROJECT WILL CONDUCT THE REQUIRED PILOT WORK TO SUPPORT FACILITY DESIGN.

(4011) TITLE -- CAUSTIC RECOVERY FROM SODIUM NITRATE SLUDGE

PROBLEM - HOLSTON IS CURRENTLY LOUSING $200 PER TON OF SODIUM NITRATE BY-PRODUCT SODIUM NITRATE IS EXTREMELY DIFFICULT TO DISPOSE OF DUE TO COMPETITION FROM OTHER FERTILIZERS ON THE MARKET.

SOLUTION - CONVERT SODIUM NITRATE INTO SODIUM HYDROXIDE FOR FEAST IN SPENT ACID RECOVERY OPERATIONS AT HOLSTON. A SUBSTANTIAL COST BERTIFIT RESULTS BY REDUCING THE AMOUNT OF NEW SODIUM HYDROXIDE SOLUTION TO BE PURCHASED.

(4544) TITLE -- FIRST WASTE DISPOSAL TECH FOR HAB PLYA PRIMARY PROJ FAC

PROBLEM - LARGE QUANTITIES OF SOLID WASTES ARE GENERATED DURING O&M. THERE IS NO ACCEPTABLE DISPOSAL METHOD. TRUE STORAGE IS NOT FEASIBLE AND LANDFILL MAY REQUIRE SPECIAL PERMIT.

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 WTR FACILITY AND RECYCLE STILL POTIONS WHICH WILL REDUCE SOLID WASTE BY 5 PERCENT.

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CATEGORY
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PROPELLANTS
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### Component -- Hall

**470** Title: Nitrocellulose & Nitroglycerine Recovery From Scrap Prop

- **Problem:** There are large quantities of excess scrap double base propellant currently backlogged for disposal. The normal disposal method is burning which causes air pollution.
- **Solution:** Develop a process to safely and economically recover the nitrocellulose and, if possible, the nitroglycerine contained in the double base propellants. These materials could then be used in the production of ball propellant.

**454** 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 QM's St. Marks, FL facility to develop a safe and efficient process to coat 7.62mm ball propellant with calcium carbonate.

### Component -- Bedite

**420** Title: Dry Cutting of Energetic Materials

- **Problem:** Bedite straws are cut to required length using a milling machine with two circular saws. This is unusually costly because of excessive handling, and additional testing and inspection operations.
- **Solution:** Initiate high pressure water jet in the form of a fine jet stream to cut bedite straws. This will reduce the number of operations, eliminate handling, testing/inspecting operations, and regrading will be minimized.

### Component -- General

**482** Title: Emerging Propellant Mfg Technology

- **Problem:** Many processes for manufacturing of propellants use techniques developed during World War II. Such processes involve costly batch-type, labor-intensive operations. These methods are excessive in energy users and solution concentrations.
- **Solution:** Develop a low cost, efficient, cost-effective propellant production process. Utilize 24/7 continuous and automated advanced technology. Benefits include greater labor, pollution, and energy consumption.

#### Funding ($000)

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COMPONENT -- GENERAL

TITLE - CONTROL DRYING IN AUTO SE AND HALL PROP MFG

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.

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 PILOT SCALE EQUIPMENT TO AUTOMATICALLY PRODUCE HUCKED SOLVENT-TYPE STICK PROPELLANT, WHICH WILL BE CUT BY FLUID JET CUTTER. THIS PROCESS WILL OPERATE WITH EXISTING 12 INCH PRESS AND PRESS BAY.

TITLE - LOVA PROPELLANT MANUFACTURING PROCESS

PROBLEM - VUL OF PROP TO WAR ATTACK FORCES CONTRIP MAJOR PORTION OF PROBABILITY OF LOSING A FIRING VEHICLE. VUL OF PULP PROPELLANT IN COMPLETE ROUND ASSEMBLY STORAGE OR TRANSPORT IS ALSO A PROBLEM. THIS CHANCE IS INHERENT IN CURRENT MULTIBASE FORMULATION.

SOLUTION - CLASS OF PROP UTIL NITRAMINES REDUCES PROP TO ACCEPT LEVEL. A PROCESS FOR MFG OF LOVA PROP + AN INERT RINDER RL DEV. PILOT SCALE PROCESS EQUIP HE ASSEMBLED TO PROV AN EFFECTIVE PROP IN OPTIMUM GEOMETRIC CONFIG /BALLISTIC EVAL IN SPEC APPLICATIONS.

COMPONENT -- MISCELLANEOUS

TITLE - CONVERSION OF SURPLUS PENTABRANE TO B10

PROBLEM - THE DIOXIDE (H2) USED IN THE MANUFACTURE OF DECABRANE (B10) IS A COST DRIVER.

SOLUTION - DEVELOP A PROCESS TO MIX GOVERNMENT OWNED PENTABRANE (B5) WITH B7 TO REDUCE THE COST OF THE PRODUCT B10.
COMPONENT -- MULTI-BASE

(4512) TITLE - AUTOMATED DIE CUTTER FOR 12-INCH PRESS

PROBLEM - PRODUCTION OF DOUBLE- AND TRIPLE-BASE GRANULAR PROPELLANT REQUIRE EXTRUSION OF STRANDS INTO COMPARTMENTS ON A BUGGY. THE STRANDS ARE MANUALLY FED TO A CUTTER AND THE GRAINS ARE PLACED IN DRYING TRAYS. THIS PROCESS REQUIRES NUMEROUS PERSONNEL.

SOLUTION - DEVELOP A PROTOTYPE CUTTING AND MATERIAL HANDLING SYS OF AUTOMATIC CUTTERS MOUNTED BELOW THE PRESS WHICH FEED, MEASURE, AND CUT THE INDIVIDUAL STRANDS TO THE DESIRED LENGTH. THE CUT GRAINS FROP INTO CONTAINERS FOR MOVEMENT TO A TRAYING STATION.

(4511) TITLE - CONTINUOUS PRODUCTION OF NEW PROPELLANTS ON CAMBL

PROBLEM - VARIOUS HIGH ENERGY AND LOVA GRANULAR AND STICH 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 - ACCEPT 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.

(4564) TITLE - DEVELOP A THIRD GENERATION DYNA GUN TO SIMULATE TANK GUN

PROBLEM - STANDARD ELLISTIC 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 DYNA GUN WHICH CAN BE USED IN LIEU OF STANDARD ELLISTIC TESTS AS A MORE RAPID AND LESS COSTLY MEANS OF ASSESSING PROPELLANTS FOR THE 105MM AND 120MM TANK GUNS.

COMPONENT -- NITROCELLULOSE

(4029) TITLE - PROCESS FOR KG OF CELLULOSE NITRATE SHEETSTOCK

PROBLEM - THE ARMY INTENDS TO PURCHASE THE MFG RIGHTS TO THE UK MORTAR ROUND WHICH USES CN SHEETSTOCK. THE CURRENT PRODUCTION METHOD OF CASTING THE CN INTO BLOCS AND SLICING THE BLOCS INTO SHEETS IS TIME CONSUMING AND LABOR INTENSIVE.

SOLUTION - INVESTIGATE OTHER METHODS OF MANUFACTURE, DETERMINE FEASIBILITY AND PROVIDE EQUIPMENT TO AUTOMATE THE SHEETSTOCK MANUFACTURING PROCESS.
COMPONENT -- NITROCELLULOSE

(4541) TITLE -- IMPROVED NITROCELLULOSE PURIFICATION

PROBLEM -- EXISTING NITROCELLULOSE PURIFICATION FACILITIES WERE BUILT IN EARLY 1940'S AND ARE IN DETERIOERATIVE CONDITION. THE PROCESS USES DATES BACK TO WW II AND CONSUMES LARGE QUANTITIES OF ENERGY AND WATER.

SOLUTION -- SELECT AND DEVELOP A NITROCELLULOSE PURIFICATION PROCESS TO BE USED IN THE MODERNIZATION PROGRAM WHICH IS MORE ENERGY AND WATER EFFICIENT. THE METHOD SELECTED IS BASED ON THE SWISS CONICELL PROCESS AS A RESULT OF THE FY77 EFFORT.

(4514) TITLE -- CONFINING NITRATING ACID REMOVAL

PROBLEM -- THE CONTINUOUS NITRATING PROCESS USES A CONTINUOUS COUNTER CURRENT WASH TYPE CENTRIFUGE. OPERATIONAL DIFFICULTIES CAN LEAD TO AN EXCESSIVE AND UNSAFE ACCUMULATION AND CONFINEMENT OF ACID WET UNSTABLE NITROCELLULOSE.

SOLUTION -- CONDUCT A SURVEY OF EQUIPMENT FOR OFF-THE-SHELF AVAILABILITY. MINIMIZE FLOOR AREA REQUIREMENTS TO AVOID ADDITIONAL BUILDING REQUIREMENTS. PROCURE, INSTALL, AND EVALUATE THE EQUIPMENT SELECTED OR DESIGNED.

COMPONENT -- NITROGUANIDINE

(4554) TITLE -- MG CRYSTALLIZATION FOR CONTINUOUS FUP LINES

PROBLEM -- NITROGUANIDINE PRODUCED ON THE NEW LINE AT SUNFLOWER AAF IS EXPECTED TO HAVE A DIFFERENT PARTICLE SIZE DISTRIBUTION THAN THAT OF PREVIOUS SUPPLIER. THIS MAY CREATE PROCESSING PROBLEMS IN THE NEW CONTINUOUS AUTOMATED MULTI-BASE LINE (CAMEL) PROCESS.

SOLUTION -- THIS PROJECT IS TO QUALIFY THE NITROGUANIDINE PRODUCED AT SUNFLOWER AAF ON THE CAMEL PROCESS AT RAPPERS AAF AND DETERMINE IF THERE WILL BE ANY SERIOUS PROCESSING PROBLEMS.

(4561) TITLE -- NITROGUANIDINE PROCESS OPTIMIZATION

PROBLEM -- A NITROGUANIDINE FACILITY IS UNDER CONSTRUCTION AT AAF TO BE OPERATIONAL IN FY78. IT UTILIZES PROCESS: NOT PREV. USED COMMERCIAL THE OPERATION OF WHICH ARE STRONGLY INTERDEPENDENT.

SOLUTION -- CONDUCT PROCESS IMPROVEMENT PROCEDURES USING NITROGUANIDINE SUPPORT EQUIPMENT (ASE) INSTALLED UNDER PROJECT 9725632 AND APPLY EVOLUTIONARY OPERATION (EVOP) TO THE NITROGUANIDINE FACILITY BEING CONSTRUCTED AT SUNFLOWER AAF.
COMPONENT -- NITROGUANIDINE
(Continued)

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

PROBLEM - A NITROGUANIDINE MPG FACILITY IS BEING CONSTRUCTED AT SUNFLOWER
AIR. MPT 5 TF 4447 INDICATED THE FEASIBILITY OF AUTOMATED ON-LINE
INSTRUMENTATION FOR PROCESS ST-100 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 NO SUPPORT EQUIPMENT WHICH IS
TO BE OPERATED DURING FY66 UNDER MPT 5 TF 4061. NO PROCESS OPTIMIZATION.

COMPONENT -- SINGLE FUEL

(4527) 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 LABOR AND EMERGENCY 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.

COMPONENT -- SOLVENTLESS

(4111) TITLE - PROCESS FOR DEPOSITION OF PROPELLANT ON A SCREEN SUBSTRATE

PROBLEM - NO PROCESS OR MANUFACTURE CAPACITY EXISTS FOR THE VOLUME PRODUCTION
OF UNUSUAL PROPELLANT CONFIGURATION WHICH INVOLVES COATING A PLASTIC SCREEN
WITH PROPELLANT. THIS CONFIGURATION IS BEING CONSIDERED FOR A NEW ANTITANK
ROUND.

SOLUTION - ADAPT EXISTING FACILITIES TO MEET SAFETY AND PRODUCTION
REQUIREMENTS AUTOMATING AREAS AS REQUIRED.

***********************
* C A T E G O R Y *
***********************
* QUALITY CONTROL/TESTING *
***********************

COMPONENT -- INSPECTION

(4103) TITLE - AUTO LINK INSPECTION EGPT SYSTEM (ALIES)

PROBLEM - CURRENT MANUAL INSPECTION METHODS FOR SMALL ARMS AMMUNITION LINKS
ONLY PROVIDES FOR A SAMPLING OF LESS THAN ONE PERCENT OF OUTGOING LINKS.
NON-CONFORMING LINKS CAUSE COSTLY LOADING MACHINE JAMS.

SOLUTION - THIS PROJECT WILL DEVELOP AND BUILD AN AUTOMATED LINK INSPECTION
SYSTEM. THE SYSTEM WILL TEST AND INSPECT CRITICAL AND MAJOR FEATURES OF EACH
M13 LINK PRODUCED.
COMPONENT -- INSPECTION

(4357) TITLE -- FLUX LEAKAGE INSPECTION SYSTEM FOR M483
PROBLEM -- THERE IS NO NONDESTRUCTIVE METHOD WITH FLOW DETECTION RELIABILITY.
ESTABLISH A MAGNETIC FLUX LEAKAGE DECOY PURCHASED FROM LOUISIANA AAR.
DEMONSTRATED FEASIBILITY BUT COST OF OPERATION MUST BE DETERMINED.
SOLUTION -- DESIGN DEVELOP AND FABRICATE A Prototype NDE INSPECTION SYSTEM.

(4358) TITLE -- AUTO LINE -- PROCESS INSPECTION OF FUSION EECS (ALPINE)
PROBLEM -- INSPECTION OF BRIDGE WIRE ON ELECTRIC MOTOR.
SOLUTION -- AUTOMATE THE TESTING TECHNOLOGY DEVELOPED BY TTS ARRACOM 1276.
"ELECTRO-HEAT ANALOG RESPONSE INSPECTION OF EECS" FOR FINAL END ITEM.
NONDESTRUCTIVE ACCEPTANCE INSPECTION.

(4359) TITLE -- IMPROVE PROCESS TECHNOLOGY FOR INSPECTION OF CLOTH
PROBLEM -- REDUCE TIME AND COST OF VISUAL INSPECTION OF CLOTH USED IN
PROPELLANT BAGS, FLASH REDUCERS, ACTIVATION LINERS AND IGNITER PADS.
SOLUTION -- IMPLEMENT EQUIPMENT PROVEN FEASIBLE.
PROCUREMENT AND INSTALLATION OF MODERN STATE-OF-THE-ART SENSORS.
LOCATION OF CLOTH DEFECTS DURING SLITTING OPERATION. CLOTH WILL BE REMOVED
DISCARDED PRIOR TO SUBSEQUENT SPOOLING OPERATIONS.

(4471) TITLE -- CONICAL SURFACE INSPECTION
PROBLEM -- NO SATISFACTORY AUTOMATED INSPECT SYSTEM IS KNOWN TO
ACCOMPLISH THE VARIOUS CONICAL SURFACE INSPECTIONS FOR CONVENTIONAL AND
ADVANCED SHARPED CHARGE LINERS.
SOLUTION -- PROVIDE AN AUTOMATED INSPECTION SYSTEM COMPATIBLE WITH PROPOSED
CONVENTIONAL AND SHARPED CHARGE TECHNOLOGY PROGRAMS, SPECIFICALLY FOR CONICAL
SURFACE MEASUREMENTS.

COMPONENT -- NONDESTRUCTIVE TESTING

(3717) TITLE -- APPLICATION OF X-RAY SYSTEMS SCANNER 100 FCT
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 NDE METHOD TO CONTINUOUSLY VERIFY
THE TENSILE AND HARDNESS PROPERTIES OF EACH SHELL PRODUCED.
COMPONENT -- NON-DESTRUCTIVE TESTING

(4121) TITLE - SHELL HOLOGRAPHIC INSPECTION AND EXAMINATION LINE DEVICE

PROBLEM - THERE IS NO COMPLETE AUTOMATIC NON-DESTRUCTIVE INSPECTION SYSTEM FOR TESTING SHELLS AT 100 PERCENT PRODUCTION RATE.

SOLUTION - DEVELOP A PRODUCTION Prototype HOLOGRAPHIC SYSTEM TO AUTOMATICALLY INSPECT ENTIRE 155MM M4A1 M199 PROJECTILES.

(4473) TITLE - AUTO LEAK DETECTION OF WP MUNITIONS

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

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 - BONED AREAS OF 11/4 INCH MORTAR INCREMENT CONTAINERS

PROBLEM - LACK OF NONDESTRUCTIVE TEST OF INSPECTION OF THE BONING OF THE CONTAINER HALVES AND THE CLOSURE OF FILLING NOSE.

SOLUTION - DEVELOP NOT AND EQUIPMENT FOR AUTOMATIC 100 PERCENT INSPECTION OF THE INCREMENT CONTAINER BONDED AREA. THE FEASIBILITY OF OPTICS TECHNOLOGY WILL BE INVESTIGATED FOR PRACTICABILITY WHICH WILL BE FOLLOWED BY EQUIPMENT DESIGN AND FABRICATION.

COMPONENT -- SIMULATION

(2546) TITLE - SHOCK IMPULSE HYDROSTATIC TESTING

PROBLEM - BALLISTIC ACCEPT TEST OF METALLIC CARTRIDGE CASES UTILIZES 100 SAMPLE ITEMS LOADED INTO COMPLETED HOUSING AND FIRED AT A P.H. THIS TEST CONSTITUTES APPROX 40 PERCENT OF ALL BALLISTIC ACCEPT TEST DONE ON ENTIRE ROUND REQUIRED TO PRODUCT LINE.

SOLUTION - A SHOCK IMPULSE HYDROSTATIC PRESSURE TESTER DEVELOPED TO TEST COMPONENT CARTRIDGE CASE IN-PLANT W/O NEED OF ASSEMBLING INTO A FULL-UP ROUND WHILE STILL SIMULATING INTRAHOLE BALLISTIC FAIL WILL MINIMIZE EXCESS OF TESTING BALLISTICALLY.

COMPONENT -- X-RAY

(4444) TITLE - AUTOMATIC INSPECTION DEVICE EXPLOSIVE CAST II SHELL

PROBLEM - THE PRESENT METHOD OF INSPECTION LOADED PROJECTILE UTILIZES A STANDAR HOLOGRAPHIC FILM METHOD. EACH AND MATERIAL (FILM) ARE COSTLY. DETERMINATION OF CRITICAL OBJECTS SUBJECT TO HUMAN JUDGMENT, FATIGUE, AND PROOF.

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 AUTOMATIC INSPECTION SYSTEM.
MPT FIVE YEAR PLAN
RCS ORCMT 126

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<td><strong>(4546) TITLE</strong></td>
<td>DIGITAL IMAGE AMPLIFICATION 3-RAY SYSTEM</td>
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<td><strong>PROBLEM</strong></td>
<td>EXISTING IMAGE AMPLIFICATION 3-RAY DOES NOT MEET THE IMAGE QUALITY CRITERIA TO BE USED AS AN INSPECTION TOOL FOR HE MORTAR BATTERIES. FILM RADIOGRAPHY, AS CURRENTLY USED, IS LABOR INTENSIVE, TIME CONSUMING, AND SUBJECT TO HUMAN INTERPRETATIVE JUDGEMENT.</td>
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<td><strong>SOLUTION</strong></td>
<td>REPLACE WITH AN IMPROVED REAL-TIME IMAGE AMPLIFICATION SYSTEM. TECHNIQUES FOR DIGITAL IMAGE ENHANCEMENT AND ANALYSIS DEVELOPED UNDER THE APS PROJECT WILL BE ADOPTED.</td>
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<th>(4771) TITLE</th>
<th>EXPLOS PREVENTION IN DRY DUST COLLECTION SYSTEMS</th>
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<td><strong>PROBLEM</strong></td>
<td>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.</td>
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<tr>
<td><strong>SOLUTION</strong></td>
<td>DEVELOP DATA TO ESTABLISH SAFE OPERATING PARAMETERS FOR DUST COLLECTION SYSTEMS. UTILIZE THESE DATA TO DEVELOP FAIL-SAFE COLLECTION SYSTEM DESIGNS WHICH PREVENT DUST EXPLOSIONS BY EMPLOYMENT OF PROPER VENTS, LIMITING IGNITION ENERGY, ETC.</td>
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<th>(471) TITLE</th>
<th>BLAST EFFECTS IN THE MUNITIONS PLANT ENVIRONMENT</th>
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<td><strong>PROBLEM</strong></td>
<td>MOST OF THE DESIGN EFFECT IS IN THE AREA OF LACE REINFORCED STRUCTURES FOR CLOSE TO AREAS OF EXPLOSION, WE MUST ATTEMPT TO UTILIZE CON CONSTRUCTION MATERIAL.</td>
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<td><strong>SOLUTION</strong></td>
<td>TO STUDY CHARACTERISTICS OF THE BLAST ENVIRONMENT AND DETERMINE THE RESPONSE OF DIFFERENT MATERIALS AND ELEMENTS SUBJECT TO THESE LOADINGS.</td>
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COMPONENTS

(4374) TITLE - EXPLOSIVE SAFETY SHIELDS

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

SOLUTION - DETERMINE PLASTIC CAP OF ACRYLIC MAILS. PRP DESIGN GUIDANCE EFFORTS WERE TAKEN FOR THIS TYPE OF PROTECTIVE SHIELDS WILL BE REVISED TO ELIMINATE CASE-BY-CASE METHOD NOW USED.

(4437) TITLE - IMPROVED SAFETY OF SCALE WEIGHTING EQUIPMENT

PROBLEM - ELECTRONIC CONTROLS FOR WEIGHING SYSTEMS DO NOT MEET THE NATIONAL ELECTRICAL CODE STANDARDS AND OSHA. PRESENTLY, RESTRICTIONS TO THE CODE.

SOLUTION - SCALE TRANSDUCERS WILL BE STUDIED AND SPECIFICATIONS OF THE VARIOUS COMPONENTS WILL BE REVIEWED. SPECIFICALLY AVAILABLE COMPONENTS WILL BE CONFIGURED TO ACHIEVE AN INTRINSICALLY SAFE TRANSDUCER.

COMPONENTS -- PROPELLANTS/EXPLOSIVES

(4424) TITLE - TNT LOADING TESTING FOR SAFETY ENGINEERING

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

SOLUTION - BY TESTING TO GENERATE FEM PRESSURE AND PCS IMPULSE DATA FROM LOADING MEASUREMENTS OF HIGH ENERGY MATERIALS, DATA IS GENERATED. THESE RESULTS ARE COMPARED WITH THE HEADING OUTPUT IF HEMISPHERICAL TNT TO DETERMINE THE TNT EQUIVALENCY OF THE MATERIAL.

(4224) TITLE - EXPLOSIVE SAFE SEPARATION AND SENSITIVITY CRITERIA

PROBLEM - DATA IS REQUIRED TO UPDATE PROCESSES AND MATERIAL FOR THE MAXIMUM SAFETY OF PERSONNEL AND EQUIPMENT AGAINST EXPLOSION PROPAGATION.

SOLUTION - TESTS WILL BE DESIGNED AND CONDUCTED FOR EXPLOSIVES AND END ITEMS TO DETERMINE THE SAFE SEPARATION DISTANCE AND THE EXPLOSIVE DEPTH ON CONVEYORS.

(4313) TITLE - OCCUPATIONAL EXPOSURE TO NITRATE ESTERS IN MUNITION PRODUCTION

PROBLEM - THE THRESHOLD LIMIT VALUE FOR NITROLYLEIN, AND OTHER NITRATE ESTERS, MAY BE REDUCED FROM 0.25 TO 0.25 PPM. THIS COULD INVOLVE EXTENSIVE ATTENTION ON ALL FACILITY PROJECTS INVOLVING MUNITIONS NITRATE ESTERS.

SOLUTION - UTILIZE MORE EFFECTIVE VENTILATION OR CHEMICAL ENTRAPMENT, REMOTE AUTOMATIVELY OPERATIONS DEVELOP PROTECTIVE CLOTHING AND AIR RESPIRATORS.
COMPONENT: PROPPELLANTS/EXPLOSIVES

(449) TITLE: PROPAGATION DISTANCE FOR EXPLOSIVE MATERIALS

PROBLEM - THE EXISTING SAFETY MANUAL (APFM 315-102) HAS BECOME OBSOLETE BY RECENT ADVANCE IN WEAPONS TECHNOLOGY. THERE IS A NEED TO UPGRADE ACCIDENTAL DETONATION SUPPRESSION CRITERIA.

SOLUTION - A SERIES OF PROPAGATION SUPPRESSION CRITERIA TESTS ON VARIOUS EXPLOSIVE MATERIALS WILL BE CONDUCTED. THE SAME CONFIGURATIONS WILL SIMULATE STATES OF THE ITEM MANUFACTURE AND ASSEMBLY.

(450) TITLE: WATER DELUGE SYSTEM APPLICATION IN MUTATIONS PLANTS

PROBLEM - INFORMATION ON DELUGE REQUIREMENTS FOR EXTINGUISHING FIRES FROM EXPLOSIVES + PROPELLANTS PRIOR TO THE MATERIALS PROCEEDING TO DETONATION IS NOT AVAILABLE TO THE ARM. THIS INFORMATION CANNOT BE INTRAPOLATED BETWEEN PROPELLANTS AND EXPLOSIVES.

SOLUTION - WATER DELUGE SYSTEMS WILL BE DEVELOPED TO EXTINGUISH FIRES FROM VARIOUS EXPLOSIVES + PROPELLANTS PRIOR TO DETONATIONS. THIS DATA WILL BE INCORPORATED INTO FIRE EXTINGUISHING MANUALS AND APPLIED TO OLD + NEW CONSTRUCTION IN ARM PLANTS.

COMPONENT: GENERAL

(441) TITLE: TRACK/BULLET JACKET IMPROF PROCESS

PROBLEM - TRACK/BULLET JACKET IS MORE SENSITIVE TO BULLET JACKET DRAW QUALITY THAN STANDARD CARTRIDGE. GILDING METAL CLAD STEEL JACKET DRAW PROCESS REQUIRES IMPROVED TOOL CONTROL, EQUIPMENT AND INCREASED PROCESS SURVEILLANCE.

SOLUTION - EVALUATE DRAW PROCESS TO DETERMINE CRITICAL PROCESS PARAMETERS THAT CONTROL JACKET QUALITY. ENDORSE TO ESTABLISH IMPROVED TOOL DESIGN.

(443) TITLE: IMPROVED STORAGE TECHNOLOGY FOR PRODUCTION MACHINE

PROBLEM - NEED TO OVERCOME DEGRADATION OF ELECTRONIC COMPONENTS + MELT RAPID HEATING OF AUTO-PIE EXAMPLE REQUIREMENTS.

SOLUTION - DEVELOP PACKAGING TECHNIQUE AND USE OF DRY NITROGEN FOR SCAMP EQUIPMENT.
<table>
<thead>
<tr>
<th>COMPONENT -- GENERAL</th>
<th>(CONTINUED)</th>
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<tbody>
<tr>
<td>(44.4) TITLE - COMPUTER/GRIND TECHNOLOGY FOR SMALL CAL AMMO</td>
<td>269 225</td>
</tr>
<tr>
<td>PROBLEM - PRESENTLY THERE IS NO METHOD TO OPTIMIZE DESIGN OF TOOLING AND TO SELECT PROPER EQUIPMENT FOR SMALL CALIBER AMMO.</td>
<td></td>
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<tr>
<td>SOLUTION - INVESTIGATE POSSIBLE USE OF COMPUTER FOR OPTIMUM TOOL AND EQUIPMENT DESIGN, AND TO PREDICT PROCESS PARAMETERS AND COSTS.</td>
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<tr>
<td>(45.4) TITLE - AUTOMATIC CARTRIDGE CASE HARDNESS MEASUREMENT</td>
<td>360 400</td>
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<tr>
<td>PROBLEM - MANUAL MEASUREMENTS BY SAMPLING METHODS ARE INADEQUATE AND COSTLY.</td>
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<tr>
<td>SOLUTION - DIRECT EDY CURRENT TECHNIQUE WOULD PROVIDE CONTINUOUS AND 100% INSPECTION.</td>
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<tr>
<td>COMPONENT -- METAL PARTS</td>
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<tr>
<td>(54.4) TITLE - PROCESS FOR 20MM TUBULAR F/GUN/F/14 IN DEFENSE</td>
<td>145 606</td>
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<tr>
<td>PROBLEM - HIGH VOLUME PRODUCTION PROCESS DOES NOT EXIST FOR METAL PARTS: LOAD ASSEMBLE AND PACK.</td>
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<tr>
<td>SOLUTION - DEVELOP PRODUCTION PROCESS.</td>
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<tr>
<td>(41.4) TITLE - G/F SPIN ZINC COATING FOR SMALL CALIBER CASES</td>
<td>148</td>
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<tr>
<td>PROBLEM - CURRENT FINISHING PROCESS FOR BUSHMASTER STEEL CASINGS CONSISTS OF ZINC ELECTROPLATING, CHROME CONVERSION COATING, POLYamide topcoating, AND WASTE TREATMENT TO CONTROL HAZARDOUS CYANIDES AND HEAVY METAL POLLUTANTS.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION - ESTABLISH THE ELECTROLESS ZINCO COATING PROCESS WHICH CONSISTS OF IMMERGING CLEAN CASES IN A WASTE DISPERSDION OF ZINC FLAKES, CHROMATES AND SOME SULFUR, THE PARTS ARE THEN SPUN AND HARDEN. NO POLLUTANTS ARE GENERATED.</td>
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<tr>
<td>(44.4) TITLE - WELD OVERLAY ROTATING FORGEO FOR 155M/40MM PROJECTILES</td>
<td>340</td>
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<tr>
<td>PROBLEM - HIGH SPEED WELDING MACHINES FOR ROTATING BANDS DO NOT EXIST FOR 20MM/40MM PROJECTILES.</td>
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<tr>
<td>SOLUTION - DEVELOP WELDING MACHINES.</td>
<td></td>
</tr>
<tr>
<td>(44.5) TITLE - MACHINING OF 155M CARTRIDGE CASES</td>
<td>170</td>
</tr>
<tr>
<td>PROBLEM - TOOL WEAR AND TOOL LIFE IS LIMIT OF GROUND IS EXCESSIVE AND PRODUCES A GREAT DEAL OF SCRAP. ALSO HOLEING COMPONENTS IS A PROBLEM.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION - FIND ALTERNATE DESIGNS FOR CUTTING TOOLS. INVESTIGATE NEW WAYS TO HOLD COMPONENTS FIRMLY IN PLACE.</td>
<td></td>
</tr>
</tbody>
</table>
## COMPOUND -- 5.56 - .25 CAL

**(3214) TITLE -- M203 FLANK CONVERSION SPECIFICATION FOR SCAMP CASE SUBMODULE**

**PROBLEM** - Evaluate equipment for multiproduct production. Most likely candidate is M203 flank.

**SOLUTION** - Establish a process for flank case manufacturing on SCAMP equipment, include investigation of knurling and anfaling process requirements.

<table>
<thead>
<tr>
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<td>264</td>
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</tbody>
</table>

## COMPOUND -- 5.56M - .30 CAL

**(3417) TITLE -- 7.62MM BULLET MFG BY TOOL FORGING**

**PROBLEM** - Method to manufacture 7.62 utilizes same process as 5.56. It is uncertain whether it will work on 7.62.

**SOLUTION** - Investigate other methods of producing 7.62 bullet roll forming appears very promising.

<table>
<thead>
<tr>
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</tbody>
</table>

## COMPOUND -- 5.56M - .30 CAL

**(2743) TITLE -- IMPROVED TECH FOR SMALL FAIRFAX AMMUNITION**

**PROBLEM** - The small arms munition production base must keep abreast of the rapidly emerging new manufacturing techniques on a cost/productivity basis.

**SOLUTION** - Continually monitor the small arms developments and applicable emerging manufacturing technology.

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<thead>
<tr>
<th>PRIOR</th>
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</table>

## COMPOUND -- 5.56M - .30 CAL

**(3201) TITLE -- MODERNIZED PROCESSES FOR MANUFACTURE OF NATO 5.56MM AMMO**

**PROBLEM** - An Americanized version of Belgium SS-109 will be used in the saw system. This effort is directed toward development of conventional processes to mass produce saws ammunition on SCAMP equipment.

**SOLUTION** - This project will define processes and equipment/tooling changes required on SCAMP line. Initiation of these efforts this year will provide process equipment specifications for implementation in sufficient time to meet FY95 and on requirements.

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<tr>
<th>PRIOR</th>
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</table>

## COMPOUND -- 5.56M - .30 CAL

**(3215) TITLE -- MANUFACTURING PROCESSES FOR 9MM AMMUNITION**

**PROBLEM** - Only limited commercial capacity exists to produce 9mm ammunition. There are no good lines to satisfy anticipated military requirements.

**SOLUTION** - Develop a process for production of 9mm ammunition utilizing an In-Line Transfer Press from a prototype 5.56mm line. One million parts will be produced and tested for process verification.

<table>
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<td>COMPONENT -- 5.56MM - .223 CAL</td>
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<tr>
<td>(4.1) TITLE - NEW MFG PROCESSES FOR SMALL CAL PENETRATORS</td>
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<tr>
<td>PROBLEM - MANUFACTURE OF PENETRATORS INTO BALL BULLETS IS VERY COSTLY.</td>
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<tr>
<td>SOLUTION - INVESTIGATE SKEWED AND ROLL FORMING OF PENETRATOR AS WELL AS HYBRID SLIDES MANUFACTURING AND FEEDING METHODS. COLD HEADING WILL ALSO BE EVALUATED.</td>
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<tr>
<td>(4.2) TITLE - NEW PROCESS FOR SAW TRACER AMMUNITION</td>
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<tr>
<td>PROBLEM - THERE IS NO U.S. CAPABILITY FOR MANUFACTURING THE PROPOSED NATO 5.56MM TRACER PULLET IN THE QUANTITIES REQUIRED FOR THE SAW SYSTEM.</td>
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<tr>
<td>SOLUTION - THE CONVENTIONAL SMALL CALIBER TRACER PULLET MANUFACTURING EQUIPMENT WILL BE MODIFIED TO PRODUCE THE NATO TRACER PULLET.</td>
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<tr>
<td>(4.3) TITLE - 5.56MM CARTRIDGE LINKING SYSTEM</td>
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<tr>
<td>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.</td>
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<tr>
<td>SOLUTION - LINKING MACHINES FOR 7.62X51 AMMUNITION DO EXIST. A MODIFICATION AND IMPROVEMENT SHOULD PROVIDE A SATISFACTORY SOLUTION. A PRODUCTION RATE OF 64.5 MILLION ROUNDS PER YEAR IS REQUIRED.</td>
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<tr>
<td>(4.4) TITLE - MANUFACTURE OF FRAGILE TRAINING AMMUNITION</td>
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<tr>
<td>PROBLEM - FRAGILE PULLET (V160) WAS DEVELOPED IN 1948. AN EFFORT IS REQUIRED TO EXPLORE PROCESSES TO ACHIEVE A LOW COST PRODUCTION CAPABILITY.</td>
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<tr>
<td>SOLUTION - DEVELOP APPROPRIATE PROCESS EQUIPMENT FOR PRODUCTION OF QUALITY PROJECTILES. THE PROTOTYPE AND PROTOTYPE DEVELOPMENT EFFORT WILL ESTABLISH COST EFFECTIVE TECHNOLOGY FOR PRODUCTION MANUFACTURE, CARTRIDGE, ASSEMBLY, AND MANTLE HANDLING TECHNIQUES.</td>
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<tr>
<td>(4.5) TITLE - 5.56MM SAW LINK ORIENTED FEED SYSTEM</td>
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<tr>
<td>PROBLEM - THE LINKS ARE MANUALLY COLLECTED AND PAINTED AT THE LINK MANUFACTURING. AT THE LOADING PLANTS, LINKS MUST BE MANUALLY UNPACKED AND FEED INTO THE LINKING MACHINE. THIS IS TIME CONSUMING AND COSTLY.</td>
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</tbody>
</table>
| SOLUTION - BY DEVELOPING HANDY WOMAN EQUIPMENT, THE LINK MANUFACTURERS WILL BE ABLE TO SHIP LINKS IN TIME TO THE LOADING PLANTS. THIS ELIMINATES MANUAL UNPACKING TIME AND COST OF CUSTOM.
CONTINUING -- 5.56mm -- .50 cal

(4561) TITLE -- AUTO PRIMER INSERT LACQUER AND ANVIL PRESENCE INSPECT SYS

PROBLEM -- LACQUERING INSPECTION AT SITE A, WHICH IS BEING ELIMINATED. THE PRIMERS INSERT SUBCOMPONENT CURRENTLY INSERTS 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 EYE 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.

(4562) TITLE -- MFG PROCESS PARAMETERS FOR .50M1/509 RMM

PROBLEM -- THE ARMY IS DEVELOPING A PRODUCTION BASE FOR THE NATO 5.56mm AMMUNITON. 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 M-50/509 AMMUNITON FROM LOCAF PRODUCED BY THE NEWLY DEVELOPED PROCESS AND TO DO A TECHNICAL EVALUATION AND PRODUCTION ACCEPTABILITY.

COMPONENT -- .50 CAL AND LARGER

(5561) TITLE -- HOT FORMING OF M1 PROJECTIONS

PROBLEM -- CURRENT WELDING OF FABRICATING CANNON CALIBER ROUNDS REQUIRES EXTENSIVE FORMING TO REMOVE 1% TO 7% PERCENT OF THE STARTING MATERIAL.

SOLUTION -- FABRICATE PROJECTILE SHELLS BY UTILIZING POWDER METALLURGY. NOT FORMING INTO THE DESIRED SHAPE.

(5562) TITLE -- PRODUCTION PROCESS FOR CALIBER .50 PLASTIC BLANK AMMUNITON

PROBLEM -- CURRENTLY, THERE IS NO PRODUCTION EQUIPMENT FOR MANUFACTURING OF CALIBER .50 PLASTIC CASE COMPONENTS AND LOADING TO MEET THE EXPECTED HIGH PRODUCTION REQUIREMENTS.

SOLUTION -- INVESTIGATE MANUFACTURING PROCESSES FOR COMPONENTS. PLASTIC CASES, METAL BASED ASSEMBLY, MOLTING AND LOADING. MOLTING DIES AND OPERATING TOOLS WILL BE DESIGNED AND TESTED TO PROVE OUT SELECTED PROCESS.

(5563) TITLE -- PLASTIC EQUIPMENT FOR .50 CALIBER BLANK AMMUNITON

PROBLEM -- THE EXISTING EQUIPMENT IS OLD, WORN, LOW MATELITY, AND LARGE INVESTMENT. EXISTING EQUIPMENT IS LIMP IN OUTPUT CAPACITY.

SOLUTION -- EQUIMENT WILL BE UPGRADED WITH A HIGH CAPACITY FOR THE SMALL CALIBER AMMUNITON PROJECT AND FUTURE PRODUCTS. DETAILING AND FINANCIAL UPDATES WILL BE ENSURED AND PROVEN.

COMPUTER -- .50 CAL AND LARGER
ARMAMENT R&D COMMAND
ARMAMENT MATERIEL READINESS COMMAND
(ARRADCOM, ARRCOM)
(WEAPONS)
<table>
<thead>
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<td>Small Caliber</td>
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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 FY81-85 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 reduction 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/management 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 electrochemical grinding.
Minimizing energy consumption and pollution during manufacturing is a national priority and an important part of AIA's MMT submission. Areas being studied include heat recovery, and optimized heat treatment processes. As anti-pollution requirements become more stringent, it is necessary for manufacturers to improve their environmental posture while maintaining a competitive position or face close down by economic or legal factors. Rock Island Arsenal's MMT submission will correct present environmental difficulties and help prevent future ones so that the Arsenal's vital defense role will not be jeopardized.

Improved metalworking methods and increased use of computer-aided manufacturing are major production trends and the results of the projects in this submission are expected to hold significant interest for other producers, both Government and non-government. These projects will also be of importance in the modernization and upgrading of the facilities of weapons contractors, many of which are seriously outdated.
<table>
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<tr>
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**CATEGORY**  
FIRE CONTROL  

**COMPONENT** -- ASSEMBLIES  

**(8321) TITLE** - EXPANDED APPLICATION OF ADHESIVE BONDING TO F.C. ASSEMBLY  

**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  

**(9566) TITLE** - PRODUCTION ENGINEERING F.C. TRITIUM RADIOLUMINOUS LAMPS  

**PROBLEM** - CURRENT METHODS OF CONTROLLING MOISTURE CONTENT, SEALING AND ALUMINIZING TRITIUM LAMPS ARE BELIEVED RESPONSIBLE FOR THE PRESENT LACK OF REPEatability.  

**SOLUTION** - DETERMINE THE PRODUCTION CONDITION THAT WILL RESULT IN OPTIMUM HALF-BRIGHT LIFE AND MODIFY CURRENT PRODUCTION METHODS ACCORDINGLY.  

**(9861) TITLE** - MILLIMETER WAVE ANTENNA FABRICATION  

**PROBLEM** - THERE IS A GROWING REQUIREMENT FOR RADAR SYSTEMS OPERATING AT WAVELENGTHS OF APPROXIMATELY 3 MILLIMETERS. A KEY COMPONENT IS THE ANTENNA. MANUFACTURING THESE TO REQUIRED TOLERANCES IS DIFFICULT AND COSTLY.*  

**SOLUTION** - REPLICATING TECHNIQUES SIMILAR TO THOSE USED IN OPTICAL F.G.S. WILL BE EVALUATED, PROTOTYPE WILL BE FABRICATED AND TESTED, THE PROCESS WILL BE EVALUATED FOR PROD. SUITABILITY.  

**(9863) TITLE** - PROD. IN-PROCESS INSPECT QUAL FOR LASER RANGE FINDER CHARAC  

**PROBLEM** - CURRENT PRODUCTION/IN-PROCESS INSPECTION TECHNIQUES ARE REJECTING GOOD LASER RANGE FINDERS. THE REJECTION OF GOOD LIF. IS ATTRIBUTED TO INACCURACIES OF RADIOMETERS AND INCANDESCENT LIGHT SOURCES USED TO MEASURE THE LASER POWER OUTPUT AND SENSITIVITY.  

**SOLUTION** - ADVANCES IN ELECTRO-OPTICAL TECHNOLOGY, DIGITAL RADIOMETERS AND CALIBRATED SOLID STATE LIGHT SOURCES WILL BE USED TO CORRECT CURRENT INSPECTION INACCURACIES.  

**(9867) TITLE** - COMPUTER AIDED ENGINEERING (CAE) TECHNIQUES F.C.  

**PROBLEM** - MANUFACTURING METHODOLOGIES AND THE APPLICATION OF CAD AND CAM TO F.C. MANUFACTURING HAS ONLY PRODUCED ISOLATED IMPROVEMENTS AND MANY OF THE MAJOR PRODUCTION PROBLEMS STILL PERSIST.  

**SOLUTION** - A SYSTEM APPROACH WITH COMPUTER INTEGRATED MANUFACTURING METHODOLOGIES TO ESTABLISH A CLOSED LOOP SYSTEM FOR THE DESIGN-THROUGH MANUFACTURING PROCESS FOR F.C. INCLUDING PLANNING, ENGINEERING, QA AND DECISION MAKING.
<table>
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<td>(3.65) TITLE</td>
<td>DISTRIBUTED NETWORK FOR FIRE CONTROL MANUFACTURING</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>NO PROBLEM PROVIDED BY ARRADCOM.</td>
</tr>
<tr>
<td>SOLUTION</td>
<td>NO SOLUTION PROVIDED BY ARRADCOM.</td>
</tr>
<tr>
<td>COMPONENT</td>
<td>-- OPTICS</td>
</tr>
<tr>
<td>(70.07) TITLE</td>
<td>PROGRAMMED OPTICAL SURFACING EQUIP AND METHODOLOGY-CAM</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>CURRENT TECHNIQUES FOR FITTING, TURNING, AND FLOCKING PRECISION LENSES USE OLDER CONVENTIONAL EQUIP, ACCURACY DEPENDS ON THE SKILL AND EXPERIENCE OF WELL TRAINED MASTERS WHO ARE BECOMING SCARCE.</td>
</tr>
<tr>
<td>SOLUTION</td>
<td>ADAPT COMPUTER TECHNIQUES AND INSTRUMENTATION WITH CONTROLS TO FITTING, TURNING, AND FLOCKING OPERATIONS. THE END PRODUCT WILL BE AN INTEGRATED SURFACING SYSTEM IMPLEMENTED IN THE FIRE CONTROL Fabrication Facility AT ARRADCOM.</td>
</tr>
<tr>
<td>(6.24) TITLE</td>
<td>IMPROVE MFG TECH AND QUAL OF OPTICAL SCRATCH AND DIP STAND</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>PRESENT OPTICAL SCRATCH AND DIP STANDARDS ARE DIFFICULT AND EXPENSIVE TO MANUFACTURE, CALIBRATE, AND MAINTAIN</td>
</tr>
<tr>
<td>SOLUTION</td>
<td>ESTABLISH STANDARD MFG METHODS AND EQUIPMENT FOR EFFICIENTLY PRODUCING IMPROVED OPTICAL SURFACE AND DIP STANDARDS, VALIDATE THE IMPROVED MFG TECHNIQUES.</td>
</tr>
<tr>
<td>(50.06) TITLE</td>
<td>HIGH SPEED FABRICATION OF ASPHERIC OPTICAL SURFACES</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>THE BULK OF THE COST OF OPTICS FOR FIRE CONTROL SYSTEMS LIES IN THE Figuring AND Polishing STAGE.</td>
</tr>
<tr>
<td>SOLUTION</td>
<td>USE THE POPULAR TOLV GRINDING PROCESS TO PRODUCE ASPHERIC SURFACES DIRECTLY DURING THE GRINDING PROCESS.</td>
</tr>
<tr>
<td>(21.4) TITLE</td>
<td>THERMOGRAPHIC EVALUATION OF OPTIC BANDS</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>THE BOND BETWEEN OPTICAL ELEMENTS AND THEIR STRUCTURAL SUPPORTS MUST BE FLEXIBLE. NOISE, OF ЈEQUIPMENT THICKNESS AND OF SUFFICIENT STRENGTH TO HOLD FAST AND MAINTAIN ALIGNMENT UNDER SEVERE SHOCK.</td>
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<tr>
<td>SOLUTION</td>
<td>INTRODUCE THERMOGRAPHIC PROCEDURES TO THE INSPECTION OF OPTICAL BANDS.</td>
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<tr>
<td>COMPONENT -- OPTICS</td>
<td>(CONTINUED)</td>
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<tr>
<td>(8169) TITLE -- STANDARDS FOR DIAMOND TURNED OPTICAL PARTS</td>
<td></td>
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<tr>
<td>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 MICROINCH).</td>
<td></td>
</tr>
<tr>
<td>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.</td>
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<tr>
<td>213 274</td>
<td>205 287</td>
</tr>
<tr>
<td>(8249) TITLE -- PILOT PRODUCTION OF GRADIENT INDEX OPTICS</td>
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<tr>
<td>PROBLEM -- GRADIENT OPTICS, WHERE THE INDEX OF THE GLASS IS SEQUENTIALLY VARIED TO OBTAIN DESIRED OPTICAL CHARACTERISTICS IS FAR MORE DESIRABLE THAN CURRENT USES, I.E., FORMING A CURVE ON THE GLASS SURFACE.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION -- ENSURE SUBSEQUENT TO THE INTRODUCTION AND DEVELOPMENT OF GRADIENT OPTICS TO MILITARY USE, A PILOT PRODUCTION FACILITY TO MANUFACTURE GRADIENT OPTICS AT A REQUIRED RATE.</td>
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<td>400 500</td>
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<tr>
<td>(8213) TITLE -- NET SHAPE OPTICAL PROCESSING</td>
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<tr>
<td>PROBLEM -- CONSIDERABLE TIME AND EFFORT IS REQUIRED TO PROCESS AN OPTIC FROM A RAW PRESSING TO ITS FINAL SHAPE.</td>
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<tr>
<td>SOLUTION -- IMPROVE OPTICAL PRESSING TECHNIQUE TO ACHIEVE NEAR NET SHAPES IN THE INPUT PLANKS.</td>
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<td>130</td>
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<tr>
<td>(8211) TITLE -- DEBONDING OF EPOXY RESIN ADHESIVE SYSTEM</td>
<td></td>
</tr>
<tr>
<td>PROBLEM -- A RELIABLE AND EFFICIENT PROCEDURE FOR PRODUCTION AND DEPOT MAINTENANCE DEBONDING OF GLASS TO METAL MIL-A-4661 JUNCTIONS DOES NOT EXIST.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION -- CONVINCING DEMONSTRATED LABORATORY DEBONDING TECHNIQUES TO PRODUCTION/DEPOT REPAIR PROCEDURE THAT WILL BE INCLUDED IN MIL-A-4661. THIS PROCEDURE WILL ALLOW FOR THE RECOVERY OF EXPENSIVE OPTICAL ELEMENTS AND THEIR REMAINING.</td>
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<tr>
<td>480 425</td>
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<tr>
<td>(8214) TITLE -- PRODUCTION METHODS FOR OPTICAL WAVEGUIDES</td>
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<tr>
<td>PROBLEM -- MANUFACTURE OF INTEGRATED WAVEGUIDES IS COMPLICATED AND TIME CONSUMING INVOLVING PROCESSES RELATED TO METHODS USED TO MAKE SEMICONDUCTOR INTEGRATED CIRCUITS.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION -- USE ION IMPLANTATION TO ALTER OPTICAL PROPERTIES OF GALLIUM ARSENIDE AND PHOSPHIDE SUBSTRATES TO DIRECTLY FORM OPTICAL WAVEGUIDES IN A ONE-STAGE PROCESS.</td>
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<td>(8246) TITLE -- RADIAL GRADIENT INDEX OPTICS</td>
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<tr>
<td>SOLUTION -- NO SOLUTION PROVIDED BY APPARATUS.</td>
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### COMPOUND --- OPTICS

**Title:** Diamond Point Turning of Class Optics

**Problem:** No problem provided by PARCOM.

**Solution:** No solution provided by ARRA EPS.

### Category
- General Manufacturing

### COMPOUND --- EQUIPMENT

**Title:** Laser Welding Technology for Weapon Component

**Problem:** Conventional welding and other joining methods yield joints which are unsuitable in certain high states applications.

**Solution:** Laser welding can provide acceptable joint.

**Title:** Computer Integration (CIM) CONC

**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 MFG system. Utilize CNC technology.

**Title:** Rigid Loading of WC Machines

**Problem:** Although MODFPN numerically controlled machines can machine many parts with virtually no operator attention, operators are still required to load and unload the machines.

**Solution:** Design fixtures and workstations for machines that can be loaded and unloaded by a programmable robot for job shop operation. Design the system so one robot can load several machines which are machining different parts.

**Title:** Application of NC Welding (MAP)

**Problem:** Although RIA is a job shop, many manufactured items, such as the MG gun mount, NSN recoil mechanisms, etc., have production life spans of many years. For these items, NC welding will prove more economical and provide better quality.

**Solution:** Apply NC welding to like run production parts on applicable items. NC welding will provide better repeatability, faster final machining of the weldment, reduced welding times, and reduce the amount of costly welding certification required.

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<thead>
<tr>
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<td>--- Optics</td>
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<td>--- Equipment</td>
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<td>--- Computer Integration (CIM) CONC</td>
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<td>--- Application of NC Welding (MAP)</td>
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</table>
COMPONENT -- EQUIPMENT

(124.0) TITLE -- ROLLING CONTROL OF ARC WELDING

PROBLEM -- THE REPAIR OF DEFECTIVE WELDS ARE FREQUENTLY EXPERIENCED. REPAIR REQUIREMENTS ARE OFTEN TRACED TO THE SKILL LEVEL OF THE WELDING OPERATORS.

SOLUTION -- ADAPATIVE CONTROLS ARE being USED IN AN INCREASING NUMBER OF WELDING APPLICATIONS TO DEEPENIZE OPERATOR'S SKILL IN MAKING CONSISTENT PRODUCT. SUCH FEEDBACK CONTROL METHODS SHOULD BE USED ALSO IN WEAPONS FABRICATION.

(125.0) TITLE -- NON-ROTATION METHODS OF FRICTION WELDING

PROBLEM -- ROTATIONAL FRICTION WELDING IS CONFINED TO APPLICATIONS IN WHICH AT LEAST ONE OF THE TWO PIECES TO BE JOINED HAS A CIRCULAR OR NEAR-CIRCULAR CROSS SECTION.

SOLUTION -- NON-ROTATION FRICTION WELDING SUCH AS CRITAL AND OSCILLATORY TYPES ARE NOW AVAILABLE WHICH OVERCOME RESTRICTIONS IN SHAPE.

COMPONENT -- INFORMATION SYSTEM

(411.0) TITLE -- LOWEST COST OF A SYSTEM FOR THE MANUFACTURING (CAM)

PROBLEM -- PRESENT METHODS OF DETERMINING THE CHARGE FOR PARTICULAR ALLOYS DO NOT ALLOW FOR THE MOST EFFICIENT USE OF RAW MATERIALS.

SOLUTION -- DESIGN AND INSTALL A COMPUTERIZED LINEAR PROGRAMMING MODEL THAT WILL SELECT RAW MATERIALS INCLUDING SCRAP TO PROVIDE THE LOWEST COST CHARGE FOR THE DESIRED ALLOY.

(412.0) TITLE -- PERFORMANCE MEASUREMENT PARAMETERS FOR GOOD MFG.

PROBLEM -- MEASURING THE PERFORMANCE OF A GOVERNMENT MANUFACTURING OPERATION IS DIFFICULT. GOOD 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 ACCURATELY ASSESS PERFORMANCE. INCURRING DATA OR TECHNOLOGICAL IMPROVEMENTS, INFLATION, PRODUCT COSTS, ETC. MEASUREMENTS WILL BE USEFUL IN LONG RANGE PLANNING.

(411.0) TITLE -- COMPUTER AIDED WORK MEASUREMENT SYSTEM (CAM)

PROBLEM -- TIME STUDIES AND USE OF STANDARD DATA PRESENTLY REQUIRE TIME CONSUMING ANNUAL CALCULATIONS TO DEVELOP PRODUCTION STANDARDS.

SOLUTION -- DEVELOP A COMPUTERIZED WORK MEASUREMENT SYSTEM THAT WILL VIRTUALLY ELIMINATE MANUAL CALCULATIONS IN THE DEVELOPMENT OF PRODUCTION STANDARDS. ROUTINES WILL INCLUDE PROGRAMS TO DEVELOP ESTIMATED STANDARDS FROM PRODUCTION USAGE DATA.
COMPONENT -- INFORMATION SYSTEMS

4245) TITLE - INTEGRATED MANUFACTURING SYSTEM (ICAM)

PROBLEM - MTS'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 INTRUPTIONS, AND SHORTAGES OF MACHINE AVAILABILITY, LABOR AND MATERIALS.

SOLUTION - DEVELOP AN MIS WHICH ADDRESSES ACTIVITIES OF ALL DIRECTORATES SUPPORTIVE TO MANUFACTURING AT PIA. THE SYSTEM WILL USE STATE-OF-THE-ART TECHNOLOGY TO DELINEATE OPTIMUM SCHEDULING AND PIN POINT POTENTIAL PROBLEM AREAS FOR EASIER RESOLUTION.

4252) TITLE - ON-LINE PRODUCTION INFORMATION SYSTEM (OPM)

PROBLEM - THE MANUFACTURING DATABASE CANNOT BE ACCESSED THROUGH AN ON-LINE DATABASE SYSTEM. INTEGRATION OF AUTOMATED SYSTEMS FOR PROCESS PLANNING, THE SGS GENERATION, FACILITIES/DEPLOYMENT PLANNING AND PRODUCTION CONTROL SIMULATION IS DIFFICULT.

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

35 COMPONENT -- MISCELLANEOUS

4746) TITLE - HEAT RECOVERY FROM MANUFACTURING PROCESSES

PROBLEM - LARGE AMOUNTS OF ENERGY ARE WASTED IN MANUFACTURING PROCESSES, E.G., HEAT TREATING, FORGING, SURFACE TREATMENT, AND CASTING.

SOLUTION - ANALYZE ENERGY CONSUMPTION RELATED TO THESE MANUFACTURING PROCESSES TO DETERMINE AREAS WHERE HEAT CAN BE ECONOMICALLY RECOVERED. DESIGN, INSTALL, AND PROVE OUT HEAT RECOVERY DEVICES WHERE ECONOMICAL.

4750) TITLE - MANUFACTURING GUIDE FOR ELASTOMERIC SEALS

PROBLEM - CONSTANT PROBLEMS IN THE PROCUREMENT OF SATISFACTORY SEALS FOR WEAPONS SYSTEMS, I.E., M140, M127, ETC., ARE EXPERIENCED WITH RESULTANT SOLF SOURCE PURCHASES.

SOLUTION - ELIMINATE SOLF SOURCE PROCUREMENT BY DOCUMENTING PROCESSING TECHNIQUES AND FORMULA VARIATIONS FOR A VARIETY OF MILITARY SEALS FOR PUBLICATION IN A GUIDE FOR USE IN INDUSTRY.

4750) TITLE - INITIAL PRODUCTION HANDBOOK

PROBLEM - A HIGH PERCENTAGE OF CRITICAL FIRE CONTROL EQUIPMENT FAILS FIRST ARTICLE TESTS. THE FAILURES ARE TRACABLE TO THE USE OF INADEQUATE OR OUTDATED PRODUCTION AND TEST PROCEDURES.

SOLUTION - IDENTIFY AND ISOLATE FIRE CONTROL PRODUCTION PROBLEMS. INVESTIGATE ANY TEST-article techniques TO ELIMINATE INADEQUATE MANUFACTURING PROCEDURES.

OCURRENT GENERATION PRODUCTION PROBLEMS RELATED TO FIRE CONTROL ITEMS.
<table>
<thead>
<tr>
<th>COMPONENT -- MISCELLANEOUS</th>
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<tbody>
<tr>
<td>(A252) TITLE -- INDUCTION HEATING OF VARYING DIAMETER PREFORMS</td>
<td>241</td>
</tr>
<tr>
<td><strong>PROBLEM</strong> -- INDUCTION HEATING OF RECYCLED CABLE TUBES AND TAPERED PREFORMS REQUIRES VARYING POWER INPUTS TO MAINTAIN A UNIFORM TEMPERATURE. THE PRESENT POWER CONTROL DOES NOT PROVIDE THE AUTOMATIC AND PRECISE CONTROL OF POWER NEEDED.</td>
<td></td>
</tr>
<tr>
<td><strong>SOLUTION</strong> -- DESIGN A DEVICE THAT AUTOMATICALLY ADJUSTS POWER TO THE COILS BASED ON THE PREFORM DIAMETER AT THE SECTION ENTERING THE COIL</td>
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<tr>
<td>(A425) TITLE -- IMPROVED REPAIR WELDING PRACTICES</td>
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<td><strong>PROBLEM</strong> -- NO PROBLEM STATEMENT PROVIDED BY APPARATUS</td>
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<tr>
<td><strong>SOLUTION</strong> -- NO SOLUTION STATEMENT PROVIDED BY APPARATUS</td>
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<tr>
<td>(A444) TITLE -- PLASTIC COMPONENTS/INSTRUMENTS</td>
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<td><strong>SOLUTION</strong> -- NO SOLUTION PROVIDED BY APPARATUS</td>
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<tr>
<td>(A466) TITLE -- INTEGRATED MILLIMETER WAVE COMPONENTS</td>
<td>250 450</td>
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<td><strong>PROBLEM</strong> -- NO PROBLEM PROVIDED BY APPARATUS</td>
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<tr>
<td>(A546) TITLE -- NON-TOXIC COOLANT FOR HIGH SPEED MACHINING</td>
<td>150</td>
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<tr>
<td><strong>PROBLEM</strong> -- HIGH SPEED MACHINING CREATES HIGHER Pressures, Temperatures, and Velocities in the Tool/Workpiece Interface. Present Coolant Materials Are Not Volatile Enough to Provide Sufficient Cooling and Lubricity.</td>
<td></td>
</tr>
<tr>
<td><strong>SOLUTION</strong> -- NEW COOLANTS ARE NEEDED WITH INCREASED VOLATILITY TO BOTH COOL AND LUBRICATION THE WORKPIECE. CARE IN SELECTION IS NECESSARY TO AVOID THE USE OF HIGHER VOLATILE MATERIALS THAT MAY BE TOXIC</td>
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<tr>
<th>COMPONENT -- PROCESSES</th>
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<tr>
<td>(A466) TITLE -- NICKEL WIRE TIG WELDING</td>
<td>150 200</td>
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<tr>
<td><strong>PROBLEM</strong> -- WELD QUALITY PROBLEMS LIMIT THE USE OF CONVENTIONAL HIGH PRODUCTION SLAG-LIT WELDING (MIG) FOR WELDING OF ALLOY STEELS. ORDINARY TIG WELDING IS HIGHER QUALITY BUT SLOW.</td>
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<tr>
<td><strong>SOLUTION</strong> -- IMPROVING WELD TIG WELDING FOR MAXIMUM SPEED AND QUALITY FUSION WELDING OF ALLOY STEELS</td>
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</table>
**COMPONENT -- PROCESSES (CONTINUED)***

**1747** TITLE -- AUTOMATED PROCESS CONTROL FOR MACHINING (CAM)

**PROBLEM** -- MACHINING OPERATIONS ARE SELECTED, PARAMETERS ARE SET, AND STANDARDS ARE ESTABLISHED EMPIRICALLY WITH LITTLE OR NO ENGINEERING ANALYSIS, CONTROL OR FEEDBACK.

**SOLUTION** -- APPLY COMPUTERIZED CONTROLS FOR OVERALL SELECTION OF PROCESSES, OPERATIONS, PARAMETERS, FEEDBACK AND OPTIMATION, WITH AUTOMATED ESTIMATING AND DETERMINATION OF REAL TIME AND COSTS.

**1748** TITLE -- SYNERGISTIC PLATING WITH INFUSED LUBRICANTS

**PROBLEM** -- LOW FRICTION, WEAR RESISTANT SURFACES ARE NEEDED FOR COMPONENTS IN SLIDING CONTACT.

**SOLUTION** -- USE OF TWO-SYSTEM COATINGS INCORPORATING SOLID LUBRICANT INTUMESCENCE WITH METAL PLATING.

**1749** TITLE -- ESTABLISH CUTTING FLUID CONTROL SYSTEM

**PROBLEM** -- THE LACK OF A CONTROLLER PROGRAM FOR THE USE OF CUTTING FLUIDS RESULTS IN HIGH MACHINING COSTS AND STOCKING OF MANY FLUIDS.

**SOLUTION** -- ESTABLISH A PROGRAM TO CONTROL SHOP FLOOR TESTING AND DEFINE METHODS TO CONTROL USE OF CUTTING FLUIDS DURING MANUFACTURING OPERATIONS.

**1750** TITLE -- ALLOY PLATING TO REDUCE CONSUMPTION OF CRITICAL MATERIAL

**PROBLEM** -- SEVERAL COATING MATERIALS SUCH AS CHROMIUM ARE IN SHORT SUPPLY.

**SOLUTION** -- REPLACE OR REDUCE THE AMOUNT OF CRITICAL ELEMENTS IN THE COATING BY ALLOY PLATING.

**1751** TITLE -- "MANUAL" ADAPTIVE CONTROL (CAM)

**PROBLEM** -- APPLICATION AND ADJUSTMENT OF MACHINING RATES AND OTHER PARAMETERS IS UNCERTAIN, SLOW AND COSTLY.

**SOLUTION** -- APPLY MANUAL-COMPUTER PROGRAMS ON SHOP FLOOR TO OPTIMIZE AND CONTROL MACHINING OPERATIONS.

**1752** TITLE -- ESTABLISHMENT OF ION PLATING PROCESS FOR ARMAMENT PARTS

**PROBLEM** -- CK is replacing CK71 (CHROMIUM WHEREVER POSSIBLE). CURRENTLY, CKM PLATING IS SPECIFIED FOR ONLY APROXIMATELY 50% ARMAMENT COMPONENTS. EQUALLY IMPORTANT IS THE ELIMINATION OF THE HYDROGEN EMBRITTLEMENT OF STEEL CAUSED BY ALL ELECTROPLATING PROCESSES.

**SOLUTION** -- ION PLATING ALUMINUM CHROMIUM TO STEEL ARMAMENT SUBSTRATE WILL PROVIDE CORROSION RESISTANCE SIMILAR TO THAT OF ZINC OR CHROMIUM PLATING. ION PLATING AND ELECTROPLATING PROCESSES ARE SIMILAR, PROCESS NEEDS TO BE ESTABLISHED FOR ARMAMENT PARTS.

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**FUNDING ($000)**

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</table>
**COMPONENT -- PROCESSES**

(8126) **TITLE -- ADAPTIVE CONTROL TECHNOLOGY (CAP)**

**PROBLEM --** INEFFICIENT USE OF V/C MACHINE TOOLS DUE TO CONSERVATIVE PROGRAMMING IS UNECONOMICAL. ALSO THE INABILITY TO MONITOR A MULTIPlicity OF TOOL FORMS CHARACTERISTIC OF V/C MACHINE CAPABILITY IS A LIMITATION.

**SOLUTION --** EXTEND THE CURRENT ADAPTIVE CONTROL TECHNOLOGY TO CONTROL THE TOOL LOADS IN SMALL MILLS AND DRILLS SO THEY CAN BE PERFORMED IN THE SAME SETUP. THIS WOULD MAXIMIZE THE USE OF BOTH NC EQUIPMENT AND TOOL SYSTEMS.

(8127) **TITLE -- SECOND ORDER MFG. METHODS FOR WEAPON COMPONENTS**

**PROBLEM --** DURING MFG. OF RECEIVED CONTROL OFFICES, 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 AUTOMATIC INSPECTION EQUIPMENT WILL BE ESTABLISHED. MACHINE TOOLS WILL BE RETROFITTED.

(8256) **TITLE -- APPLICATION OF HIGH-RATE AFFRASIVE MACHINING**

**PROBLEM --** CONVENTIONAL GRINDING IS SLOW AND COSTLY. LONG, MULTIPLE PASSES AND INFEDS ARE REQUIRED TO SIZE AND FINISH WEAPON COMPONENTS.

**SOLUTION --** APPLY HIGH-SPEED ABRASIVE-BELT MACHINING.

(8257) **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 UP, WHILE CHANGES ARE REPETITIVE MULTIPLE PASSES. FOR EXAMPLE - PLANNING / GRINDING OF HEAD / MOUNT RAIL.

**SOLUTION --** RETROFIT EXISTING SPECIAL LONG HEAD / MOUNT, SURFACE GRINDER WITH ELECTROLYTIC SYSTEM TO PROVIDE FAST, SINGLE PASS ROUGH FINISHING OF LARGE COMPONENTS. ELIMINATE ROUGHING BY PLANNING OF MILLING BEFORE ELECTROLYTIC GRINDING.

(8226) **TITLE -- NON-SOLVENT BASED PAINTING PROCESSES**

**PROBLEM --** CURRENT FLUX / SPRAY PAINT METHODS ARE USED FOR COATING METALS FOR HEATING-FIXED / CORROSION RESISTANT. THE METHOD REQUIRED HYDROCARGEN SOLVENTS AS A VAPOR FOR THE PAINT. CONSEQUENTLY, THE SOLVENT IS DISCHARGED TO THE ATMOSPHERE.

**SOLUTION --** NEW SPECIFICATIONS MUST BE ENFORCED TO SPECIFY THE USE OF NON SOLVENT PAINT. PAINT METHODS SUCH AS ELECTROSTATIC PAINTING WOULD BE ADAPTED TO ELIMINATE HYDROCARBON SOLVENTS. THIS WILL ALSO REDUCE WATER CONSUMPTION REQUIRED FOR PREPARATION OF SOLVENTS.
4.1 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 ARE TOO DIFFICULT TO CUT OFF. MATERIAL PROPERTIES OFTEN VARY WITH CASTING PROCEDURES.

SOLUTION - USING COMPUTERIZED techniques AND PRODUCTION CASTING FACILITIES, THE OPTIMUM SHAPE AND TIMES, RISER SLEEVES AND CASTING AND RISER CONFIGURATIONS WOULD BE DETERMINED. PROPERTIES OF CAST MATERIALS WILL BE EVALUATED FOR DIFFERENT CAST EDITIONS.

4.2 TITLE - AUTOMATED SURFACE COATING OF CANNON (CAM)

PROBLEM - IT TAKES APPROXIMATELY 2 1/2 HOURS FOR 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 ELECTRICALLY CONTROLLABLE HYDRAULICALLY POWERED ELECTRO-DYNAMIC MACHINES, INTEGRATED MATERIAL HANDLING AND AUTOMATIC DRYING SYSTEMS, ALLE QUITE COMPUTER CONTROL.

4.3 TITLE - ESTABLISHMENT OF ZINC ION VAPOR DEPOSITION PROCESS

PROBLEM - NO PROBLEM PROVIDED BY APPACOM.

SOLUTION - NO SOLUTION PROVIDED BY APPACOM.

4.4 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 CAM/COM TECHNIQUES FOR DIE DESIGN, FORGING WILL BE DONE AT MUCH LOWER TEMPERATURE AND THE FINAL PARTS WILL HAVE BETTER MECHANICAL PROPERTIES.

4.5 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 WELMENTS ARE PROBLEMS CURRENTLY ADDRESSED BY EMPIRICAL METHODS.

SOLUTION - THE RELATIONSHIP OF DIFFERENT VARIABLES SUCH AS QUENCH RATES, COMPONENT SIZE, SHEET, AND COMPOSITION WILL BE ELUCIDATED. A COMPUTER WILL BE PROGRAMMED TO SELECT THE APPROPRIATE INFORMATION.
COMPONENT -- PROCESSES

(56) TITLE - AUSTENITIZING AND HOMOGENIZING PROCEDURES FOR ARMOR CASTINGS

PROBLEM - ARMOR CASTINGS HAVE TO PASS IMPACT REQUIREMENTS WHICH DEPEND UPON
THE HARDNESS, SOME OF THE HEATS FAILED TO MEET THESE STRICNT REQUIREMENTS.

SOLUTION - DEFERRING ON THE DISTRIBUTION, HIGH TEMPERATURE AUSTENITIZING
TREATMENT IN THIS TEMPERATURE RANGE WILL BE EVALUATED AND THE
EFFECTIVENESS OF AUSTENITIZING AND HOMOGENIZING TREATMENTS FOR THE CAST ARMOR WILL
BE DETERMINED.

(566) TITLE - ELECTRO-MECHANICAL JOINING TECHNIQUES

PROBLEM - PURITY MECHANICAL (FRICTION WELDING) OF MOSTLY ELECTRICAL
(RESISTANCE) WELDING MACHINES OF VARIOUS TYPES WOULD HAVE TO BE LARGE AND
WOULD TAKE EXCESSIVE TIME TO WELD JOINED AREAS 2 SQ INCHES OR MORE.

SOLUTION - COMBINE THE FEATURES OF BOTH METHODS TO DELIVER SUFFICIENTLY LARGE
SPECIFIC ENERGY FOR WELDING OF LARGE PARTS.

(57) TITLE - INTEGRATED DESIGN FOR CAST/FORGED COMPONENTS

PROBLEM - MANY WEAPON COMPONENT SPECIFICATIONS REQUIRE THE DESTRUCTIVE
TESTING OF A SEPARATELY PREPARED COUPON RATHER THAN THE ACTUAL PART.
FREQUENTLY THE MECHANICAL PROPERTIES OF THE MATERIAL IN THE COUPONS DIFFER
FROM THOSE IN THE CASTINGS.

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

(577) TITLE - LASER SURFACE ALLOYING PROCESS FOR IMPROVED WEAR RESISTANCE

PROBLEM - NO PROBLEM PROVIDED BY APPRACOM.

SOLUTION - NO SOLUTION PROVIDED BY APPRACOM.

(578) TITLE - ION IMPLANTATION OF WEAPON COMPONENTS

PROBLEM - NO PROBLEM PROVIDED BY APPRACOM.

SOLUTION - NO SOLUTION PROVIDED BY APPRACOM.

(579) TITLE - ISOHERMAL FORGING OF WEAPONS

PROBLEM - NO PROBLEM STATEMENT PROVIDED BY APPRACOM.

SOLUTION - NO SOLUTION STATEMENT PROVIDED BY APPRACOM.
COMPONENT — TOOLING

(6242) TITLE — APPLICATION OF HIGH-SPEED CUTTING TOOLS

PROBLEM — APPLICATION OF NEW HIGH-SPEED CUTTING TOOLS LAGS DUE TO LACK OF TESTING AND DEVELOPMENT. MANUFACTURERS PROVIDE INSUFFICIENT DATA FOR EFFICIENT APPLICATIONS OF CERAMICS, OXIDES, NITRIDES, AND OTHER MATERIALS.

SOLUTION — HIGH-SPEED CUTTING TOOLS WILL BE TESTED, ANALYZED, AND APPLIED WITH NEW AND EXISTING MACHINING TECHNIQUES. 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 THE HARDER MATERIALS AND REQUIRE FREQUENT REHARDENING.

SOLUTION — CRYOGENIC TREATMENT OF TOOL STEELS GREATLY IMPROVES THE WEAR CHARACTERISTICS OF THE TOOL AND GREATLY REDUCES THE FREQUENCY OF REHARDENING.

(9473) TITLE — SPECIAL TOOLING FOR FLEXIBLE MANUFACTURING

PROBLEM — CONVENTIONAL, CNC, AND FLEXIBLE MANUFACTURING SYSTEMS USE SEPARATE TOOLING WHICH LIMITS COMPLETE FLEXIBILITY FOR MULTIPLE TOOL AND MULTIPLE-SIZE CUTTING WITH INTERCHANGEABILITY.

SOLUTION — CLASSEFIC TOOLING BY GROUPS, ESTABLISH INTERCHANGEABILITY, APPLY SPECIAL MULTIPLE TOOL AND MULTIPLE-SIZE TOOLING IN FLEXIBLE MANUFACTURING OFFERING SYSTEMS.

COMPONENT — PEEF MACHINES

(7716) TITLE — MANUFACTURE OF SLIP RING PEEF SEALS

PROBLEM — SLIP RING REQUIRE SPECIFIC MACHINER MACHINES ARE OUTDATED AND COSTLY REQUIRING MUCH HAND FINISHING BY HIGH SKILLED WORKERS. REJECTION RATE HITS WITH MACH WORK.

SOLUTION — AUTOMATE ALL EXISTING MAChINES WILL BE ADAPTED. NEW METHOD OF SLIPPING RING REQUIRE LESS SLIP REMOVAL. SPECIAL EQUIPMENT WILL BE DESIGNED AND PURCHASED TO MINIMIZE HAND FINISHING BY HIGH-SKILLED OPERATORS.
COMPONENT -- FRECH MECHANICS

CONTINUED)

(7456) TITLE -- HOT ISOSTATIC PRESSING (HIP) OF LARGE CANNON COMP

PROBLEM -- MANY HOURS ARE REQUIRED TO MACHINE THE FRECH BLOCK FORGING TO THE FINISHED PART. MORE THAN 25% OF FORAGE BECOMES CHIPS. WITH HIGH COST OF ALLOY STEEL, THIS BECOMES A VERY COSTLY WASTE OF MATERIAL.

SOLUTION -- HOT ISOSTATIC PRESSING (HIP) WILL FORM FRECH BLOCKS TO NEARLY FINAL SHAPE, GREATLY REDUCING MACHINING COSTS.

(7947) TITLE -- GENERATION OF FACE MACHINING SURFACES

PROBLEM -- TO OBTAIN A GLOSS OF STICK ON A ROUGH CAST COMPONENT, IT IS CURRENTLY NECESSARY TO "DRAW" THE FINISHED COMPONENT ON THE MATERIAL USING HT GAGE AND LAYOUT TEMPLATES. THIS IS DONE ON A TABLE FROM WHICH THE PART MOVES TO A MACHINE FOR SIMILAR "FIT-UP".

SOLUTION -- USING PRESENT LAYOUT TECHNIQUES SUCH AS OPTICAL SHADOW LAYOUT TEMPLATES, THE COMPONENT CAN BE POSITIONED DIRECTLY ON THE MACHINE TO ESTABLISH THE FIRST CUT ELIMINATING THE INITIAL LAYOUT OPERATION.

(7958) TITLE -- OPTIMIZE BENCHING OPERATIONS (CAM)

PROBLEM -- BENCHING OPERATIONS ON FRECH BLOCKS AND RINGS ARE UNSAFE AND TIME CONSUMING.

SOLUTION -- DEVELOP INDOOR ROLL TO PERFORM THESE OPERATIONS.

(8042) TITLE -- RAPID INTERNAL THREADING

PROBLEM -- PRODUCING INTERNAL METRIC THREADS IN FRECH BLOCKS IS A SERIOUS PRODUCTION PROBLEM BECAUSE OF THE TECHNIQUES AND TOOLING REQUIRED. CONVENTIONAL THREAD MACHINING PRESENTS A PRODUCTION BOTTLENECK.

SOLUTION -- CURRENT TECHNOLOGY AND RECENT TOOLING BREAKTHROUGHS HAVE EXPANDED HIGHEALED THREADING CAPABILITY. AUTOMATED THREADING WILL BE AN EFFICIENT, ECONOMIC REPLACEMENT FOR THE CURRENT MILLER-TYPE INTERNAL MACHINING PROCESSES.

(8102) TITLE -- APPLIANCE OF POWDER METALLURGY FORMING TO CAM

PROBLEM -- PRODUCING A CANTILEVERED OVERSIZE AND SUBSEQUENTLY MACHINE DOWN TO FINAL DIMENSIONS. FINAL COMPONENT CONFIGURATION INVOLVES A LARGE AMOUNT OF WASTE AND MUST BE IMPORTED ALLOY STEEL AS CHIPS.

SOLUTION -- RECENT ADVANCES HAVE FACILITATED POWDER METALLURGY FORGING. THE ADVANTAGES WILL PRODUCE "FIRE" METAL FOR USE IMMEDIATELY WHICH REDUCES AMOUNT OF MACHINING, CORRECTS FOR IMPROVED MECHANICAL PERFORMANCE, UTILIZES NEW TECHNOLOGY.
<table>
<thead>
<tr>
<th>COMPONENT -- BREECH MECHANISMS</th>
<th>FUNDING ($000)</th>
</tr>
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<tbody>
<tr>
<td>(P105) TITLE -- ESTABLISH ROUGH THREAD BLANKS &amp; IN. M201 HUSINGS</td>
<td>PRIOR</td>
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<tr>
<td>PROBLEM -- A SINGLE POINT TOOL IS CURRENTLY USED TO PRODUCE THE ROUGH FORMED BLANK FOR STEP THREADS ON STEP BLANKS. CURRENT TIME VALUE IS 13.9 HOURS.</td>
<td>88</td>
</tr>
<tr>
<td>SOLUTION -- POSSIBLE APPLICATION OF MULTIPLE SPLITTING TOOLS AND MILLING OFFER A FAR MORE EFFICIENT METAL REMOVAL PROCESS AIMED AT TIME/COST REDUCTION.</td>
<td>207</td>
</tr>
<tr>
<td>(P117) TITLE -- SHAPED CASTING OF EXTRUDED MATERIAL</td>
<td>103</td>
</tr>
<tr>
<td>PROBLEM -- COMPONENTS REQUIRE FORGING PLUS EXTENSIVE MACHINING TO ACHIEVE THE FINAL DIMENSIONS. THE FORGING PROCESS HAS ENCOUNTERED SOME PROBLEMS WITH THE MECHANICAL PROPERTIES RECEIVING IN THE STEEL.</td>
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<tr>
<td>SOLUTION -- A PRODUCTION PROCESS CAPABLE OF PRODUCING A SHAPED CASTING HAS BEEN DEVELOPED.</td>
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<tr>
<td>(P237) TITLE -- MULTIPLE MACHINING OF CARRIER HOUSINGS</td>
<td>203</td>
</tr>
<tr>
<td>PROBLEM -- THE 152MM M42 AND M32 CARRIER HOUSINGS REQUIRE NUMEROUS OPERATIONS FOR THE PRODUCTION OF COMPLEX INSIDE AND OUTSIDE DIAMETERS. STANDARD EQUIPMENT CANNOT PRODUCE THESE FEATURES EFFICIENTLY.</td>
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<tr>
<td>SOLUTION -- A SPECIAL EQUIPMENT DESIGN WILL BE APPLIED TO ALLOW MACHINING AS MANY SURFACES AS POSSIBLE IN ONE SETUP.</td>
<td></td>
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<tr>
<td>(P249) TITLE -- IMPROVED FORMING TOOLS FOR BREECH RING LUGS</td>
<td>700</td>
</tr>
<tr>
<td>PROBLEM -- PRESENT METHODS OF PRODUCING THE VARIOUS HOLES ON BREECH RINGS ARE TIME CONSUMING AND COSTLY OPERATIONS. PRODUCTION OF THESE HOLES IS A TIME CONSUMING AND COSTLY OPERATIONS.</td>
<td></td>
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<tr>
<td>SOLUTION -- THE NEW PROCESSES OF QUICK DRILLING AND INDEXABLE CARRIER INSERT HOLE DRILLING PROMPTED TO REDUCE THE NUMBER OF STEPS NOW REQUIRED AND TO PROVIDE A FAR MORE COST EFFECTIVE PLAN OF PRODUCING AN ACCEPTABLE PART.</td>
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<tr>
<td>(P339) TITLE -- AFFIXING OF NON-TRADITIONAL TYPES HARDWARE METHODS</td>
<td>700</td>
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<tr>
<td>PROBLEM -- PRESENT METHODS OF FIXTURE HARDWARE WERE COSTLY, TIME CONSUMING AND MAY IMPACT FINISHED PART STRESS.</td>
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<tr>
<td>SOLUTION -- TO IMPROVE THE SURFACE LAYER OF THE STEEL TO ALLOW MATERIAL TO BE USED IN THE NON-TRADITIONAL WAYS. THE ADVANTAGES ARE LESS MACHINE USAGE, POLLUTION FREE, ALLOWS HIGHER PRODUCTION RATES, AND MINIMAL POST-PROCESSING SUCH AS CLEANING AND STAINLESS.</td>
<td></td>
</tr>
</tbody>
</table>
COMPONENT -- BEECH MECHANICS

(8463) TITLE -- CONTROLLED CHAIN SIZE CASTINGS, PRODUCTION AND HEAT TREAT

PROBLEM -- FIN CHAIN CASTINGS HAVE DEMONSTRATED AN IMPROVEMENT IN LOW CYCLE
FATIGUE LIFE BY A FACTOR OF 2. TO 3, IT IS EXPECTED THAT A HEAT
TREATMENT WILL EXTEND THE LIFE STILL FURTHER.

SOLUTION -- PROVIDE FOR CASTING A BEECH BLOCK BY ONE OF THE AVAILABLE
TECHNIQUES THAT OPTIMIZE THE HEAT TREATMENT FOR THE CHOSEN ALLOY. LIFE
IMPROVEMENT WILL BE DEMONSTRATED.

COMPONENT -- GENERAL

(7724) TITLE -- INVESTIGATE TECHNOLOGY OF WEAPONS SYSTEMS

PROBLEM -- THERE IS A NEED TO RELOCATE AND CONTROL THE PRODUCTION OF PARTS
AND DESIGNS FOR ITEMS MANUFACTURED AT WATKINS VETERANS 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 AND STANDARIZATION.

(8028) TITLE -- APPLIC OF SYNTHETIC GUMS TO CIRCUIT TYPES -- COMP.

PROBLEM -- GUMS HAVE NOT SATISFACTORY FROM BOTH THERMAL AND SAFETY
STANDPOINT.

SOLUTION -- USE OF POLYMER MATERIAL TO ALLOW GUMS TO FUNCTION AS CIRCUIT TYPES
WHILE ELIMINATING HAZARDS ASSOCIATED WITH OVERWARMING.

(8249) TITLE -- SHORT-CYCLE HEAT TREATING OF WEAPONS COMPONENTS

PROBLEM -- HEAT TREATING LEADS TO THE ELIMINATION OF NON-THOROUGH HEAT TREATING
THERMAL CYCLE IS WASTED.

SOLUTION -- SUITABLE SYSTEMATIC PROCTORING METHODS WILL BE DEVELOPED TO DETER
THE PROPERTIES OBTAINED AT MINIMAL PROCESSING TIME TO REDUCE ENERGY
CONSUMPTION AND IMPROVE PRODUCTION EFFICIENCY.

(8523) TITLE -- SPRAY-ON-FUSE PROCESSING OF APPARENT COMPONENTS

PROBLEM -- MISMATCHED AND WORN COMPONENTS ARE NOT ONLY COSTLY TO
REPLACE BUT SHORTAGE OF STEEL MANUFACTURING JOB ON THE SUPPLY AND
REPLACEMENT OF WEAPONS.

SOLUTION -- UTILIZE THE THERMAL SPRAY AND FUSE COATING PROCESS TO SALVAGE OR
RECLAIM OVERSIZED OR WORN WEAPONS COMPONENTS (E.G., M16 COIL PISTOLS).
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>GENERAL</th>
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</thead>
<tbody>
<tr>
<td><strong>(65-1)</strong> TITLE - APPLICATION OF CORROSION RESISTANT GALVANIC COATINGS</td>
<td></td>
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<tr>
<td><strong>Problem</strong> - CURRENT METAL FINISHES DO NOT PROVIDE ADEQUATE CORROSION AND HEAT RESISTANCE. COMPONENTS ARE REPLACED OR REWORKED BEFORE THEIR INTENDED LIFE, FREQUENT MAINTENANCE IN THE FIELD AND DEPOTS ADD TO THE OVERALL COST OF THE COMPONENTS.</td>
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<tr>
<td><strong>Solution</strong> - A NEW PROCESS HAS BEEN DEVELOPED FOR APPLYING SUPERIOR CORROSION AND HEAT RESISTANT COATINGS. THE PROCESS, USING SERNIL-16, CONSISTS OF AN AUTOMATED SPRAY-ENGAGE PROCESS FOR A CASTING OF ALUMINUM/CERAMIC AND INORGANIC COATINGS.</td>
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<tr>
<td><strong>Funding</strong> ($000)</td>
<td><strong>P1</strong></td>
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<tr>
<td><strong>(675)</strong> TITLE - IMPROVED TOOLING PERFORMANCE, PREDICTIVE MODEL (CAM)</td>
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<tr>
<td><strong>Problem</strong> - INABILITY TO PREDICT TOOL PERFORMANCE LIMITS TOOL WEAR LIFE AND OFTEN RESULTS IN PREMATURE FAILURE OF THE INSERT, THUS LIMITING PRODUCTIVITY AND INCREASING MACHINE DOWN TIME.</td>
<td></td>
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<tr>
<td><strong>Solution</strong> - ESTABLISH A METHOD FOR EVALUATING QUALITY/CAPABILITY OF TOOLING INSERTS TO OPTIMIZE WEAR LIFE BY VARYING MACHINING PARAMETERS (FEEDS, SPEEDS, DEPTH OF CUT) AND PROVIDE STATISTICAL PREDICTION ABOUT FAILURE INTERVALS.</td>
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<tr>
<td><strong>Funding</strong> ($000)</td>
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<tr>
<td><strong>(835)</strong> TITLE - IMPROVED PRODUCTION OF MUZZLE BRAKE CASTINGS</td>
<td></td>
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<tr>
<td><strong>Problem</strong> - ONLY ONE COMMERCIAL SOURCE OF MUZZLE BRAKE CASTINGS FOR THE 155MM M105 EXISTS, NON-COMPETITION RESULTS IN A HIGHER COST PER MUZZLE BRAKE CASTING. THE SOLE SOURCE SITUATION LIMITS MOBILIZATION RESPONSE.</td>
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<tr>
<td><strong>Solution</strong> - INITIATE &quot;BEST EFFORT&quot; CONTRACTS TO SEVERAL FOUNDRIES TO ESTABLISH CAPABILITY TO MEET TOP REQUIREMENTS AND OBTAIN PROCUREMENT PROCESS TO ADDITIONAL QUALIFIED SOURCES.</td>
<td></td>
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<tr>
<td><strong>Funding</strong> ($000)</td>
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<tr>
<td><strong>(952)</strong> TITLE - FORGING OF MULTI-LAYERED ARMAMENT COMPONENTS</td>
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<tr>
<td><strong>Problem</strong> - NO PROBLEM STATEMENT PROVIDED BY ARRAacom</td>
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<tr>
<td><strong>Solution</strong> - NO SOLUTION STATEMENT PROVIDED BY ARRAacom</td>
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<tr>
<td><strong>Funding</strong> ($000)</td>
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<tr>
<td>COMPONENT</td>
<td>GUN MOUNTS</td>
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<tr>
<td><strong>(802)</strong> TITLE - COATING TUBE SUPPORT SLEEVES WITH HEATING MATERIALS</td>
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<tr>
<td><strong>Problem</strong> - METALLIZED COATINGS ON SUPPORT SLEEVES FOR GUN MOUNTS ARE BRITTLE AND LACK BOND STRENGTH.</td>
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<tr>
<td><strong>Solution</strong> - USE INDUCTIVE-ARC-ENGAGE GAS METHOD TO COAT SLEEVES WITH HEATING MATERIALS.</td>
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<td><strong>Funding</strong> ($000)</td>
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</table>
**HMT FIVE YEAR PLAN**

**COMPONENT -- GUN MOUNTS**

**(2-53) TITLE -- IMPROVED MELTING AND POURING TECHNOLOGY**

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

**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**

**(2-258) TITLE -- BALL SIZING OF RECOIL CYLINDERS**

**PROBLEM -- INTERNAL HONING IS REQUIRED TO ACHIEVE THE SURFACE FINISHES AND TOLERANCES REQUIRED FOR RECOIL CYLINDERS. HONING IS EXCESSIVELY TIME CONSUMING AND ALSO NOISY.**

**SOLUTION -- REPLACE INTERNAL HONING WITH BALL SIZING ON RECOIL SIZING MECHANISMS. BY FORCING A BALL (WITH A DIAMETER SLIGHTLY LARGER THAN THAT OF THE CYLINDER) THROUGH THE CYLINDER, THE SURFACE FINISH AND TOLERANCE CRITERIA CAN BE ACHIEVED.**

**(2-259) TITLE -- IMPROVED MACHINING PROCEDURES FOR RAILS**

**PROBLEM -- CURRENTLY THE FOETAL 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 65 PERCENT REDUCTION IN MANUFACTURING TIME COULD BE REALIZED USING THE LATEST CONCEPTS IN MILLING TOOLS. THESE INCLUDE CROSS AXIAL MOVEMENTS AND A METHOD OF HIGH SPEED MILLING USING INDEXABLE CARBIDE INSERTS.**

**(2-260) TITLE -- IMPROVED FABRICATION OF RECOIL WEAR SURFACES**

**PROBLEM -- PRESENTLY GRINDING AND HONING OPERATIONS OF 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.**

**(2-265) TITLE -- FOUNDRY MOLDING WITH POLYSTYRENE PATTERNS**

**PROBLEM -- COMPLEX CASTING SHAPES REQUIRE A LARGE NUMBER OF CORES WHICH ARE EXTENSIVE TO MAKE, SET, AND ANCHER IN PLACE. ALSO, WOOD PATTERN COSTS ARE HIGH FOR THESE CASTINGS.**

**SOLUTION -- THE USE OF LOW DENSITY EXTRUDED POLYSTYRENE PATTERNS REQUIRE NO CORES, EVEN FOR COMPLEX SHAPES AND ELIMINATE THE NEED FOR WOODEN PATTERNS AND CORE FIXTURES.**
**MMT FIVE YEAR PLAN**

**RCS ORCHT 126**

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<tr>
<th>COMPONENT -- Recoil Mechanisms</th>
<th>(CONTINUED)</th>
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**8422** TITLE - NONE 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** - None 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.

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<th>COMPONENT -- Tubes</th>
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**7309** TITLE - Replaceable Steel Liners for Cannon Tubes

**Problem** - Tube life in several high performance canons such as the 155mm How M199 and others is limited by erosion and loss of accuracy in a relatively few rounds at maximum charge.

**Solution** - Develop MFG. process for fabrication of thin liners and process for placing these liners in cannon tubes, thereby extending cannon life.

**7916** TITLE - Application of Low Cost Mandrel Materials

**Problem** - To produce a satisfactory substitute for tungsten carbide mandrel to eliminate sole source procurement, the price of the mandrels has increased fifty percent over the last 5 years.

**Solution** - High speed steel mandrels have been used for swage process in United Kingdom. This should be a substitute for tungsten carbide mandrels.

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<tr>
<th>7925</th>
<th>TITLE - Bore Evacuator Unfogging</th>
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</table>

**Problem** - Both ends of the bore evacuator have similar diameter bores and require almost equal machining, with high cost of machining time, reduction of machining time is imperative. Orientation of the bores is to each other.

**Solution** - A special purpose machine and tooling FKG providing a head for each end of the evacuator can be developed to produce both bores simultaneously. If both surfaces were produced from the same set up, orientation of centers lines would be assured.

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<th>7957</th>
<th>TITLE - Improved Fabrication and Repair of Anodes</th>
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**Problem** - The purchase of new or the repair of anodes is expensive and time consuming. Currently used method of line clamping is inferior to electromagnetic clamping because of variations of thickness and oxide inclusions.

**Solution** - An electro-eroding system capable of depositing lead will enable fabrication and repair of anodes in considerably less time than now required and at a lower cost.
COMPONENT -- TUBES (CONTINUED)

(804) 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 DEFERRING ON ITS APPLICATION HAS METAL REMOVAL RATES WHICH CAN EXCEED MILLING OR GRINDING AT THE SAME TIME PRODUCING EXCELLENT TOLERANCES AND SURFACE FINISH.

(8056) TITLE -- RECYCLING SPENT GUN TUBES BY LSA 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 LSA INTO INGOTS FOR USE ON THE ROTARY FORGE.

(8105) TITLE -- HIGH VELOCITY MACHINING

PROBLEM -- SPEED OF MACHINING CANNOT BE ACCOMPLISHED WITH CURRENT EQUIPMENT.

SOLUTION -- EVALUATE HIGH SPEED METAL REMOVAL METHODS AND AVAILABLE EQUIPMENT. FUTURE YEARS FUNDING WILL PROVIDE FOR ACQUISITION AND TESTING OF THIS MACHINING PROCEDURE.

(8106) TITLE -- LARGE CALIBER POWER CHAMFER FORGING

PROBLEM -- FORGER CHAMFER PRODUCTION ON LARGE BORE CANNONS IS CURRENTLY REQUIRED TO COMPLETE BOTH ROUGH AND FINISH OPERATIONS.

SOLUTION -- PERFORM THE FINISHING OPERATION ON 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 THE CHAMFERING OPERATION.

(8107) TITLE -- CREEP FEED CRUSH FORM GRINDING

PROBLEM -- THE RACKET SLOT ON THE 10" X 2" X .061 EXPEH RING IS A HIGH COST OPERATION. IT IS CURRENTLY MILLED WITH FORM TOOLS IN TWO OPERATIONS -- ROUGH AND FINISH.

SOLUTION -- A NEW PROCESS IS BEING DEVELOPED THAT REPERMULATES THE CRUSH FORM ABRASIVE MACHINE FOR CYLINDRICAL PARTS EXCEPT THAT THE PROCESS IS USED TO PRODUCE FLAT CONTINUOUS SURFACE. IT IS PROPOSED THIS PROCESS BE ADAPTED TO PRODUCTION OF THE RACKET SLOT.
COMPONENT -- TUBES (CONTINUED)

(8151) 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 OPERATION OF THE FATIGUE AND HAZARD OF HAND STAMPING. THIS WILL RESULT IN MORE UNIFORM SPACING AND DEPTH CONTROL AND REDUCE BOTH TIME AND COST.

(8152) TITLE -- IMPROVED ANODE STRAIGHTNESS FOR CHROMIUM PLATING

PROBLEM -- ANODE STRAIGHTNESS AND FUIDITY ARE IMPORTANT FOR MAXIMUM AND UNIFORM RADIAL DISTRIBUTION OF CURRENT. A SOLID COPPER ROD IS PRESENTLY USED, ALTHOUGH ANODES ARE MADE AND PRESERVED AS CAREFULLY AS POSSIBLE STRAIGHTNESS IS A RECURRING PROBLEM.

SOLUTION -- THIS PROJECT WILL USE IN THE COPPER ANODES A COMMERCIAL AVAILABLE COMPOSITE ROD MADE OF UNIDIRECTIONAL GRAPHITE FILAMENTS IN A SUITABLE MATRIX. THE SPECIFIC STRENGTH WILL BE 35 TIMES HIGHER AND THE SPECIFIC MODULUS 9 TIMES HIGHER THAN COPPER.

(8153) TITLE -- INCREASING GUN TUBE HEAT TREATMENT CAPACITY

PROBLEM -- OIL-FIRED SLAG CONTINUOUS HEAT TREATING CANNOT MEET THE PRODUCTION CAPACITY OF THE ROTARY FORGE. THE OUTPUT OF THE HEAT TREAT LINE MUST BE INCREASED THREE-FOLD TO MEET MILITARIZATION REQUIREMENTS.

SOLUTION -- INCREASE CAPACITY BY MODIFYING SYSTEM, ADDING SECOND MODIFIED SYSTEM, ADDING A STABILIZING FURNACE, AND SHORTENING AUSTENITIZATION CYCLE. ANOTHER POSSIBILITY IS TO USE RAPID HEATING RATES AVAILABLE WITH INDUCTION HEATING TO REDUCE TIME NEEDED.

(8241) TITLE -- COMPUTER APPLICATIONS TO FIRE GUIDANCE

PROBLEM -- THE FIRE 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 SUCH FEATURES AS SELF TESTING, CHECKING, MONITORING, AND CALIBRATION. CONTROL, TEST, AND MEASUREMENT SYSTEMS.

(8242) TITLE -- DUAL PRESS LOADING

PROBLEM -- ABOUT 20 PIECE GUN TUBE FINDINGS REQUIRE STRAIGHTENING AT TEMPERATURE ABOVE 1000 DEG F BECAUSE THE CRITERIA FOR "COOL" 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, THEREBY REDUCING INCREASE STRESSES.
## MTP Five Year Plan

**Component:** Tires

<table>
<thead>
<tr>
<th>Title</th>
<th>Funding (K)</th>
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</thead>
<tbody>
<tr>
<td>Problem: Chemical Plating of Tires is a Complex, Multi-Stage Process Which is Slightly Controllable, Poor Control of Valve Stress, Switching, etc. is Often Irregular, and Can Result in Decreased Deposit Quality Due to Human Error.</td>
<td>Prior $300$, 260</td>
</tr>
<tr>
<td>Solution: The Critical Stages of the Chemical Plating Process Will Be Identified and Refinements Developed to Reduce to Near Zero the Manipulation Functions Required of an Operator.</td>
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</table>

<table>
<thead>
<tr>
<th>Title</th>
<th>Funding (K)</th>
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<tbody>
<tr>
<td>Problem: Rotary Forget Tuffs 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>
<td>290</td>
</tr>
<tr>
<td>Solution: Information On Each Process 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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<thead>
<tr>
<th>Title</th>
<th>Funding (K)</th>
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<tbody>
<tr>
<td>Problem: High Concentration Chromium Coating is Currently Used to Resist Erosion. In Our Process, Inherent Properties Make the Coating Susceptible to Sparking and Electroplating.</td>
<td>Prior $290$, 195</td>
</tr>
<tr>
<td>Solution: Plating with Low Concentration Chromium Will Give a Marked Increase in Wear Resistance due to its Quench Characteristics.</td>
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<table>
<thead>
<tr>
<th>Title</th>
<th>Funding (K)</th>
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<tbody>
<tr>
<td>Problem: Machining of CRT Check Seats is a Precision Process Involving Grindins and Lapping of a Critical Area of the CRT Which Results in 0.02 to 0.05 Percent Error to Meet CRT Eduction Requirements.</td>
<td>185</td>
</tr>
<tr>
<td>Solution: A More Precise Alignment of Finishing Equipment and Eliminate the Machining Facility Which Time to Reduce Eductivity. The Grinding System Will Also Be Revisited.</td>
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<thead>
<tr>
<th>Title</th>
<th>Funding (K)</th>
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<tbody>
<tr>
<td>Problem: In Measuring and Correctly Marking the Fire Control Register, a Variety of Calibration Whithe Systems Indicate Compensation for Manufacturing Variance Due to Eductivity Allocations.</td>
<td></td>
</tr>
<tr>
<td>Solution: An Analog Leveling Measuring System Which Will Provide Input Data to a Servocontrolled Watering System to Position Level a Tree at the Muzzle Line and a Measuring System for the Variations at the Habit Leveling Site.</td>
<td>281</td>
</tr>
</tbody>
</table>
**FIVE YEAR PLAN**

**FINANCING ($000)**

<table>
<thead>
<tr>
<th>13340</th>
<th>TITLE - MILL CYLINDER CUT OFF MACHINERY</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBLEM - Cylinder length is set in 1 or 2 ways, parted off in a lathe and faced to length or turned off and then set up in a lathe for facing to final length and dimensions. In either case, the operation requires double handling or slow operating procedure.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION - New technology is being developed whereby a set of rotating cutters wills the cylinder to length producing a face surface to satisfy our tolerance length requirements. Current mill, lathe will not perform this function but this technology is applicable.</td>
<td></td>
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<table>
<thead>
<tr>
<th>13342</th>
<th>TITLE - LASER CUTTING OF CANNON TUBES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBLEM - An individual amount of time is required to perform cutting and removal of excessive material from cannon tubes.</td>
<td></td>
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<tr>
<td>SOLUTION - A laser machining process with sufficient output energy to accommodate large wall thicknesses will be developed.</td>
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<table>
<thead>
<tr>
<th>13344</th>
<th>TITLE - PARTIAL REFRACTORY LINERS FOR CANNON TUBES</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBLEM - Manufacturing problems are associated with the fabrication, machining, and assembly of thin refractory liners into cannon tubes.</td>
<td></td>
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<tr>
<td>SOLUTION - Develop new techniques and manufacturing processes to solve these problems.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>13346</th>
<th>TITLE - Boring of Pave Evacuator Holes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBLEM - An inability to successfully and consistently produce a smooth bore leading to the internal refining of the bore evacuator holes of the 120mm is due to key chemic failure.</td>
<td></td>
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<tr>
<td>SOLUTION - An improved fixture aligning as a constant for the unit and solution will be developed and fabricated. The unit will be capable of churning the internal area of the evacuator and use of electric-chemical polishing.</td>
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<thead>
<tr>
<th>13347</th>
<th>TITLE - AUTOMATIC MACHINING HEAD ALIGNMENT</th>
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</thead>
<tbody>
<tr>
<td>PROBLEM - Alignment of the machining head is a time consuming manual operation requiring skilled operator to maintain proper position relative to the alignment of the machining head body.</td>
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<tr>
<td>SOLUTION - Application of an automatic fixture alignment and positioning system will substantially reduce this operation.</td>
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</tbody>
</table>
COMPANY ** TUBES (CONTINUED)

** TITL** - SIMULTANEOUS HOLE SHRINKING

**PROBLEM** - PRESENT SHRINK FITTING OF HOLES ONTO CARBON TUBES IS ACCOMPLISHED ONE HOLE AT A TIME. THIS INVOLVES INDUCTION HEATING OF THE HOLES, LOUVING IT WITH THE POSITIVE TUBE AND SPRAY COOLING TO SHRINK.

**SOLUTION** - A VERTICAL SYSTEM TO SIMULTANEOUSLY FIT THE THREE HOLES WITH INDUCTION COILS AND LOCATE POSITION AS THE TUBE IS LOWERED INTO THE FIT WILL BE DESIGNED AND FABRICATED. WATER COOLING SYSTEM WILL BE DESIGNED TO SPEED UP COOLING OF THE HOLES.

**TITL** - IMPROVED HOLLOW SPINDLE LEADING TO UNDERSIZE

**PROBLEM** - LOADING AND UNLOADING OF LARGE TUBES IN HOLLOW SPINDLE LATHE REQUIRES TWO GRAY LIFTS AND THE MANUAL MOVES BY THE OPERATOR THAT IS POTENTIALLY HAZARDOUS.

**SOLUTION** - A CHUTE DEVICE THAT WILL AUTOMATICALLY LOAD THE TUBE INTO POSITION WILL BE DESIGNED, FABRICATED AND Fitted TO PRODUCTION HOLLOW SPINDLE LATHES.

**TITL** - THE MFG. OF QUARTZ FLATS & MUZZLE PLATES

**PROBLEM** - PRESENT METHODS OF MACHINING FLATS AND MUZZLES REQUIRE TWO SET-UPS ON TWO SEPARATE MACHINES WITH ADDITIONAL MATERIAL HANDLING REQUIREMENTS.

**SOLUTION** - DESIGN A SINGLE MACHINING SYSTEM CAPABLE OF MANUFACTURING BOTH THE MUZZLE AND THE LEVERED FLATS IN A SINGLE SET-UP, FABRICATE AND Retrofit TO CURRENT EQUIPMENT.

**TITL** - DRIVING OF MACHINE TUBE BORES

**PROBLEM** - INTERMITTENT TOOLS BEING OPERATIONS FOR SURFACE FINISH AND PREVENT COOLING ARE COSTLY TIME CONSUMING, COSTLY REPAIR & REMOVAL PROCESSES. INTERMITTENT OPERATIONS ARE ALSO TIME CONSUMING, AND HAVE HIGH TOOLING COSTS.

**SOLUTION** - THE APPLICATION OF RECENTLY DEVELOPED DRIVING TECHNOLOGY AND EQUIPMENT WILL ELIMINATE COSTLY PRODUCTION CHANGEOVER OPERATIONS.

**TITL** - AUTO FLAME CUTTING OF HOT ROTARY FORGED TUBE

**PROBLEM** - CUT OFF OF MUZZLE AND MUZZLE TONS OF ROTARY FORGED FORGINGS IS A SLOW OPERATION PRIOR TO HOT TREATING.

**SOLUTION** - AUTOMATIC FLAME CUTTING WILL ELIMINATE A HOTTER NECK OPERATION AND REDUCE CUTTING TIME.
PMT FIVE YEAR PLAN
HCS PMT 126

FUNDING ($000)

Prior F1 F2 F3 F4 F5

356 300 200

COMPONENT -- TUBES

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

PROBLEM -- REDUCED WEIGHT WITHOUT SUFFICIENT ACCURACY. GRAPHITE FIBER REINFORCED COMPOSITE 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 IMPREGNATED REDUCES PROCESSING REQUIREMENTS SIGNIFICANTLY, THUS MAKING CARBON/CARBON COMPOSITES A COST COMPETITIVE MATERIAL.

(3.4.7) TITLE -- CONTOUR CHEMICAL MILLING PROCESS FOR GUN TUBE FAR.

PROBLEM -- NO PROBLEM PROVIDED BY AFRACOM.

SOLUTION -- NO SOLUTION PROVIDED BY AFRACOM.

(3.4.8) TITLE -- W/M FABRICATION OF GUN TUBES

PROBLEM -- MANUFACTURE OF BARRELS USING IMPROVED MATERIALS WITH RESISTANCE TO WEAR AND EROSION CAUSED BY THERMAL AND CHEMICAL DETERIORATION DESIGNED FOR USE AT ELEVATED TEMPERATURES UNDER ADVERSE CONDITIONS BY CONVENTIONAL TECHNIQUES IS EXPENSIVE.

SOLUTION -- ROTARY SWAGING OF COMPACTED PREFORMS HAS BEEN DONE FOR IRON POWDER COMPACTS IN AND LACES. THIS TECHNIQUE CAN BE EXTENDED TO FABRICATE PRECISION GUN BARRELS FROM LOW ALLOY-HIGH STRENGTH STEEL POWDERS.

******************************************************************************

* CATEGORY *

* POLLUTION ASSESSMENT *

******************************************************************************

COMPONENT -- MISCELLANEOUS

(3.5.6) TITLE -- SEPARATION OF OILS AND CUTTING FLUIDS FROM WASTE WATER

PROBLEM -- REMOVAL OF OILS AND CUTTING FLUIDS FROM WASTE WATER IS NECESSARY TO MEET EPA REQUIREMENTS.

SOLUTION -- EVALUATE CHEMICAL AND MECHANICAL METHODS FOR OIL AND CUTTING FLUID REMOVAL FROM WASTE WATER.

******************************************************************************

* CATEGORY *

* QUALITY CONTROL/TESTING *

******************************************************************************
COMPONENT -- FIRE CONTROL

(P.31) TITLE -- DIGITAL IMAGE EJASTOMETERIC TECHNIQUES

PROBLEM -- NO PROBLEM PROVIDED BY ARPA/COM.

SOLUTION -- NO SOLUTION PROVIDED BY ARPA/COM.

COMPONENT -- GUN SYSTEMS

(P.32) TITLE -- IMPROVE IMPULSE PROGRAMMER FOR HYDRAULIC SIMULATOR

PROBLEM -- UNSATISFACTORY SHOCK AND VIBRATION IN TESTS OF CERTAIN RECOIL MECHANISMS LIMIT THE EXTENT OF TESTING THAT CAN BE ACCOMMODATED ON THE HYDRAULIC ARTILLERY TEST SIMULATOR.

SOLUTION -- DESIGN AND MANUFACTURE IMPROVED IMPULSE PROGRAMMERS TO GET BETTER SIMULATED FIRING THAT WILL BE MORE EFFECTIVE FOR A GREATER NUMBER OF WEAPONS.

(P.33) TITLE -- AUTOMATIC ADJUSTMENT FOR SIMULATOR ARTILLERY TEST

PROBLEM -- HIGH OPERATING COST DUE TO NEECESSITY OF MANUAL ADJUSTMENT OF VALVES AND OF SPACING BETWEEN SIMULATOR AND WEAPON.

SOLUTION -- PROVIDE INCREASED TEST EFFICIENCY BY PROVIDING REMOTE AND AUTOMATIC ADJUSTMENT OF SIMULATION SPECIFIC TO WEAPON, AND FOR AUTOMATIC ADJUSTMENT OF PRECHARGE PRESSURES.

(P.35) TITLE -- ROBOTIC IMPLACEMENT DEVICE FOR INSPECTION BY X-RAY (RENEW)

PROBLEM -- EXISTING INSPECTION METHODS ARE TIME CONSUMING AND DIFFICULT TO PERFORM. FEASIBILITY OF AUTOMATIC MEASUREMENT OF DIMENSIONS, HARDNESS, AND SURFACE CHARACTERISTICS HAS BEEN SHOWN BUT HAVE NOT BEEN APPLIED IN SMALL CALIBER WEAPONS MANUFACTURE.

SOLUTION -- REPLACE THE MANUAL HANDLING AND THE X-RAY FILM IN THE GUN CARRIAGE SUB-ASSEMBLIES AND THE X-RAY SOURCE BY AN AUTOMATED ROBOTICS DEVICE TO ALIGN AND INSPECT THE GUN CARRIAGE WELDS.

(P.37) TITLE -- AUTOMATED INSPECTION OF WEAPONS COMPONENTS

PROBLEM -- NO PROBLEM PROVIDED BY ARPA/COM.

SOLUTION -- NO SOLUTION PROVIDED BY ARPA/COM.
<table>
<thead>
<tr>
<th>COMPONENT -- MISCELLANEOUS</th>
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</thead>
<tbody>
<tr>
<td><strong>(6253) TITLE -- MACHINE TOOL DYNAMIC MEASUREMENTS AND DIAGNOSTICS</strong></td>
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<td>190</td>
</tr>
</tbody>
</table>

**PROBLEM -- VIBRATIONS IN MACHINE TOOLS, KNOWN AS CHATTER, CAN BE THE CAUSE OF POOR MACHINING OPERATIONS WHICH, IN A HIGH PRODUCTION ENVIRONMENT, CAN RESULT IN MUCH LOST TIME AND DOLLARS.**

**SOLUTION -- DEVELOP A MACHINE TOOL DYNAMIC MEASUREMENTS TECHNIQUE WHICH USES VIBRATION SIGNALS RECEIVED FROM VARIOUS MACHINE LOCATIONS AND IDENTIFIES THE ORIGIN AND MAGNITUDE OF THE VIBRATION. VIBRATION ANALYSIS WOULD INDICATE CORRECTIVE ACTION.**

<table>
<thead>
<tr>
<th>CATEGORY</th>
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</thead>
<tbody>
<tr>
<td><strong>SMALL CALIBER</strong></td>
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<thead>
<tr>
<th>COMPONENT -- BARRELS</th>
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<tbody>
<tr>
<td><strong>(17905) TITLE -- SMALL ARMS WEAPONS NEW PROCESS PRODUCTION TECHNOLOGY</strong></td>
</tr>
<tr>
<td>350 436 520 692 239</td>
</tr>
</tbody>
</table>

**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 .40 TO 40MM BARRELS BY ESTABLISHING THE TECHNOLOGY AND PROCESS EQUIPMENT REQUIRED TO BRIDGE GAP BETWEEN CAPABILITIES AND REQUIREMENTS.**

<table>
<thead>
<tr>
<th><strong>(80CI) TITLE -- RAPID FLOW PLATING OF SMALL CAL GIUN TUBES</strong></th>
</tr>
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<tbody>
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<td>132 132</td>
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</table>

**PROBLEM -- CHROMIUM PLATING IS A RELATIVELY SLOW PROCESS.**

**SOLUTION -- RAPID SOLUTION FLOW GREATLY INCREASES PLATING RATE.**

<table>
<thead>
<tr>
<th><strong>(81F2) TITLE -- IMPROVED SC GUN BARREL RIFLING MFG TECHNIQUES</strong></th>
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<td>175 246</td>
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</tbody>
</table>

**PROBLEM -- RIFLING SMALL CALIBER GUN BARRELS USES ANTIQUATED TECHNOLOGY (E.G., 1940-50), AS MANY AS 26 FASSES WITH WAFFER TYPE PROACHES ARE NEEDED. EACH PASS REQUIRES DISASSEMBLY OF FIT-UP. EQUIPMENT IN CAL .50 TO 40MM SIZE IS EXTREMELY LIMITED.**

**SOLUTION -- APPLY AND REDUCE TO PRACTICE THE CONCEPT OF ULTRASONIC EXCITATION OF RIFLING FORMING TOOLS. THE USE OF ULTRASONICS FOR RIFLE FORMING WILL RESULT IN REDUCED FUACES TO FORM RIFLING, IMPROVED FINISH CHARACTERISTICS, AND REQUIRE FEWER FASSES.**
COMPONENT -- COMPONENTS

(471) TITLE -- SQUEEZE CASTING OF SMALL CAL. WEAPONS

PROBLEM -- NO PROBLEM PROVIDED BY ARRAacom.

SOLUTION -- NO SOLUTION PROVIDED BY ARRAacom.
## MP5 Five Year Plan

### Funding ($1000)

<table>
<thead>
<tr>
<th>Component</th>
<th>General</th>
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<tbody>
<tr>
<td><strong>(A5-1) Title:</strong> Application and control of machine tools</td>
<td></td>
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<tr>
<td>Problem - Current procedures for the justification, selection, application, and maintenance of machine tools are inadequate to avoid procurement of inefficient, unreliable machine tools.</td>
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<tr>
<td>Solution - Establish an accurate definition of machine tool requirements in relation to component achieving requirements. Develop performance analyses and competitive performance evaluation criteria.</td>
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</tr>
<tr>
<td><strong>(A1-5) Title:</strong> PM steel preforms for small caliber weapons</td>
<td></td>
</tr>
<tr>
<td>Problem - Manufacturing of weapons components such as bolts and sprockets have been by conventional metal removal processes, while NC equipment reduces machining times, equipment costs are high and much material waste occurs.</td>
<td></td>
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<tr>
<td>Solution - FPM offers a means of achieving near net shape at low cost. PMF preform approach has been shown for simple shapes. Recent advances in P/M technology have demonstrated the capability of manufacturing P/M preforms in complex shapes.</td>
<td></td>
</tr>
<tr>
<td><strong>(A3-4) Title:</strong> Process controls for PM weapons components</td>
<td></td>
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<tr>
<td>Problem - Present methods of producing weapon components is mainly by machining from wrought stock. This is a high cost method which produces much alloy steel scrap.</td>
<td></td>
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<tr>
<td>Solution - Forge parts from PM steel for savings and increased durability and reduced use of alloy steel.</td>
<td></td>
</tr>
<tr>
<td><strong>(B4-6) Title:</strong> Assembly &amp; handling techniques for small cal weapons</td>
<td></td>
</tr>
<tr>
<td>Problem - No problem provided by ARACCON.</td>
<td></td>
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<tr>
<td>Solution - No solution provided by ARACCON.</td>
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<tr>
<td><strong>(A5-5) Title:</strong> Group technology for S/C component</td>
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<tr>
<td>Problem - No problem statement provided by ARACCON.</td>
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<tr>
<td>Solution - No solution statement provided by ARACCON.</td>
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<tr>
<td><strong>(A5-6) Title:</strong> Processing of high strength/light weight weapons components</td>
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<tr>
<td>Problem - No problem statement provided by ARACCON.</td>
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<tr>
<td>Solution - No solution statement provided by ARACCON.</td>
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</tbody>
</table>
COMPONENT -- GENERAL

TITLE: FABRICATION OF COMPOSITE WEAPON COMPONENTS

PROBLEM: CONVENTIONAL WEAPONS DEVELOPMENT SURFACE TREATMENTS ARE APPLIED TO ELECTROPLATING AND THE Internal ELEMENTS 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 PAW PROCESS WHICH ARE CURRENTLY USED FOR HEATING TO FORM WEAK AND FRACTURE RESISTANT LAYERS.

COMPONENT -- LIGHTWEIGHT FIRE ARMS COMPONENTS

TITLE: MODERN WEAPONS REQUIRE THAT MATERIALS HAVE A HIGH SPECIFIC STRENGTH-TO-WEIGHT RATIO IN ORDER TO REDUCE THEIR WEIGHT.

SOLUTION: THE F.A. AND NAVY HAVE DEVELOPED METAL MATRIX COMPOSITE MATERIALS THAT HAVE HIGHER SPECIFIC STRENGTH THAN STEEL OR ALUMINUM ALLOYS. DEVELOP THE PROPER PROCESS PARAMETERS FOR PRODUCING THESE MATERIALS INTO WEAPON COMPONENTS.

COMPONENT -- FIRE ARMS OR SMALL CAL WEAPON COMPONENTS

TITLE: NO PROBLEM PROVIDED BY ARMY

SOLUTION: NO SOLUTION PROVIDED BY ARMY

COMPONENT -- SPRINGS

TITLE: STRESS RELIEF OF METAL COMPRESSED 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 PARAMETERS SUCH AS SIZE, SHOT INTENSITY, AND SPRING STRESS LEVELS.

FUNDING (1968)

<table>
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<th>61</th>
<th>62</th>
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<tr>
<td>Rotor System</td>
<td>117</td>
<td></td>
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<tr>
<td>Turbine Engine</td>
<td>120</td>
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</table>
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 cannot 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.
## AVRAICOM

### CURRENT FUNDING SUMMARY (THOUSANDS)

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>FYR1</th>
<th>FYR2</th>
<th>FYR3</th>
<th>FYR4</th>
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<td>AIRFRAME</td>
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<td>DRIVE SYSTEM</td>
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<td>MOTOR SYSTEM</td>
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<td>1725</td>
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<td>TURBINE ENGINE</td>
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<td>5616</td>
<td>7890</td>
<td>6320</td>
<td>6520</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>9443</td>
<td>13009</td>
<td>15285</td>
<td>17425</td>
<td>19485</td>
</tr>
</tbody>
</table>
CURRENT TITLE -- REASONS FOR INCREASED AIRCRAFT MANUFACTURING COSTS

- The increased cost and weight of composites for aircraft components have not yet been fully realized due to fabrication limitations relative to configuration requirements, for example, flat-plate joining, complex contours, and sub-assemblies.

- Experimental fabrication technology, developed under an NAP effort, will be evaluated. All known advanced manufacturing procedures will be evaluated for the wing-related tail section, filament weaving in the primary technology involved.

- Low cost/advanced composites as frame material

- Current cost high for internal vane/encased load-hinging advance materials require innovative technique for filament composites into primary structure.

- Develops well into any fabrication techniques which permit direct integration of composites materials within the composite structure. This will reduce the overall cost of the airframe structure.

CURRENT TITLE -- GENERAL

- Technology for aircraft and secondary structure

- Manufacturing problems arising from inefficiently developed state-of-the-art technology are responsible for various failures in production of aircraft.

- Develops technology to manufacture primary and secondary structures from existing new metallic to composite materials at substantially lower cost.
<table>
<thead>
<tr>
<th>COMPOUND -- GENERAL</th>
<th>(CONTINUED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.7.3.6) TITLE:</td>
<td>FUEL OF TIB2 COATED LONG LIFET TOOLS</td>
</tr>
<tr>
<td>PROBLEM:</td>
<td>AIRFRAME COMPOSITE COMPONENTS REQUIRE EXTENSIVE MACHINING WHICH IS EXPENSIVE IN TERMS OF LABOR HOURS REQUIRED AND TOOL COSTS.</td>
</tr>
<tr>
<td>SOLUTION:</td>
<td>MANUFACTURE OF TIB2 COATED TOOLS WILL BE SCALED UP FROM LAB-SIZED ELECTROLYTIC CELLS (11.5 LBS) TO PRODUCTION SIZE (ABOUT 320 LBS) WITH THE CAPABILITY TO FABRICATE VARIOUS TOOL TIPS AND SHAFTS. TOTAL TOOLING COST WILL BE ABOUT 20% OF CURRENT.</td>
</tr>
<tr>
<td>4.7.4.1) TITLE:</td>
<td>STRUCTURAL COMPOSITE FABRICATION GUIDE</td>
</tr>
<tr>
<td>PROBLEM:</td>
<td>THE NEED EXISTS TO DOCUMENT INDUSTRY EXPERIENCE IN COMPOSITES SO THAT COST AND MANUFACTURING COMPARISONS CAN BE MADE.</td>
</tr>
<tr>
<td>SOLUTION:</td>
<td>THE GUIDE WILL PROVIDE INFORMATION IN A SYNERGISTIC FASHION TO PROVIDE PRODUCTION ANALYSIS, PROVIDE PROCESS/PRODUCT INTERRELATIONSHIPS AND IDENTIFY A THOROUGH MANUFACTURING INTERFACE.</td>
</tr>
<tr>
<td>4.7.4.3) TITLE:</td>
<td>MACHINING OPERATIONS ON KEVLAR LAMINATES</td>
</tr>
<tr>
<td>PROBLEM:</td>
<td>PRESENT METHODS OF MACHINING KEVLAR LAMINATES TEND TO CAUSE DELAMINATION AND EXCESSIVE FUSING OR FRAYING IF THE CUT EDGES. THIS NECESSITATES THE USE OF TIME CONSUMING AND REPETITIVE TECHNIQUES TO ACHIEVE ACCEPTABLE MACHINE SURFACES.</td>
</tr>
<tr>
<td>SOLUTION:</td>
<td>EXPERIENCE INDICATES THAT RECENTLY DEVELOPED ADVANCED CUTTING TECHNIQUES, INCLUDING HIGH PRESSURE WATER JET AND CONVENTIONAL DIAMOND TOOLS HAVE THE ABILITY TO EFFECTIVELY MACHINE KEVLAR WITH INCREASED TOOL LIFE.</td>
</tr>
<tr>
<td>4.7.4.4) TITLE:</td>
<td>LASER CUTTING AND WELDING OF METAL</td>
</tr>
<tr>
<td>PROBLEM:</td>
<td>TECHNIQUES ARE NEEDED TO REDUCE CUTTING AND WELDING TIMES ON AIR-CRAFT PARTS.</td>
</tr>
<tr>
<td>SOLUTION:</td>
<td>DEVELOP LASER CUTTING TO PERMIT RAPID, PRECISE AND STRUCTURALLY SOUND WELDING. DEVELOP LASER CUTTING METHODS TO CUT COMPLEX CORNERS AT HIGH SPEED.</td>
</tr>
<tr>
<td>4.7.4.5) TITLE:</td>
<td>INTEGRAL LOW COST FASTENER SYSTEMS FOR COMPOSITE</td>
</tr>
<tr>
<td>PROBLEM:</td>
<td>INSTALLING FASTENERS IN COMPOSITE IS ACCOMPLISHED BY THE TRADITIONAL SCREW DRILLS AND BOLT METHODS, UTILIZATION OF THESE METHODS ARE HIGHLY TIME AND INEXPRESSIVE AND ADD TO THE WEIGHT OF THE SYSTEM.</td>
</tr>
<tr>
<td>SOLUTION:</td>
<td>THIS PROJECT WILL DEVELOP TECHNOLOGY FOR UTILIZATION AND INTEGRATION OF PLASTIC FASTENERS, SNAP LATCHES, AND OTHER LOW COST FASTENING DEVICES IN AN INNOVATIVE TECHNOLOGY INTO THE PRODUCTION OF NEW SYSTEMS.</td>
</tr>
</tbody>
</table>
(71) TITLE = COMPOSITE ENGINE INLET FOR HELICOPTER STRUCTURE

PROBLEM = MAKING COMPOSITES TO SIMPLY SUCH AS THE BLACK HAWK INLET IN PRODUCTION HAS NOT BEEN DEVELOPED.

SOLUTION = ESTABLISH A PROCESS TO MANUFACTURE AN INLET COMPOSITE OF ALUMINIZED GLASS TOWERS USING A POLYUREA MATRIX.

(72) TITLE = HELICOPTER SECONDARY STRUCTURE

PROBLEM = HELICOPTER SECONDARY STRUCTURES ARE EXPENSIVE AN A FREQUENT SOURCE OF FAILURES, THE CONTINUOUS REPAIRS AND REPLACEMENTS OF THESE ITEMS IS A MAJOR FACTORY OPERATIONAL COST FACTOR.

SOLUTION = ESTABLISH A MANUFACTURING PROCESS TO INTEGRATE HIGH STRENGTH AND HIGH MODULUS FIBERS, INTO THERMOPLASTIC FOR HELICOPTER STRUCTURES.
<table>
<thead>
<tr>
<th>COMPONENT -- STRUCTURAL MEMBERS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1711</strong> TITLE -- ADV FILAMENT WINDING FOR AIRCRAFT COMPONENTS</td>
<td></td>
</tr>
<tr>
<td>PROBLEM -- CURRENT COMMERCIAL PRACTICES ON FILAMENT WINDING ARE EXPENSIVE.</td>
<td>250</td>
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<tr>
<td>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.</td>
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<tr>
<td><strong>1725</strong> TITLE -- PULTRUSION OF HONEYCOMB SANDWICH STRUCTURES</td>
<td></td>
</tr>
<tr>
<td>PROBLEM -- FABRICATION OF HONEYCOMB SANDWICH PANELS IS LABOR INTENSIVE AND FACE-THE-CUT FUNDING OFTEN TAKES THE CORE OPERATIONS. PULTRUSION CAN BE USED FOR CONTINUOUS PRODUCTION, BUT COMMERCIAL PARAMETERS AND TOOLING ARE NOT SUITABLE FOR MILITARY USE.</td>
<td>500 250 92</td>
</tr>
<tr>
<td>SOLUTION -- ESTABLISH TECHNOLOGY NECESSARY FOR PRODUCTION PULTRUSION OF SANDWICH STRUCTURES INCLUDING FRAME FOR USE IN COMPOSITE AIRFRAMES. PARAMETERS WILL BE GENERATE AND OPTIMIZED FOR PULTRUSING MILITARY QUALITY FLOORING.</td>
<td></td>
</tr>
<tr>
<td><strong>1777</strong> TITLE -- SANE FUNCH SHR OF TITANIUM</td>
<td></td>
</tr>
<tr>
<td>PROBLEM -- MANY AIRFRAME PARTS CONSIST OF MULTIPLE DETAILS RIVETED OR S/N WELDED TOGETHER THAT INCREASE THE FORMING CYCLES, TOOLING COSTS, AND LABOR. ALSO MANY PARTS CONTAIN ARE IMPASSIBLE TO FORM BY CONVENTIONAL METHODS.</td>
<td>300 250</td>
</tr>
<tr>
<td>SOLUTION -- THIS PROJECT WILL DEVELOP A SANE FUNCH METHOD OF SUPERPLASTICALLY FORMING TITANIUM ALLOYS AS A PRACTICAL, ECONOMICAL PRODUCTION METHOD.</td>
<td></td>
</tr>
<tr>
<td><strong>1774</strong> TITLE -- 3-D MATRIX CARBON-CARBON STRUCTURAL COMPONENTS</td>
<td></td>
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<tr>
<td>PROBLEM -- RECENT ADVANCES IN THE DEVELOPMENT OF LASER WEAPONS HAVE REAPPROPRIATED THE IDEAS FOR THE INTRUSION OF LASER TACTICAL WEAPONS.</td>
<td>450 300</td>
</tr>
<tr>
<td>SOLUTION -- THIS PROJECT WILL DEVELOP THE MANUFACTURING TECHNOLOGY NECESSARY FOR PRODUCTION AND REFINEMENT OF 3-D MATRIX CARBON-CARBON STRUCTURAL COMPONENTS. 3-D MATRIX CARBON IS A HIGH STRENGTH LIGHTWEIGHT INTEGRAL HIGH ENERGY LASER PROTECTIVE TAILOR SYSTEM.</td>
<td></td>
</tr>
<tr>
<td><strong>1723</strong> TITLE -- SUPERPLASTIC FORMING OF ALUMINUM COMPONENTS</td>
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<tr>
<td>PROBLEM -- CURRENT METHODS ALUMINUM FORMING ARE EXPENSIVE AND REQUIRE AN EXCESSIVE AMOUNT OF ENERGY.</td>
<td>300 400 200</td>
</tr>
<tr>
<td>SOLUTION -- ESTABLISH FABRICATION TECHNOLOGY NECESSARY TO MANUFACTURE ALUMINUM AIRFRAME COMPONENTS FROM THE FABRICATION OF SUPERPLASTIC FORMING OF ALUMINUM ALLOY SHEET MATERIAL.</td>
<td></td>
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</table>
COMPONENT -- STRUCTURAL MEMBERS

(744A) TITLE -- JOINTING OF REIN THERMOPLASTIC COMPOSITE STRUCT

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

SOLUTION -- USE LOW COST EFFECTIVE JOINING METHODS SUCH AS ULTRASONIC
SOLDER OR SHOT WELDING, DIRECT THERMAL FUSION, ETC FOR REINFORCED
THERMOPLASTIC STRUCTURAL ELEMENTS.

COMPONENT -- STRUCTURAL PANELS

(774A) TITLE -- POLYIMIDE FOAM FOR MULTIFUNCTIONAL AIRCRAFT STRUCT

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

SOLUTION -- AN AUTOMILL FOAM DISPENSING UNIT WILL BE COMBINED WITH HONEYCOMB
FOAMING AND SHAPING EQUIPMENT TO FORM CURVILE OR COMPLEX SHAPED HONEYCOMB
CORE WITH CURVED POLYIMIDE FOAM IN PLACE. MICROVAPRRTY, OR FOAM AIR WILL
BE USED FOR CURVING.

(774B) TITLE -- HAND HELD WATERTIGHT CUTTING

PROBLEM -- CONVENTIONAL METHODS OF CUTTING FLAT AND FORMED COMPOSITE AND
METAL PANELS RESULTS IN HIGH TOOL WEAR AND HIGH DUST LEVELS. WHEN
USED ON KEVLAR FABRIC IT CAUSES DYES TO SINGE RESULTING IN SECONDARY OPERATIONS.

SOLUTION -- THIS PROJECT WILL DEVELOP A HAND HELD WATERTIGHT CUTTER TO BE USED
FOR CUTTING COMPOSITES.

***************
ATTER CREEPY
***************

COMPONENT -- DISPLAYS

(777A) TITLE -- MULTI-LEGEND DISPLAY SWITCH (MLEDS)

PROBLEM -- EXPERIMENTAL VERSIONS ARE EXTENSIVE AND DIFFICULT TO MANUFACTURE
BECAUSE THE MOUNTING OF THE COMMERCIALLY AVAILABLE ELECTRONICS DISPLAY CHIP
AND SWITCHES MUST BE DONE BY HAND TO OBTAIN PROPER FREEDOM AND OPERATION
OF THE STRUCTURE.

SOLUTION -- MAKE THE WLED A MANUFACTURABLE ITEM OF THAT IT CAN BE HINT
ROUTINELY AVAILABLE FOR INCORPORATION IN AVIONIC SYSTEMS. ESTABLISH THE
MANUFACTURING TECHNIQUES TO FACTORY MOUNT, ALIGN AND FUNCTION MULTI-LEGEND
DISPLAYS AND SWITCHES.
COMPONENT -- GENERAL

(7112) TITLE - MOLDED WAVEGUIDE PARTS FOR ANTENNAS

PROBLEM - Phase array antennas are typically very expensive and heavy. Therefore, mechanically scanned antennas have often preferred for Army airborne applications. The array antenna waveguide is a prime contributor to weight and cost.

SOLUTION - By using injection molding and metalization of the composite form less expensive and lighter weight waveguides can be fabricated.

(71412) TITLE - INFRARED DETECTOR FOR LASER WARNING RECEIVER

PROBLEM - Supply of gallium arsenide etalons for use as IR detectors is limited. Methods for diffusing the detector 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 small detectors.

(7112) TITLE - COMPOSITE ELECTRO-OPTICAL SYSTEMS

PROBLEM - Mechanical rigidity, stability, overall weight, and costs are principle areas affecting the utility and affordability of sophisticated costs.

SOLUTION - A composite based EOS will be fabricated utilizing the results obtained in the SLCG program.

**CATEGORY:**

**DRIVE SYSTEM:**

**COMPONENT -- BEARINGS

(7154) TITLE - ESTABLISH MANUFACTURING METHODS FOR POWER FROM ROLLING BEARINGS

PROBLEM - Life improvements conceived on fewer processed AISI M2 steel have been observed when compared to brought consumable vacuum arc remelted (CVAR) AISI M42 steel.

SOLUTION - Develop economically viable production procedures for quality assurance of the power, plasma, and sintering and subsequent operations to manufacture finished components. The components will be pressed to near net shape.
11. TITLE: MANUFACTURING TECHNOLOGY FOR DRIVE PARTS AND COMPONENTS

PROBLEM: MANUFACTURING PROBLEMS ARISING FROM INSUFFICIENTLY DEVELOPED PRODUCTION TECHNOLOGY ARE RESPONSIBLE FOR FAILURE IN PRODUCTION BUY ITEMS.

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

12. TITLE: COST-EFFECTIVE PROCESSES FOR HELICOPTER GEAR SHAFTS

PROBLEM: DEMAND ON HELICOPTER CAPABILITY OF GREATER RELIABILITY OF HIGH PERFORMANCE GEARS AT LOWER COSTS HAS LED TO THE DEVELOPMENT OF IMPROVED PROCESSING AND EVALUATION TECHNOLOGY AT INSTITUTE.

SOLUTION: PROJECT WILL ADDRESS THE HELICOPTER MANUFACTURING PROCESS TO INTEGRATE AVAILABLE NON-DESTRUCTIVE INSPECTION PROCEDURES AND REPLACE INDIVIDUAL TOOTH GRINDING WITH A COMBINATION OF AIR POLLING AND A FINAL ROTARY TOOTH FINISHING PROCEDURE.

13. TITLE: LOW-COST METALLURGICAL GEARS FOR AIRCRAFT COMPONENTS

PROBLEM: NEW HYDROGEN-RESISTANT MATERIALS NOW AVAILABLE 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 METAL GEARS ARE FABRICATED WITH ADVANCED SURFACE PROCESSING THAT COMBINES FORGING, ROLLING, AND HARDENING TO CREATE A LOW-COST MANUFACTURING PROCESS.

14. TITLE: LOW-COST GEARS FOR TURBINE ENGINES AND AIRCRAFT GEARBOX

PROBLEM: CURRENT PRODUCTION METHODS FOR AIRCRAFT GEARS DO NOT TAKE FULL ADVANTAGE OF THE ADVANCED TECHNOLOGICAL PROCESSES AVAILABLE.

SOLUTION: DEMONSTRATE THE ECONOMY OF USING ADVANCED TECHNOLOGICAL PROCESSES SUCH AS DIGITAL PRECISION FORGING, ROLLING, AND HARDENING IN THE MANUFACTURE OF AIRCRAFT GEARS.

15. TITLE: EVALUATION OF HIGH TEMPERATURE CARBURIZING

PROBLEM: GEAR CARBURIZING IS COMMONLY CARRIED OUT WITH A RELATIVELY SLOW TRANSITION PROCESS, TYPICALLY AT 750°C, WHICH RESULTS IN SURFACE PROTECTION AGAINST LACQUERING DURING THE CYCLE AND POST-HEAT TREATMENT REQUIREMENT OF THE DECOMPOSITION LAYER.

SOLUTION: PROCESSING TIME BY INCREASING THE THERMAL CAPACITY, ALSO INVESTIGATE VACUUM CARBURIZING AS A PART OF VARIOUS GEAR CONFIGURATIONS IN ORDER TO PRODUCE A MORE UNIFORM CARBURIZING PROFILES ON HEAT TREATMENT.
Miltive Year Plan

Funding (1000s)

Prior P1 P2 P3 P4 P5

1. TITLE - Auto Laser Inspection of Spiral Bevel Gears

Problem - The control of tooth geometry in spiral bevel gears requires extensive manual inspection and checks relative to master gears. The acceptance / rejection criteria are highly subjective and impact the product's useful life.

Solution - Apply laser measurement to the surface of spiral bevel gears. This will automate the inspection techniques and provide better quality control with reduction in inspection time.

2. TITLE - Auto Inspect and Precise Grinding of Spl Gears

Problem - Current NCG methods for spiral bevel gears is labor intensive requiring contact pattern checks with expensive master mating gears. The pattern shifts with a change in temperature, as a result, the tooth form experiences great stress.

Solution - Develop an automated feed process of grinding spiral bevel gears by using a coordinate sy. Made possible by a partial non-involute tooth form.

3. TITLE - Double Helical Gear

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.

Solution - This project will establish the manufacturing process to produce the one-piece double-helical gear transmission by shaping, shaving, hardening, and honing to reduce transmission failure rates.

4. TITLE - Computer Controlled Gear Crowning

Problem - Present technology of grinding crowned spur gears is based on computer aided usage. A precise microprocessor controlled stepper motor system to correlate the movement of wheel and work table is needed for increased accuracy.

Solution - Develop a microprocessor controlled stepper motor system to perfect the gear crowning technology.
**OUTLINE -- GENERAL**

**(7.4) TITLE -- FIREWELL SHELL CLUTCH MANUFACTURING PROCESS**

**PROBLEM** -- With the high output speed of today's engines, the need exists for a cost-effective manufacturing process of high-speed overrunning clutches to be used in helicopter transmissions.

**SOLUTION** -- Develop a process to produce helical springs without the need of 'start-stop' miles, which create an imbalance and stress concentration utilizing vital machining process.

**OUTLINE -- SHAFTS**

**(7.5) TITLE -- NEW TECHNIQUE FOR TRANSMISSION SHAFT SEALS**

**PROBLEM** -- Current helicopter transmission seals are susceptible to wear and thermal degradation resulting in leakage of transmission oil and frequent seal replacement.

**SOLUTION** -- Integral molding of a nylon elastomeric segmented carbon ring seal combines the compliance of elastomeric tip seals with the wear resistance and temperature tolerance of mechanical carbon seals.

**(7.6) TITLE -- START OF ELECTRONIC NEAR MECHANICAL FOR REPAIR SHAFTS**

**PROBLEM** -- Cutting overhaul of helicopter transmissions: the percentage of part reusing for repair work is high for gears with small integral shafts.

**SOLUTION** -- Establishing the tooling and inspection procedures for electronic fan, hybrid welding of gear tool shafts/plates elements in this method the most expensive element the gear case will save by a single low cost well of a new line to the front.

**OUTLINE -- TRANSMISSION HOUSING**

**(7.7) TITLE -- INTERNALLY STIFFEN HELICOPTER TRAN CASK**

**PROBLEM** -- The low stiffness of the current flown fast magnesium alloy transmission case causes excessive noise, excessive noise and excessive vibration.

**SOLUTION** -- This project will utilize the manufacturing process for casting pile -- develop internally stiffened chaff transmission case.

**(7.8) TITLE -- STAINLESS STEEL TRANSMISSION HOUSING**

**PROBLEM** -- Helicopter transmission housings are made from magnesium casting. They are costly and have high relamping rates at overhaul due to cracks and corrosion.

**SOLUTION** -- Apply various fabrication techniques to various materials such as stainless steel to produce a light weight, non-corrosive, and less costly housing.
COMPONENT -- TRANSMISSION HOUSING

(75+4) TITLE - COMPOSITE ENGINE GEARBOX

PROBLEM - CONVENTIONAL GEAR HOUSINGS CONSISTING OF MAGNESIUM EXHIBIT LOW MODULUS, LOW FATIGUE STRENGTH, AND SUSCEPTIBILITY TO CORROSION.

SOLUTION - ESTABLISH A COST EFFECTIVE FILAMENT WINDING MANUFACTURING METHOD FOR A GRAPHITE FIBER/HIGH TEMPERATURE RESIN COMPOSITE HOUSING.

******************************
* CATEGORY *
******************************
*GENERAL *
******************************

COMPONENT -- ALL

(74+5) TITLE - CONTROLLED LEAK PRESSURE PROCESS

PROBLEM - LIGHTWEIGHT COMPOSITE STRUCTURES ARE TYPICALLY COMPOSED OF A NOMEX CORE WITH BONDED FIBER REINFORCED SKINS. THE CORE MATERIAL AND ASSOCIATED MACHINING IS COSTLY AND SHOULD BE ELIMINATED.

SOLUTION - THE CONTROLLED LEAK PRESSURE PROCESS PROVIDES A MEANS OF PRODUCING "HOLLOW" STRUCTURES WITHOUT THE USE OF A PRESSURE TAG OR CORE MATERIAL. THE ULTIMATE RESULT IS A LIGHTWEIGHT, HOLLOW CORE, INTEGRALLY STIFFENED STRUCTURE.

COMPONENT -- SAFETY

(76+1) TITLE - FOAM OF POLYPHOSPHAZENE FIRE RESIST HYDRAULIC FLUIDS

PROBLEM - CURRENT HYDRAULIC FLUIDS THAT MEET Requires 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.

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* CATEGORY *
******************************
*ROTOR SYSTEM*
17. TITLE: ELECTRONIC BALANCE SYSTEM

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

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

COMPONENT - BLADE/COMPOSITE STRUCTURES

17.01 TITLE: OPTIMAL CURVE CURVATURE FLEXIBLE FEEDER COMPO

PROBLEM - CURRENT METHODS OF CURVE CURVATURE ARE BASED ON EMPIRICAL DETERMINATION OF REQUIRED GEOMETRY CONDITIONS. A TRIAL AND ERROR PROCEDURE IS FOLLOWED UNTIL THE MANUFACTURER IS REASONABLY SATISFIED WITH MECHANICAL PROPERTIES.

SOLUTION - BY DEVELOPING AND EMPLOYING IMPROVED METHODS OF DETERMINING REQUIRED GEOMETRY CONDITIONS FOR COMPOSITES, TIME AND PRODUCTIVITY CAN BE IMPROVED IN THE MOLD.

17.02 TITLE: COMPOSITE TAIL FLEX MECH

PROBLEM - FILAMENT WINDING FROM A SOLID FLEXIBLE TO A OPEN SECTOR SECTION, WINDING TO GET SHAPE INCREASES COST AND TOLERANCE CONTROL MUST BE OBTAINED TO ENSURE THE COST EFFECTIVENESS OF FLEXIBLE TAIL ROTORS.

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

17.03 TITLE: COMPOSITE WING FLEX MECH

PROBLEM - CURRENT FLEXIBLE COMPOSITE FLEXIBLE MECHANICS HAVE NOT BEEN OPTIMIZED TOWARDS OPTIMIZING MANUFACTURING TECHNIQUES/PROCESS RELATED TO BLADE CONFIGURATIONS/SAFETY REQUIREMENTS AND IMPROVED STRUCTURAL RELIABILITY.

SOLUTION - IMPROVED METHODS WILL INCLUDE IMPROVED MATERIALS, INCREASE DL FILAMENT WINDING IMPROVED MATERIAL CONTROL PROCEDURES, BALANCED SPHERE TOOLING AND IMPROVED WINDING.

17.04 TITLE: LOW COST COMPOSITE MAIN PROPELLER FOR THE EII-14A

PROBLEM - MANUFACTURING TECHNIQUES FOR DUAL CURVED PLANE AND FOR NYLON FILAMENT WINDING INTO PROPELLER SHAPE HAS NOT BEEN EMBRACED FOR THE PRODUCTION ENVIRONMENT.

SOLUTION - DELTA FLEXIBLE WINDING TECHNIQUES AND MANUFACTURING SPECIES THROUGH SIMILAR WINDING OF NYLON FIBERS.
COMPONENT -- PLANE/COMPOSITE STRUCTURES (CONTINUE)

(724F) 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 MANUFACTURING CYCLE.

SOLUTION -- ESTABLISH AN ACoustic Emission Technique FOR PROOF TESTING COMPOSITE ROTOR BLADES.

COMPONENT -- BLADE/LEADING EDGE

(717F) TITLE -- AUTO BLADE CONTOUR INSPECTION (AIDED INSPECTION

PROBLEM -- MEASUREMENT OF THE CONTOURS OF CERTAIN HELICOPTER SURFACES ARE REQUIRED TO BE MADE WITH A HIGH DEGREE OF ACCURACY ON SURFACES WITH WIDTHS UP TO 42 INCHES AND AT A LARGE NUMBER OF POINTS. AVAILABLE SYSTEMS ARE SUSCEPTIBLE TO ERRORS.

SOLUTION -- PROVIDE A COMPUTER AIDED NONCONTACTING OPTICAL GAUGING SYSTEM TO AUTOMATICALLY INSPECT CONTOURS OF SPAN AND AIPFOILS OF HELICOPTER ROTOR BLADES. THIS METHOD WILL INCREASE ACCURACY, REDUCE TIME REQUIRED BY 1/3 AND PROVIDE REPRODUCIBLE INSPECTION.

COMPONENT -- BLADE/SPAR

(733F) TITLE -- EXTRUSION OF PRECISION HOLLOW AIRCRAFT COMPONENTS

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

SOLUTION -- CAD/CAM TECHNOLOGIES, 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.
COMPONENT -- HUB

(11.1) 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, TOOLING AND AUTOMATED
TECHNIQUES NECESSARY TO MANUFACTURE COMPOSITE ROTOR HUBS.

COMPONENT -- HINGE COMPONENTS

(11.2) TITLE -- NFG TECHNOLOGY FOR HINGE ITEMS AND ASSOCIATED COMPS

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

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

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

PROBLEM -- IMPLEMENTATION OF COMPOSITE STRUCTURES IN THE ARMY AIRCRAFT IS
DEPENDING UPON THE ABILITY TO EFFECTIVE EVALUATE EFFECTS.

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

(11.4) TITLE -- IN-PROCESS CONTROL OF RESIN MATRIX CURE

PROBLEM -- CONVENTIONAL CONTROL OF THE CURE STATE DURING COMPOSITE HARDWARE
MANUFACTURING IS ATTAINED THROUGH PARALLEL AUTOMATIC CONTROL OF THE
AUTOCLAVE PROCESS 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
CURE PROCESS BEHAVIOR TO INSURE PRODUCTION OF COMPONENTS HAVING CONSISTENTLY
HIGH QUALITY.
## Component -- Ceramic Components

### 72) TITLE -- Ceramic Turbine Stator Parts

**Problem** - Expensive alloys with exotic elements are currently required to extend the operating temperature of metallic engine components to 2000 F.  
**Solution** - Develop and demonstrate the economical operation of ceramic components for high turbine temperature application.

### 73) 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-reproducible properties and shape limitations.  
**Solution** - Silicon nitride forged 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.

### 74) TITLE -- Zirconia Shroud Productivity Scale-Up

**Problem** - The ability to produce improved performance zirconia turbine shrouds in a production environment has not been demonstrated.  
**Solution** - This project will develop a scale-up and reproducible manufacturing process for thermally sprayed zirconium oxides.

## Component -- Combustor

### 75) TITLE -- Low Cost Transpiration Coated 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 transpiration coated liners can meet the requirements but manufacturing processes are not cost effective.  
**Solution** - Define 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 certified with the low-cost concept being pursued. Joining will also be refined.

### 76) TITLE -- Ship/Sea Static Structure for Turbine Engines

**Problem** - Titanium static components of turbine engines use forgings or castings, which fit sheet stock and machine all over. This process is too costly and has poor utilization of critical material.  
**Solution** -- Adapt the sheet metal technology to the manufacture of a titanium static component of a turbine engine.
TITLE - ISOTHERMAL ROLL FORGING OF COMPRESSOR PLATES

PROBLEM - TECHNOLOGY FOR FABRICATING ADVANCED ENGINE MATERIALS INTO COMPRESSOR PLATE CONFIGURATIONS IS EITHER UNAVAILABLE OR EXCESSIVE IN COST.

SOLUTION - ISOTHERMAL ROLL FORGING IS A UNIQUE FABRICATION PROCESS CAPABLE OF PRODUCING SHAPES FREE FROM SURFACE CONTAMINATION WITH SURFACE FINISHES EQUAL TO COLD FORGING AT REDUCED COST.

TITLE - WZF OF SPRAY APPLICABLE GAI PATH SEAL SYSTEM

PROBLEM - METALLIC SYSTEMS CURRENTLY USED IN HIGH PRESSURE TURBINE SEALS EXPAND DUE TO EXOGENOUS CORROSION AND ADVERSE ENVIRONMENT 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, AND NAVY CONTRACTS, AND IS IN DEVELOPMENT OF VARIOUS CERAMIC SEAL MATERIAL SYSTEMS. MANUFACTURING PROCESS PARAMETERS WILL BE ESTABLISHED FOR PLASMA-SPRAYED ALUMINUM OXIDE SEAL COMPONENTS.

TITLE - CVD TITANIUM IMPELLER FOR TURBINE ENGINE

PROBLEM - CURRENT BOTANICAL COMPOSITION IMPELLERS ARE FABRICATED BY Machining THE EDGE AND BLADE SURFACE FROM A BLANK, THIS RESULTS IN A SUBSTANTIAL LOSS OF MATERIAL AND EXPENSIVE MACHINING OPERATIONS.

SOLUTION - ESTABLISH THE FABRICATION OF TITANIUM COMPOSITES IMPELLERS BY CASTING AND THE ELECTROCHEMICAL PROCESS. THIS METHODOLOGY WILL REDUCE FABRICATION COSTS BY A FACTOR OF THREE TO FOUR TIMES REDUCED MANUFACTURING COSTS.

TITLE - TITANIUM POWDER METAL COMPRESSED IMPELLER

PROBLEM - IMPELLER CONFIGURATIONS UTILIZED IN CONVENTIONAL IMPELLERS ARE CURRENTLY OFTEN UTILIZED IN AN EXTREMELY LIGHT AND AT TIMES UNRELIABLE MANUFACTURING COST AND FORCABLE.

SOLUTION - DEVELOP COMPRESSION PROCESS WHICH CAN MANUFACTURE IMPELLER PARTS WITH STIFFEN AND FORTIFYING ELONGATION TO THESE HIGH QUALITY TITANIUM IMPELLERS.

TITLE - RECOVERING SPRAY APPLICABLE SCAFFOLD PLATES

PROBLEM - SPRAYING COMPOD PLATES AT COOL TEMPERATURE TO THE TITANIUM COMPRESSOR PLATE DESIGN FOR THE NEAR-TERM MANUFACTURING OF TO THE TITANPLATE DESIGN FOR THE NEAR-TERM MANUFACTURING.

SOLUTION - THE SPRAY PROCESS ENABLES TO HEAT-TREATED ALLOY PATTERN OF IMPELLER EQUIPMENT, EQUAL TO THE NEAR-TERM MANUFACTURING OF THE TITANPLATE DESIGN FOR THE NEAR-TERM MANUFACTURING APPLICATION.
COMPONENT -- GENERAL

(72-3) TITLE - MFG TECHNOLOGY FOR HI-FEAMANCE ENGINES AND COMPONENTS

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

SOLUTION - DEVELOP TECHNOLOGY TO MANUFACTURE EXISTING OR ANTICIPATED
HI-FEAMANCE ENGINE AND ASSOCIATE COMPONENTS USING CURRENT OR NEW
MATERIALS.

(72-4) TITLE - COMPOSITE ENGINE PARTICLE SEPARATOR

PROBLEM - CURRENTLY, FABRICATION OF THE 1700 INLET PARTICLE SEPARATOR (IPS)
INOLVES MACHINING OF CASTINGS AND FORGING; AND THE JOINING OF THESE PARTS
BY WELDING AND BRAZING. THIS IS COSTLY IN TERMS OF BOTH MATERIAL AND LABOR.

SOLUTION - ESTABLISH A NEW PROCESS TO FABRICATE THE IPS FROM INJECTION MOLDED
THERMOPLASTIC COMPOSITE, COMBINE WITH HIGH MODULUS, HIGH STRENGTH
THERMOSETTING COMPOSITE (GRAPHITE-FOLYIMIDE). THIS WILL PROVIDE WEIGHT AND
MONETARY SAVINGS.

(72-5) TITLE - CLOSED LOOP MACHINING, MFG-FRAME

PROBLEM - THE ENGINE MFG-FRAME HAS 20 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 THERBY REDUCING
PRODUCTION COSTS.

(72-6) TITLE - MMT-DIAGNOSTIC REVIEW OF OLD CURRENT MFG PREPATION

PROBLEM - BOTH ARM MANAGEMEN AND THE ARMY HAVE EXPRESSED CONCERN REGARDING
THE CURRENT STATE OF MANUFACTURING CAPABILITY AND HAVE RECOGNIZED THE NEED
FOR UPGRADING THE SAE TO AN UP-TO-DATE LEVEL OF MFG TECH.

SOLUTION - GROUP TECHNOLOGY EFFORT TO DEVELOP A COURSE OF ACTION FOR
OBTAINING AN OPTIMUM MANUFACTURING ERPATION FOR TURBINE ENGINES.

(72-7) TITLE - TURBINE ENGINE PRODUCTIVITY IMPROVEMENT

PROBLEM - THE STRATFORD ARMY ENGINE PLANT (SEP) IS IN NEED OF MODERNIZATION.
THE PLANT AND ITSELF 50% EFFICIENT OF EQUIPMENT IS OVER 27 YEARS OLD. A
COMBINATION OF AGING MFG FACILITIES* METHODS*, PROCESSES* ETC. HAVE RESULTED
IN EXCESSIVE MFG COSTS.

SOLUTION - THE thrust of this project it to ANALYZE THE ENTIRE SAE FACILITY
WITH A FOCUS ON PRODUCTIVITY* EFFICIENCY* AND MODERNIZATION. AREAS TO
BE EVALUATED INCLUDE BOTH MFG AND BUSINESS SYSTEMS IE. MFG METHODS,
PROCESSES, EQUIPMENT, FACILITIES, AND ETC.
COMPONENT -- SEALS

4741 TITLE: SMALL ENGINE TURBINE SEAL OPTIMIZATION

PROBLEM -- EFFICIENCIES OF SMALL ENGINE TURBINE SEALS 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.

COMPONENT -- TURBINE BLADES

4751 TITLE: COATINGS FOR UPGRADING TITANE ALLOY TURBINE BLADES

PROBLEM -- THERMAL EXPANSION COEFFICIENT MISMATCH BETWEEN THE BLADE AND CERAMIC LAYER RESULTS IN THERMAL STRESS CRACKING WITH SUBSEQUENT SPALLING WITHIN THE CERAMIC OVERLAY. IN VARIOUS APPLICATIONS, THIS CAN RESULT IN LOSS OF FUNCTIONALITY.

SOLUTION -- ESTABLISH MANUFACTURING TECHNOLOGY FOR PRODUCING IMPROVED COATINGS ON NICKEL BASED SUPERALLOYS. PLASMA SINTERING TECHNIQUES WILL BE UTILIZED TO OPTIMIZE A DUAL-DENSITY CERAMIC THERMAL BARRIER COATING BY ADDING AN INTERMEDIATE LAYER ON THE BLADE.

4771 TITLE: INTEGRATED BLADE INSPECTION SYSTEM (IBIS)

PROBLEM -- INSPECTION OF TURBINE BLADES AND BLADES NECESSITATES HIGH ACCURACY. THE INSPECTION TIMES ARE CURRENTLY OCCUPIED BY THE KIT潟 MADIGAN CAST SUPERALLOYS.

SOLUTION -- THIS PROJECT WILL IMPROVE THE INTEGRATED X-RAY AND INFRARED THERMOGRAPHIC INSPECTION MODELS BY INCREASING RELIABILITY AND SENSITIVITY. ALSO, INSPECTION COSTS WILL BE REDUCED.

4775 TITLE: ADVANCED TURBINE AIRFOIL CASTING

PROBLEM -- TURBINE AIRFOILS ARE DESIGNED TO A TEMPERATURE LIMIT WHERE THEY COULD BE CONSIDERED TO BE CASTED OR MOLDED. THIS LIMIT IS SET BY THEIR INHERENT CRACK RESISTANCE LIMITATIONS.

SOLUTION -- ADVANCED CASTING TECHNIQUES WILL INCREASE FUNCTIONALLY-COMPATIBLE GRAIN ORIENTATION WITH ELIMINATE THE GRAIN MISMATCH BETWEEN THE STRESSED AND STRESS-TOPOLOGICALLY-LIMITED DIRECTION, WHICH INCREASES THE CRACK RESISTANCE.

4780 TITLE: IMPROVED CUTTER LIFE IN THE FORM OF MILLING OPERATIONS

PROBLEM -- MILLING CUTTERS THAT ARE INADEQUATE FOR THE TASK RESULT IN AFRACING EROSION FOR MILLED ZONE TO CONSIDER EXCESSIVELY MILL.

SOLUTION -- INVESTIGATE CUTTER EROSION WHICH AFFECTS CUTTER LIFE, SUCH AS MILLING CUTTERS, MILLING MACHINES, AND CUTTING HUNDRED MILLING TOOLS TO DEVELOP A MILLING CUTTER TECHNOLOGY TO REDUCE CUTTER COSTS BY 50 PERCENT.
**COMPONENT — TURBINE DISKS**

**4711) 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.

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**COMPONENT — TURBINE DISKS**

**4717) TITLE** — LOW COST DISKS BY CAP

**PROBLEM** — POWER METAL DISKS FOR 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 LIES CAN ALSO BE USED WHICH REDUCES THE COST FURTHER.

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**COMPONENT — TURBINE ROTORS**

**4791) 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.

**4797) TITLE** — FABRICATION OF INTEGRAL ROTORS BY JOINING

**PROBLEM** — CURRENT GAS TURBINE ROTORS ARE EITHER INTEGRAIIY 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 FABRICATED BLADE AND DISC 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.

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COMPONENT -- TURBINE ROTORS (CONTINUED)

(73-1) 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 SIZE 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-REFINING TECHNIQUES.

(73-2) TITLE -- COMPOSITE SHAFTING FOR TURBINE ENGINES

PROBLEM -- CURRENT MATERIAL CAPABILITIES ASSOCIATED WITH HIGH SPEED GAS TURBINE ENGINE SHAFTING REQUIRE EXCESS SMALLINGS 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 DAMPERS.

(73-3) TITLE -- CAST IMPELLER AND CLEAN CASTING

PROBLEM -- INVESTMENT CAST METAL HAB NUMEROUS SOURCES OF NON-METALLIC CONTAMINATION DURING CONVENTIONAL PROCESSING, 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 INCO 713 IMPELLERS AND OTHER CRITICAL COMPONENTS.

(73-4) TITLE -- CAST INTEGRAL LOW PRESS TURBINE ROTOR

PROBLEM -- THE CURRENT PRACTICE FOR HIGH PRESS TURBINES IS TO ATTACH CAST TURBINE PLATES TO A FORGED DISK. EXTENSIVE MACHINING OF THE AIRFOIL AND DISK DEPTAIL JOINTS IS REQUIRED.

SOLUTION -- DEVELOP THE PROCESS FOR INTEGRALLY CAST FLIKS AND PERFORM ENDURANCE TESTING.

(73-5) TITLE -- IMPROVED CAST TURBINE ROTOR

PROBLEM -- DIFFICULTIES HAVE BEEN ENCOUNTERED IN CASTING INCONEL FOR POWER TURBINE ROTORS AS THE ROTORS ARE SHAPED AND CONTAIN RELATIVELY LONG CLEANER AIRFOILS ATTACHED TO LARGE DISKS DESPITE THE UTILIZATION OF HIP AND HIP TECHNIQUES.

SOLUTION -- SELECTED ALLOYS AND MANUFACTURING WILL BE EVALUATED IN A FULL SCALE ROTOR CONFIGURATION USING IN CONEL AS A BASELINE.

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COMPONENT -- TURBINE ROTORS

(7411) TITLE -- SECOND GENERATION DUAL PROPERTY TURBINE 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 GOLDS BY THE LOWER COST CAP (CONSOLIDATION BY ATMOSPHERIC PRESSURE) TECHNIQUE. MANUFACTURE IMPINGEMENT TUBES BY CASTING THEM AS AN INTEGRAL COMPONENT.
COMMUNICATIONS & ELECTRONICS COMMAND (CECOM)
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US ARMY COMMUNICATIONS AND ELECTRONICS COMMAND
(CECOM)

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.

Video disc information storage is a possible technology for an electronic system for the dissemination of training, technical, and doctrinal data. A project will investigate methods to reduce the cost of mastering and duplicating the discs.

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.

131
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### CATEGORY -- PHOTO/OPTICAL

#### (3554) TITLE -- III-V SEMICONDUCTOR PHOTODETECTORS

**Problem** - Intrinsic and induced losses limit range of fiber optic transmission. Production means will be needed for photodetector capable of operation in spectral region intrinsically less susceptible to such losses.

**Solution** - This project will establish production techniques for formation of a quaternary III-V semiconductor photodiode with guard ring, semiautomatic attachment and mounting and automatic testing of the assembly.

### CATEGORY -- DISPLAYS

#### (3556) TITLE -- ELECTROLUMINESCENT NUMERIC MODULE

**Problem** - High contrast numeric readouts are required for sunlight legibility and full environmental operation in tactical equip. Electroluminescent modules needed to fulfill this requirement are available only as small qty, high cost, lab built samples.

**Solution** - Thin film circuitry techniques and hybrid assembly procedures will be used to achieve an efficient high yield mfg technology capable of producing reliable fully militarized numeric display devices at reasonable cost for large volume usage.

#### (3575) TITLE -- TACTICAL GRAPHICS DISPLAY PANEL

**Problem** - Fan 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.

### CATEGORY -- FREQUENCY CONTROL
COMPONENT -- CRYSTALS

(3507) TITLE -- LOW COST HIGH STABILITY CRYSTAL RESONATORS

PROBLEM -- SINCE GARS 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.

(3507) TITLE -- HIGH STABILITY VIBRATION RESISTANT QUARTZ CRYSTALS

PROBLEM -- CURRENT CRYSTAL RESONATORS SHOW FREQUENCY CHANGES WITH ACCELERATION. THIS IS A SERIOUS PROBLEM WHERE THE RESONATOR MUST OPERATE IN A VIBRATORY ENVIRONMENT. CONSEQUENCES ARE ESPECIALLY SEVERE WHEN EQUIPMENT MUST OPERATE IN A JAMMING ENVIRONMENT.

SOLUTION -- CONSIDER ROTATING QUARTZ CRYSTAL RESONATORS, PARTICULARLY THE SC-CUT, HAVE A MUCH LOWER SENSITIVITY TO MECHANICAL STRESS THAN THE COMMONLY USED (SINGLY ROTATED) AT-CUT BASED IN H-1D AND OTHER INFORMATION PRODUCTION TECHNIQUES WILL BE DEVELOPED.

(3514) TITLE -- TACTICAL MINIATURE CRYSTAL OSCILLATORS

PROBLEM -- CURRENT MINIATURE CRYSTAL OSCILLATORS DO NOT MEET THE PERFORMANCE, PRODUCTIVITY, AND COST CRITERIA NEEDED FOR PLANNED EQUIPMENT. TACTICAL MINIATURE CRYSTAL OSCILLATOR (TMO) IS HIGH PERFORMANCE BUT REQUIRES NEW PRODUCTION TECHNIQUES.

SOLUTION -- ESTABLISH QUALITY CONTROL PROCEDURES AND COST EFFECTIVE PROCESSES FOR ASSEMBLY, OUTGASING, SEALING, AND TESTING PRODUCTION TMO. ALSO, DESIGN AND FABRICATE SPECIAL FIXTURING AND TOOLING FOR IMPLEMENTING MANUFACTURING PROCESSES UNIQUE TO TMO.

COMPONENT -- OSCILLATORS

(3507) TITLE -- MICROPROCESSOR COMPENSATED CRYSTAL OSCILLATOR

-problem -- LOW POWER TEMPERATURE COMPENSATED CRYSTAL OSCILLATORS WITH STABILITY (±500x10^-7) SUITABLE FOR USE IN JAM PROOF ARMY RADIOS (SINCGARS) ARE NOT AVAILABLE IN PRODUCTION QUANTITIES.

SOLUTION -- ESTABLISH PRODUCTION CAPABILITY FOR COST EFFECTIVE, LONG LIFE, SIMPLE TECHNICAL UTILIZING MICROPROCESSOR FOR TEMPERATURE COMPENSATION.
**COMPONENT -- OSCILLATORS**

**(3012) TITLE -- 54-47 AND 54-53 GHZ Gunn Oscillator Production Process**

**PROBLEM --TECHNIQUES FOR EFFICIENT MANUFACTURE OF DEVICES TO BE USED IN FUTURE ARMY MULTICHANNEL RADIO SYSTEMS REQUIRE GOVERNMENT INVESTMENT TO ASSURE THEIR AVAILABILITY.**

**SOLUTION -- ACHIEVE SUCH MANUFACTURING TECHNOLOGY THROUGH GOVERNMENT FUNDED MANTECH EFFORT**

**CATEGORY -- GENERAL**

**SOLUTION -- MISCELLANEOUS**

**(3015) TITLE -- GRAPHICAL PART PROGRAMMING EVALUATION**

**PROBLEM -- POTENTIAL EXISTS TO EXTEND THE EXISTING COMPUTER-AIDED INTERACTIVE DESIGN SYSTEMS FOR THE CREATION OF NUMERICAL CONTROL TAPES AND THREE-DIMENSIONAL PARTS GEOMETRIES TO A BROAD RANGE OF DOD EQUIPMENT REQUIREMENTS.**

**SOLUTION -- THIS PROJECT WILL EVALUATE THE CAPABILITY OF EXISTING COMPUTER-AIDED INTERACTIVE DESIGN SYSTEMS TO PRODUCE NUMERICAL CONTROL PART PROGRAMS AND PART GEOMETRIES FOR DOD PRODUCTION REQUIREMENTS.**

**(3041) TITLE -- TOGL FOR PRODUCTION OF SFA DOCUMENTATION**

**PROBLEM -- CONVERSION OF EXISTING MAINTENANCE AND TRAINING DOCUMENTATION TO INTERACTIVE ELECTRONIC DISPLAY FORMAT REQUIRES HIGH DEGREE OF AUTOMATION TO BE PRACTICAL.**

**SOLUTION -- ACHIEVE WORKABLE SOFTWARE DEFINE AND ACQUIRE HARDWARE**

**(3042) TITLE -- MASTERING AND DUPLICATION OF VIDEO DISCS**

**PROBLEM -- THE HIGH COST OF MASTERING AND DUPLICATION OF VIDEO DISCS HAS RESTRICTED THE USE OF THE TECHNOLOGY IN HIGH PAYOFF TRAINING AND MAINTENANCE OPERATIONS.**

**SOLUTION -- THIS PROJECT WILL PROVIDE METHODS AND TECHNIQUES FOR LOW-COST MASTERING AND DUPLICATION OF VIDEO DISCS.**

**(3072) TITLE -- INTELLIGENT Terminals & PERIPHERALS FOR MILITARY COMPUTERS**

**PROBLEM -- THERE IS A NEED TO ESTABLISH A PRODUCTION CAPABILITY TO MANUFACTURE TO FORM, FIT AND FUNCTION INTELLIGENT TERMINALS AND PERIPHERALS FOR THE MILITARY COMPUTER FAMILY.**

**SOLUTION -- OBTAINING THIS CAPABILITY WILL PERMIT THE FABRICATION OF COST EFFECTIVE TERMINALS AND PERIPHERALS WITH IMPROVED FLEXIBILITY, INTEROPERABILITY, SURVIVABILITY AND REDUCED ACQUISITION TIME.**
COMPONENT -- CIRCUITRY

1301) TITLE: SPECIAL COMPONENTS MFG. TECHNIQUES FOR SINGLE CHANNEL RADIOS

PROBLEM: Many of the Coaxial Integrated Circuits needed for the Communications Equipment must be custom designed for each device. Several different circuit sets are required for each IC. Considerable engineering effort is required.

SOLUTION: Develop computer aided design and manufacturing techniques that will reduce the cost of manufacturing the integrated circuits.

1302) TITLE: VHSI - LSI CHIP SETS FOR MILITARY COMPUTER FAMILY MODULES

PROBLEM: There is a need for continuing development of integrated circuit technology in the area of LSI and VHSI chips to provide compact circuits for the computers of military computing family modules and reduce size and cost of the systems.

SOLUTION: The development of LSI and VHSI chip sets will permit major reductions in MCF system size from two boxes today down to one box in the future. It will also mean significant reductions in costs and provision of common I/O interfacing.

**C** CATEGORY

**OPTIC**

**COMPONENT -- OPTIC**

1303) TITLE: IMPROVED GLASS PROCESS FOR OPTICAL FIBERS

PROBLEM: Glass fiber impurity content contributes to transmission loss, and the preform process limits fiber length.

SOLUTION: New techniques for processing the preform that show potential for solving the problem.

**C** CATEGORY

**SOLID STATE**
COMPONENT -- DIODES/RECTIFIERS

TITLE -- INCREASE PROD OF SEMICONDUCTOR CONTROL 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 GALLOID 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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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.

A major area of interest is developing legible tactical displays which are suitable for military use. Because of operational limitations in legibility, power requirements, weight and RAM (reliability, availability and maintainability) characteristics conventional displays are unacceptable. New technologies for rugged flat panel displays which can satisfy these requirements are now in development but need improved manufacturing methods for effective production.

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 control systems and subsystems. 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).
**Command Funding Summary (Thousands)**

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### FIVE YEAR PLAN

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**COMPONENT -- ARRAYS**

**(007) TITLE -- 5-5 MICRON FE 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 CANNOT 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 COLLECTOR MODULES TO OPERATE AT 195 K. ESTABLISH AND VALIDATE PRODUCTION AND TEST METHODS FOR COMPLETED MODULES.**

**Funding: 1000 1000**

**(006) TITLE -- VACUUM DEWAR 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.**

**Funding: 800**

**(010) TITLE -- COMMON MODULE DETECTOR ARRAY**

**PROBLEM -- MERCURY-Cadmium Telluride Detector Arrays Are Now Hand Lapped and Polished. Contact Masking Is Used For Photolithography and Wet Etching For Delineation. Also, Gold Wiring Is Used For Leads. These Are Labor Intensive and Non-Uniform.**

**SOLUTION -- USE SEMICONDUCTOR INDUCTIVE PRACTICES OF BATCH MACHINE LAPING AND POLISHING OF HC-CD-TI WAFERS, PROJECTION PHOTOMASKING, PLASMA ETCHING, ION BEAM MILLING, LEAD-OUT METALLIZATION, AND FLATING. These SHOULD PROVIDE UNIFORM RESULTS.**

**Funding: 1300 753**

**(025) TITLE -- ROOM TEMPERATURE NHMW DETECTOR ARRAYS**

**PROBLEM -- EFFICIENT RADIATION COUPLING BETWEEN ANTENNAS AND DETECTORS REQUIRES EXTREME DIMENSIONAL AND INDEX OF REFRACTION TOLERANCE.**

**SOLUTION -- DEVELOP METHODS TO DEPOSIT DIELECTRIC / THIN FILM METAL WAVEGUIDE STRUCTURES WITH PREDICTABLE AND CONTROLABLE EFFECTIVE INDICES OF REFRACTION.**

**Funding: 650**

**(011) TITLE -- LIQUID PHASE EPITAXIAL HYCITE**

**PROBLEM -- LOW YIELD ON CURRENT METHOD OF MANUFACTURE OF COMMON MODULUS DETECTOR ARRAYS. GROWTH OF NHGCDT CRYSTALS REQUIRES MANUAL LAPING, POLISHING & THINNING TO ACHIEVE PERFORMANCE SPECIFICATIONS.**

**SOLUTION -- USE LIQUID PHASE EPIITAXIAL GROWTH OF THIN-FILM ON COTI SUBSTRATE ELIMINATING MANUAL STEPS.**

**Funding: 2000**
I.

COMM. 11 - MAGNETIC SUSPENSION COOLER

PROBLEM: SECOND GENERATION FLIR* WILL REQUIRE MAGNETIC SUSPENSIONS IN THE CRYOGENIC COOLERS. MAINTAINING CRITICAL SUSPENSION TOLERANCES IN PRODUCTION WILL REQUIRE DEVELOPING EXTENSIVE QUALITY CONTROL PROCEDURES.

SOLUTION: DEVELOP MANUFACTURING METHOD FOR MAINTAINING CRITICAL TOLERANCES.

(U.S. TITLE - ADVANCED MECHANICAL COOLERS FOR 2ND GEN. FLIR* )

PROBLEM: SECOND GEN. FLIR'S ARE NEW AND VERY SUSCEPTIBLE TO VIBRATIONS AND THERMAL FLUCTUATIONS IN A CARRIER DEGREE THAN CONVENTIONAL FIRST GEN. SYSTEMS.

SOLUTION: DEVELOP MANUFACTURING TECHNOLOGIES FOR REDUCING THERMAL FLUCTUATIONS AND VIBRATIONS.

(U.S. TITLE - 1.2 MICRON CHARGE COUPLED DEVICE )

SOLUTION: NEW PROJECT NO PROBLEM FURNISHED

(U.S. TITLE - SOLID STATE PYROELECTRIC ACHE)

PROBLEM: LOW YIELD OF PYROELECTRIC MATERIAL SUITABLE FOR RETINA, LOW YIELD OF INTERCONNECT PATH PYROELECTRIC MATERIAL TO THE CCD.

SOLUTION: DEVELOP TECHNIQUES FOR THE PRODUCTION OF LARGE AMOUNTS OF PYROELECTRIC MATERIAL, DEVELOP INTERCONNECT TECHNIQUES FOR THE PRODUCTION OF PYROELECTRIC RETINA.

(U.S. TITLE - INFRARED ELECTRIC COOLER MATERIAL )

PROBLEM: INFRARED-ELECTRIC MATERIALS REQUIRED FOR 2 GEN. FLIP TO COOLERS ARE AVAILABLE ONLY IN RESEARCH QUANTITIES & QUALITIES. TRANSITION FROM RESEARCH TO PRODUCTION WILL INFRINGE VARIOUS QUALIFICATION FACTORS.

SOLUTION: ESTABLISH PRE-PRODUCTION METHODS & TECHNIQUES FOR HIGH QUALITY CONTROL NECESSARY TO MEET SECOND GENERATION FLIP DEPENDS.

(U.S. TITLE - THIRD GENERATION LOW COST COOLER TUBE)

SOLUTION: TYPICAL MANUFACTURING METHODS REQUIRE THE USE OF AN EXCESSIVE AMOUNT OF HAND LABOR WHICH CONTRIBUTES TO HIGH UNIT COSTS FOR MANUFACTURED TUBE.

SOLUTION: ESTABLISH THE COST-EFFECTIVE METHOD FOR PRODUCING A LOW COST 3RD GENERATION IMAGE INTENSIFIER TUBE. THE METHOD WILL BE PROVED BY PRODUCING A SAMPLE TUBE LOT.

FUNDING (1000)

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350
850
2000
3000
150

202  714
COMPONENT -- LASER

TITLE -- TITLE 1 TO 3 MICRON AVALANCHE DETECTORS

PROBLEM -- MANUF. COSTS, VOLUME PROD. TECHNIQUES AND RELIABILITY MUST BE
ADDRESSED.

SOLUTION -- ESTABLISH MANUFACTURING CAPABILITY FOR VOLUME PRODUCTION OF
RELIABLE, LOW COST 1-3 MICRON AVALANCHE DETECTORS.

COMPONENT -- PHOT/OPTICAL

TITLE -- UNIVERSAL INTEGRATED OPTICAL MODULE

PROBLEM -- PRESENT INTEGRATED OPTICAL DEVICES ARE COMPOSED OF SEPARATE LIGHT
SOURCE, PROCESSOR AND DETECTOR. IT IS POSSIBLE TO COMBINE THESE COMPONENTS
ON A SINGLE CHIP. FABRICATION METHOIDS AND RELIABILITY MUST BE IMPROVED.

SOLUTION -- DEVEL. FABR. METHODS FOR OPTIMUM INTERFACE OF LIGHT SOURCE AND
DETECTOR WITH ACOUSTO-OPTIC DEVICES.

******

# COMPONENT -- CRT

TITLE -- HIGH CONTRAST CATHODE RAY TUBE

PROBLEM -- HIGH CONTRAST CRT AVIONIC 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.

SOLUTION -- USE OF OPTIMIZED BILAYER TRANSFERABLE PHOSPHORS WITH A BLACK
AGGREGATE LAYER PROVIDES THE HIGH CONTRAST DISPLAY FOR THE SEVERAL MODES.
OPTIMIZATION OF PHOSPHOR TECHNIQUES FOR 5 IN AND LARGER CRTS WILL BE
ECONOMICALLY JUSTIFIED.

TITLE -- TACTICAL COLOR CATHODE RAY TUBE

PROBLEM -- PRESENTATION OF HIGH DENSITY INFORMATION UNDER TACTICAL CONDITIONS
REQUIRES CODING THAT CAN BE PRESENTED BY COLOR. AVAILABLE COLOR CRTS CANNOT
SURVIVE TACTICAL CONDITIONS WITHOUT EXPENSIVE AND MARGINAL EFFECTIVE
MODIFICATIONS.

SOLUTION -- CRT DISPLAYS CAN BE DESIGNED TO OPERATE UNDER THE VIBRATION,
TEMPERATURE AND MAGNETIC ENVIRONMENT OF THE TACTICAL BATTLEFIELD IF THE
TOTAL SYSTEM IS DESIGNED FOR THESE CONDITIONS. ECONOMICAL FABRICATION
PROCESSES FOR SUCH DISPLAYS MUST BE DEVELOPED.
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<td>MULTICOLOR DISPLAY WHICH IS CAPABLE OF GRAPHICS AND IS LEGIBLE IN DIRECT</td>
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<tr>
<td>DISPLAYS CAN BE MANUFACTURED IN LARGE QUANTITIES AT A PRICE WHICH WILL MAKE</td>
<td></td>
</tr>
<tr>
<td>THEIR FEASIBLE FOR TACTICAL USE WHERE THEY ARE FAINTLY NEEDED.</td>
<td></td>
</tr>
<tr>
<td>(SCN-3) TITLE -- MINIATURE FLAT PANEL 525-LINE DISPLAY</td>
<td></td>
</tr>
<tr>
<td>PROBLEM -- SHARING OF THE RESOLUTION OF THIS DISPLAY OVER THE 525-LINE</td>
<td></td>
</tr>
<tr>
<td>DISPLAY WILL REQUIRE THE HIGH-RESOLUTION ELECTRON LITHOGRAPHY OR X-RAY</td>
<td></td>
</tr>
<tr>
<td>LITHOGRAPHY IN ORDER TO PRODUCE THEM WITH GOOD YIELD.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION -- DEVELOP PRODUCTION TECHNIQUES INCLUDING ELECTRON BEAM LITHOGRAPHY OR</td>
<td></td>
</tr>
<tr>
<td>X-RAY LITHOGRAPHY FOR FLAT PANEL DISPLAYS.</td>
<td></td>
</tr>
<tr>
<td>(SCN-4) TITLE -- INTEGRATED 675-LINE LIQUID CRYSTAL DISPLAY CHIP</td>
<td></td>
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<tr>
<td>PROBLEM -- THE FABRICATION OF LIQUID CRYSTAL-SILICON DISPLAY CHIPS WITH AN</td>
<td></td>
</tr>
<tr>
<td>ARRIVAL FORMAT AND INTEGRATED CIVIL ELECTRONICS REPRESENTS A TREMENDOUS</td>
<td></td>
</tr>
<tr>
<td>NUMBER OF ELEMENTS FOR CHIP AND SIGNIFICANT YIELD PROBLEMS</td>
<td></td>
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<tr>
<td>SOLUTION -- IMPROVE AND AUTOMATE CONTROL OF MULTI-STEP PROCESS FOR FABRICATING</td>
<td></td>
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<tr>
<td>THE DISPLAY CHIPS AND ESTABLISH CAPABILITY FOR LARGER WAFERS WITH MORE CHIPS</td>
<td></td>
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<tr>
<td>PER WAFER.</td>
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<tr>
<td>COMPONENT</td>
<td>PLAN</td>
</tr>
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</tr>
<tr>
<td>(501.1) TITLE - FOCUS GRID CONVERGENT ELECTRON GUN</td>
<td></td>
</tr>
<tr>
<td>PROBLEM - PRESENT TECHNOLOGY CAN NOT BE USED TO BUILD GRIDED MILLIMETER WAVE TUBES. MUST USE HIGH VOLTAGE MULCATOR FOR PULSED OPERATION.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION - THE PROCESSES OF CHEMICAL VAPOR DEPOSITION OF BORON NITRIDE, GRID FABRICATION AND MOUNTING OF GLASS TO THE CADMUM BY LOW COST PRODUCTION TECHNIQUES WILL BE DEVELOPED.</td>
<td></td>
</tr>
<tr>
<td>(501.9) TITLE - LASER-CUT SUBSTRATES FOR MM TUBES</td>
<td></td>
</tr>
<tr>
<td>PROBLEM - PRESENT CFA JAMMER TUBES EMPLOY HIGH COST, PRECISION ANODE CIRCUITS LIMITING UTILIZATION IN OPTIMIZED FM SYSTEM. HIGH PERFORMANCE AND LOW WEIGHT AT MINIMUM COST IS REQUIRED IN FIELD DESIRED FM SYSTEM.</td>
<td></td>
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<tr>
<td>SOLUTION - UTILIZE LASER-CUT ANODE CIRCUIT SUBSTRATES TO ACHIEVE DESIRED RF PERFORMANCE AND MINIMIZE PARTS AND OVERALL DEVICE COST. ALSO EMPLOY PHOTOGRAPHIC TECHNIQUES TO F عمر PEANDERLINE CIRCUIT. USE PERYLICA SUBSTRATE MATERIAL FOR DIELECTRIC SUPPORT.</td>
<td></td>
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<tr>
<td>(504.9) TITLE - FOR-FERRULE CAVITIES FOR MM WAVE AMPLIFIER TUBES</td>
<td></td>
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<tr>
<td>PROBLEM - MILLIMETER WAVES REQUIRE LIGHT WEIGHT LOW COST TRANSMITTER TUBES TO PROVIDE SYSTEM TO PENETRATE SMOKE AND FOG. PRESENT HAND MACHINING IS EXPENSIVE AND POOR TOLERANCE CONTROL AT MM DIMENSIONS RESULT IN HIGH COST TRANSMITTER TUBES EVEN IN LARGE CRY.</td>
<td></td>
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<tr>
<td>SOLUTION - COMPUTER CONTROLLED ZERO PLAN COINING AND LAPPING METHODS WOULD ELIMINATE COSTLY HAND FACH AND HAND STACKING OF CAVITIES SUITABLE FOR MILLIMETER WAVE TUBES. ADAPTING PRESENT TECH AND ASSEMBLY PROC TO ACHIEVE HIGH YIELD WILL PROVIDE A LOW COST TUBE.</td>
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<tr>
<td>(601.1) TITLE - HIGH-WATTAGE LOW-COST JAMMER PACKAGE</td>
<td></td>
</tr>
<tr>
<td>PROBLEM - MANUAL ASSEMBLY OF LARGE NUMBER OF PIECE PARTS MAKES TUBES INELIGIBLE. A LARGE AMOUNT OF HIGHLY SKILLED WORK IS REQUIRED TO PERFORM - TIME CONSUMING TESTS.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION - USE AUTOMATIC CONTROL FOR TEMPERATURE AND VACUUM PROCESSING, DEPOSITION OF HELIX CIRCUIT ON SUPPORT RODS, AND DEPOSITION OF ATTENUATOR ELEMENT ON SUPPORT RODS. USE AUTOMATIC TESTING.</td>
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- The channel MCP's prevent ion feedback to the photocathodes. Ideally, this would eliminate the need for an ion barrier film. Curved channel MCPs are needed to match with crucial and expensive ion techniques. Low cost, high yield methods are needed for manufacturing. |
2.4.4 Ca- U 4.0

31.1.1 TITLE - VAPOR-ORGANO-METALLIC EPITAXIAL GROWTH PROCESS

PROBLEM - LIQUID EPITAXIAL GROWTH PROCESS REQUIRES A LARGE AND COSTLY HIGH TEMPERATURE MELT REACTOR, LARGE QUANTITIES OF SATURATION MELT MATERIALS, AND COSTLY HIGH QUALITY CALCIUM ARSENIDE SUBSTRATES, DELAYING OPERATION PROCESS PER SINGLE GROWTH.

SOLUTION - THE VAPOR-ORGANO-METALLIC PROCESS WILL ENABLE MINIMUM FACILITATION REQUIREMENTS, USE OF CONTROLLER BASES REQUIREING NO MELT MATERIALS, POSSIBLE USE OF LESS EXPENSIVE SUBSTRATES, AND MULTICRISTAL GROWTH ORIENTED PROCESS.

51.7 TITLE - FIELD EMISSION ELECTRON GUNS

PROBLEM - TECHNOLOGY TO BUILD HIGH CURRENT DENSITY LOW VOLTAGE MODULATION ELECTRON GUNS FOR HIGH POWER SUBMILLIMETER WAVE TUNES IS NOT AVAILABLE.

SOLUTION - DEVELOP TECHNIQUES FOR MANUFACTURING HIGH CURRENT DENSITY LOW VOLTAGE ELECTRON GUNS FOR SUBMILLIMETER ELECTRON GUNS CAPABLE OF OPERATING FOR HUNDREDS OF HOURS.

51.77 TITLE - REDUCED LOW FEEDBACK MICROCHANNEL PLATES

PROBLEM - EXTEND TUBE LIFE BY LOWERING CATHODE VOLTAGE AND SIMPLIFYING VACUUM PREPARING AND FABRICATION TECHNIQUES.

SOLUTION - LEVEL-6 TECHNIQUES TO PRODUCE THIS TYPICALLY MICROCHANNEL PLATE WITH INCREASED TUBE YIELD.

51.1 TITLE - CCD IMAGER FOR 1-7 MICRON WAVELENGTH REGION

PROBLEM - CURRENT TECHNIQUES FOR PRODUCTION ARE COSTLY.

SOLUTION - DEVELOP PRODUCTION TECHNOLOGIES TO FABRICATE THESE DEVICES IN A COST-EFFECTIVE MANNER.

51.2 TITLE - CRYSTAL RELIABILITY ENHANCED PURPOSE CRYSTALS

PROBLEM - CRYSTALS USED IN HIGH RELIABILITY TACTICAL FACILITIES HAVE A HIGH FAILURE RATE DUE TO FREQUENCY VARIATIONS WITH TIME, TEMPERATURE, SHOCK, AND VIBRATION. LEAKS INTO THE ENCLOSED ARE A MAJOR PROBLEM.

SOLUTION - PREVENTION ENGINEERING WILL CLOSELY CONTROL CRYSTAL PLATE GEOMETRY, ORIENTATION, MOUNTING, HERMETIC SEALING, AND TESTING OF AT-CUT CRYSTALS.
### COMPONENT -- CRYSTALS

(5049) **TITLE** - FABRIC OF OVERTONE MINIATURIZED PRECISION CRYSTALS

**PROBLEM** - MINIATURIZED PRECISION QUARTZ CRYSTALS IN MICROCIRCUIT PACKAGES ARE FRAGILE AND DIFFICULT TO FABRICATE.

**SOLUTION** - IMPROVE PRODUCTION TECHNIQUES FOR MINIATURIZED OVERTONE QUARTZ CRYSTALS THROUGH BETTER POLISHING, HANDLING, MOUNTING/BONDING AND PACKAGING TECHNIQUES.

(5134) **TITLE** - HIGH PURITY LOW DISLOCATION QUARTZ

**PROBLEM** - COMMERCIAL QUARTZ CRYSTALS ARE UNSUITABLE FOR RESONATORS TO BE USED IN SPECTRUM SYSTEMS. THIS IS ESPECIALLY TRUE IN RADIATION ENVIRONMENTS.

**SOLUTION** - ESTABLISH CAPABILITY FOR MANUFACTURING HIGH PURITY AND LOW DISLOCATION DENSITY QUARTZ.

### COMPONENT -- OSCILLATORS

(5575) **TITLE** - MICROPOWER TIME OF DAY SOURCE

**PROBLEM** - MICROPOWER PRECISION TIME OF DAY SOURCE DEVICES ARE NOT AVAILABLE.

**SOLUTION** - ESTABLISH PRODUCTION CAPABILITY FOR A MICROPOWER PRECISION TIME BASE REFERENCE OSCILLATOR TO BE USED IN ECM COMMUNICATION RADIO SETS.

(5115) **TITLE** - STANDARD FREQUENCY/TIME MODULES

**PROBLEM** - USER ELEMENTS IN MOST WARTIME C3 AND POS/NAV SYSTEMS REQUIRE PRECISION CLOCKS THAT MUST BE SYNCHRONIZED AT MISSION START TO MASTER TIMING UNITS. SYSTEM SPECIFIC MODULES 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.

| CATEGORY | | | | |
|------------------|------------------|------------------|------------------|------------------|------------------|
| | | | | |
| | | | | |
**TITLE:** MILLIMETER WAVE FILTER SOURCE COMBINER

**PROBLEM:** FILTER PARAMETERS VARY GREATLY FROM UNIT TO UNIT. PACKAGING METHODS ARE DASIRFACTORY FOR COMBINER CIRCUITS. TUNING COMBINER ELEMENTS AND ADJUSTING ASSOCIATED MODULATING CIRCUITS TAKES WEEKS OF EFFORT TO OBTAIN REQUIRED PERFORMANCE LEVELS.

**SOLUTION:** OPTIMIZE FABRICATION PROCESSES AND ESTABLISH TECHNIQUES OF CIRCUIT AND PACKAGE FABRICATION RESULTING IN HIGH YIELDS OF PERFORMING COMBINER USABLE DEVICES. OPTIMIZE COMBINER CIRCUITS AND MODULATIONS FOR HIGH PERFORMANCE AND UNCOMPLICATED TUNING.

**TITLE:** INTRINSICALLY TEMPERATURE-COMPENSATED MAGNETS

**PROBLEM:** PRESENT MAGNETS HAVE TOO HIGH A TEMPERATURE COEFFICIENT OF REVERSIBLE MAGNETIZATION FOR USE IN ACCELEROMETERS/GYROSCEPIES NEEDED IN THE SATELLITE. ALL-MAGNETIC SYSTEMS AND IN SOME NEW MILLIMETER WAVE TRAVELING WAVE TUNES ARE BEING DEVELOPED.

**SOLUTION:** DEVELOP MANUFACTURING CAPABILITY FOR NEW MEDIUM-FOURTEEN-LISTED MAGNETS WITH GADOLINUM, DysPROSium OR LITHIUM AND TRANSITION METAL SUBSTITUTENTS WHICH YIELD ZERO TEMPERATURE COEFFICIENT MATERIALS WITH HIGH ENERGY PRODUCTS.

**TITLE:** FERROELECTRIC DEVICES FOR MILLIMETER FREQUENCY APPLICATIONS

**PROBLEM:** FERROELECTRIC DEVICES FOR 50 TO 140 GHz FREQUENCIES ARE DIFFICULT TO MANUFACTURE AND ARE LIMITED IN THEIR PERFORMANCE TO REPRODUCIBLE, HIGH PERFORMANCE CHARACTERISTICS ARE DIFFICULT TO ACHIEVE DUE TO SMALL SIZE CONFINEMENT AT THESE FREQUENCIES.

**SOLUTION:** USING NEW DESIGN AND FABRICATION PROCEDURES, RELIABLE FERROELECTRIC PHASE SHIFTERS FOR PHASE ARRAY ANTENAS AND CIRCULATORS WILL BE PRODUCED.

**TITLE:** HYBRID MICROCIRCUIT

**PROBLEM:** WAVECHIP fabrication techniques offer LOW COST ASSEMBLY AND ENVIRONMENTAL PROTECTION OF INTEGRATED CIRCUIT CIRCUITS ON HYBRID WAVECHIPS. LIFETIME TREATMENT OF DISCHARGE TRANSITON AND DIBL CHEM IS NOT ECONOMICALLY VACEABLE.

**SOLUTION:** ESTABLISH PRODUCTION TECHNIQUES FOR SEALING AND HANDLING DISCHARGE TRANSITON TRANSISTOR CIRCUITS INTEGRATED CIRCUITS INCLUDING TESTING AND FLOWING OF CHIPS TO HYBRID WAVECHIP.
COMPOUND -- CIRCUITRY

(5574) TITLE - LOW COST HYBRID MICROCIRCUIT MODULES

PROBLEM - HYBRID MICROCIRCUITS WITH MANY LS1, VS2I AND VHSC CHIPS ON A THICK FILM INTERCONNECT LARGE AREA SUBSTRATES REQUIRE NEW INTERCONNECTION AND SEALING CONCEPTS FOR HIGH-SPEED PROCESSING.

SOLUTION - ESTABLISH LOW COST MANUFACTURING PROCESSES FOR LARGE AREA HYBRID MICROCIRCUITS IN MODULAR FORM, REPLACING FC POARCES AND WHICH INCLUDE INTERCONNECT SEALING AND PACKAGING SCHEMES FOR MICROWAVE HIGH-SPEED AND CONVENTIONAL SIGNAL PROCESSING.

(5605) TITLE - CHEMICAL DEVICES SILICON PROCESSORS

PROBLEM - EXTENSIVE ENGINEERING IS REQUIRED TO INTEGRATE ANY CCD PROCESSING DEVICE INTO A SYSTEM. ALL INTERFACE CIRCUITRY MUST BE ESPECIALLY DESIGNED AND ASSEMBLED. THERE ALSO EXISTS A LIMTED SELECTION OF COMMERCIAL CCD DEVICES.

SOLUTION - ESTABLISH PRODUCTION TECHNIQUES FOR DESIGN AND FABRICATION OF INTEGRATED CIRCUITS CONTAINING IN ONE CHIP CCD DEVICES, ANALOG CIRCUITRY, AND DIGITAL CIRCUITRY TO PERFORM ALL UNIQUE INTERFACE FUNCTIONS.

(5645) TITLE - HIGH SPEED DIGITAL HYBRID MICROCIRCUITS

PROBLEM - HIGH SPEED DIGITAL ICS, PAIR, VHSC ARE LEADING TO USE OF DIGITAL TECHNIQUES FOR FRONT END USE IN DIRECT SIGNAL PROCESSING REQUIRE MANY INTERCONNECTIONS BETWEEN ARRAYS OF HIGH SPEED DIGITAL ICS AND HIGH FREQUENCY TRANSMITION TECHNIQUES.

SOLUTION - ESTABLISH MANUFACTURING PROCESSES AND FACILITIES FOR FULLY MANUFACTURABLE TECHNIQUES WHICH ARE CAPABLE OF PROVIDING THE REQUIRED HIGH FREQUENCY TRANSMITION.

(5744) TITLE - MONOLITHIC X-HAND TRANSMITTER/RECEIVER

PROBLEM - REDUCE TO PRODUCTION ENVIRONMENT RESULTS OF PRIOR R&D TO DEVELOP COMPLETE MICROWAVE TRANSMITTER AND RECEIVER ON A CHIP OF GALIUM ARSENIDE. TIGHT CONTROL OF LITHOGRAPHIC, THERMAL, AND MATERIALS PROCESSES TO 2 PCT. OR BETTER REDUX FOR COST/YIELD GOAL.

SOLUTION - USE OF HIGH VOLUME AUTOMATIZED PROCESSES TO PRODUCE HIGH VOLUME AUTOMATION CIRCUITS ON ZINC-QUALIUM-ARSENIC WAFERS. AUTOMATE TESTING AND ESTABLISH PACKAGING TECHNIQUES APPROPRIATE TO VOLUME PRODUCTION. COST AND YIELD GOALS TO 10% BETTER THAN NOW POSSIBLE.

(5745) TITLE - OPTIC DISPLAY EXPANDERS

PROBLEM - NO PROBLEM GIVEN

SOLUTION - NO SOLUTION GIVEN
<table>
<thead>
<tr>
<th>Component -- Circuits (Continued)</th>
<th>Funding ($000)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Circuit -- Data and Communications Synthesizer</strong></td>
<td>700</td>
</tr>
<tr>
<td>Problem -- Frequency synthesizers are an essential component of virtually all military and data link equipment; present synthesizers are too costly, large, and require excessive power for battery operation.</td>
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<tr>
<td>Solution -- Develop a set of circuits which can be configured to satisfy a wide variety of requirements. The circuits will be fabricated using an advanced low power technology and used in large quantities to assure low costs.</td>
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<tr>
<td><strong>Circuit -- Array Lithographic Production Techniques for VHSIC</strong></td>
<td>600</td>
</tr>
<tr>
<td>Problem -- VHSIC and LCD programs will develop process for submicron high speed signal processors. Poor yield and lack of production type equipment result in very high cost and low reliability.</td>
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<tr>
<td>Solution -- Develop equipment and processes to implement VHSICs in the production line. Institute process controls to improve yield. Develop screening and production techniques to enhance reliability.</td>
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<tr>
<td><strong>Circuit -- Low Cost Sapphire Substrates for CMOS Circuits</strong></td>
<td>700</td>
</tr>
<tr>
<td>Problem -- Sapphire substrates made from sapphire wafers are costly and in limited supply due to substrate price. Operations are low production capability. SOD ICs are needed for high speed low power use but cannot be made in quantity without low cost substrates.</td>
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<tr>
<td>Solution -- Develop production method (low cost high throughput) for substrates made from sapphire.</td>
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<tr>
<td><strong>Circuit -- Optimized Substrates for Hybrid Microcircuits</strong></td>
<td>750</td>
</tr>
<tr>
<td>Problem -- Evolving high density hybrid, high speed hybrids, and high power hybrids present greater requirements for substrate dimensional stability, thermal conductivity, electrical performance, producibility and cost.</td>
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<tr>
<td>Solution -- Optimize two major forms of substrate: insulating metal and organic. Establish high productivity, yield and performance parameters. Identify optimum metal substrate, passive insulation and optimum reinforcing fillers and metal platings.</td>
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<tr>
<td><strong>Circuit -- High Reliability VHSIC Process</strong></td>
<td>700</td>
</tr>
<tr>
<td>Problem -- Submicron VHSIC for high speed signal processors are subject to early failure due to excessive electrical stresses on the circuitry. Failures result in low yield and high cost.</td>
<td></td>
</tr>
<tr>
<td>Solution -- Develop production processes for high quality VHSIC processes to sustain high yield, full wafer, develop alternate device fabrication techniques to reduce process induced degradation in device performance.</td>
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</tbody>
</table>
COMPONENT -- CIRCUITRY

(5125) TITLE -- VLSIC 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 CAN NOT 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

(995) TITLE -- LOW COST MONOLITHIC GALLIUM ARSENIDE MW INTEGRATED CIRCUITS

PROBLEM -- SIZE WEIGHT 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 BATCH FABRICATION OF GALLIUM ARSENIDE MONOLITHIC CIRCUIT DRAWING ON HARP R&D AND MMT EFFORTS IN E-Beam, ION IMPLANT, AND VAPOR EPI TO FULLY AUTOMATE PRODUCTION OF AMPLIFIER AND RECEIVER FUNCTIONS.

(5949) TITLE -- PRODUCTION TECHNIQUES FOR SI MW PWR TRANSISTORS

PROBLEM -- AS THE CONCENTRATION OF INTEGRATED CIRCUITS INCREASES THE HEAT DEPTH IS REACHING THE POINT WHERE IT WILL DESTROY THE SEMICONDUCTOR DEVICES.

SOLUTION -- REPLACE THE PRESENT PACKAGING DEVICES WITH UNITS HAVING A LARGE PERCENTAGE OF DIAMOND MATERIAL SO AS TO ACHIEVE A GREATER THERMAL TRANSMISSION.

COMPONENT -- MEMORY

(4919) TITLE -- TAB LEAD BONDING MANUFACTURING INSPECTION

PROBLEM -- PRESENT METHODS USED TO EVALUATE AND CERTIFY WIRE BONDING IN MICROELECTRONICS ARE NOT READILY APPLIED TO TAB AUTOMATED BONDING (TAB). MILITARY SPECIFICATION METHODS DO NOT ADDRESS CONFIGURATIONS USED IN TAB AND WOULD MINIMIZE MANY OF THE TAB ADVANTAGES.

SOLUTION -- AN INSPECT/VERIFY SYS FOR TAB WHICH INCORPORATES CCTV PATTERN RECOGNITION TO VERIFY BEAM POSITION AND SENSORS TO DETERMINE BEAM HEIGHT. APPLY A SCANNING LASER ACOUSTIC MICROSCOPE IN A NON-DESTRUCTIVE ANALYSIS AND EVALUATION OF THE TOTAL STRUCTURE.

FUNDING ($000)

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COMPONENT -- MILITARY MEMORIES

(Continued)

(41.4) TITLE: COST EFFECTIVE MILITARY MEMORIES

PROBLEM - MILITARY ENVIRONMENTAL CONSTRAINTS CAUSE LOW SCREENING YIELDS AND HIGH COSTS IN HIGH DENSITY MILITARY MEMORY CHIPS, FORCING INCREASED USE OF NON-MILITARIZED PARTS WITH INHERENT RISKS FOR SYSTEMS RELIABILITY.

SOLUTION - YIELD IN MILITARY MEMORY PRODUCTION WILL BE IMPROVED SIGNIFICANTLY BY DESIGNING REDUNDANCY INTO CIRCUITRY AND INTERCONNECTING WORKING SECTIONS AFTER TEST. PROGRAM WILL DEVELOP TECHNIQUES FOR ADAPTIVE DESIGN AND CONNECTING OF REDUNDANT SUBSYSTEMS.

**Laser**

COMPONENT -- GENERAL

(50.1) TITLE: 10.6 MICRON CO2 LASERS

PROBLEM - LASERS CONSTRUCTED IN UNIT QUANTITIES ARE EXPENSIVE AND VARY IN SPECIFICATIONS. PRESENT RANGE FINDER LASERS HAVE REDUCED ALL WEATHER CAPABILITIES AND ARE INEFFECTIVE AGAINST COUNTERMEASURE SMOKE.

SOLUTION - ESTABLISH LARGE SCALE PRODUCTION OF LASER COMPONENTS INCLUDING MIRRORS, ELECTRODES, AND LASER ENVELOPS TO REDUCE COSTS, DEVELOP UNITS THAT ARE RESISTANT TO THE SHOCK AND VIBRATION OF A TANK ENVIRONMENT.

(51.1) TITLE: 16-MICRON PULSED WAVEGUIDE LASER

PROBLEM - PRESENTLY FUSED WAVEGUIDE CARBON DIOXIDE LASERS FOR USE AS SOURCES FOR MISSILE BOMBLANDERS AND BEACONS ARE FABRICATED IN SMALL QUANTITIES BY HIGHLY SKILLED PERSONS, ELECTRODES, MIRRORS, AND STEEL CAVITY HOUSING REQUIRED. PRECISE FABRICATION AND ASSEMBLY ARE REQUIRED.

SOLUTION - ESTABLISH LARGE SCALE PRODUCTION OF LASER COMPONENTS INCLUDING MIRRORS, ELECTRODES, AND LASER ENVELOPS TO REDUCE COSTS, DEVELOP UNITS THAT ARE RESISTANT TO THE SHOCK AND VIBRATION OF A TANK ENVIRONMENT.

(51.2) TITLE: 16 WATT COHERENT CO2 LASER SOURCE

PROBLEM - PRESENT METHODS FOR BUILDING LASER SOURCES ARE LARGE HAND METHODS USED ON SMALL QUANTITIES OF COMPONENTS.

SOLUTION - DEVELOP MANUFACTURING TECHNIQUES FOR A 16 WATT LASER WITH A HIGH DEGREE OF SHORT TERM STABILITY FOR COHERENT DETECTION APPLICATIONS, INCLUDING IN RADAR.
COMPONENT -- GENERAL

(5.1.5) TITLE: FAR INFRARED LASER JAMMER SOURCE

PROBLEM: MOST LASER SOURCES MUST BE USED FOR OPTICAL COUNTERMEASURES AGAINST THERMAL IMAGES AND OTHER FIR DEVICES.

SOLUTION: DEVELOP COST-EFFECTIVE PRODUCTION TECHNIQUES.

(5.1.7) TITLE: HIGH POWER TUNABLE LONG WAVELENGTH INJECTION LASER

PROBLEM: FEW PRODUCTION METHODS HAVE BEEN DEVELOPED FOR HIGH POWER INJECTION LASERS.

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.

COMPONENT -- MATERIALS

(5.1.9) TITLE: QUATERNARY INJECTION LASERS

PROBLEM: NO VOLUME PRODUCTION METHODS EXIST FOR PRODUCING TRAINING LASERS.

SOLUTION: DEVELOP PRODUCTION CAPABILITY FOR INJECTION LASERS FROM VAPOR PHASE EPITAXIAL FABRICATION METHOD FOR USE IN FIBER-OPTIC COMMUNICATION DEVICES AND EYE-SAFT TRAINING SYSTEMS.

COMPONENT -- MODULUS

(5.1.10) TITLE: MINI LASER TRANSMITTER MODULUS

PROBLEM: PRESENT LASER TRANSMITTER MODULUS FOR MINI LASER SYSTEMS MUST BE ASSEMBLED IN A LAB ENVIRONMENT FROM MANY DISCRETE COMPONENTS AND ARE NOT DESIGNED FOR PRODUCTION.

SOLUTION: DEVELOP PRODUCTION METHODS FOR MANUFACTURE AND ASSEMBLY OF MINIATURE COMPONENTS USING RF NETWORKS. COMBINED METAL LASER DIODE MODULUS WITH OTHER MOD TECHNIQUES TO FABRICATE AND ASSEMBLE IN A PRODUCTION ENVIRONMENT.

COMPONENT -- Nd:YAG

(5.1.13) TITLE: CONSTANT COMPOSITION GROWTH OF NEODINUM FOULDS

PROBLEM: HIGH QUALITY NEODINUM FOULDS ARE EXTREMELY DIFFICULT TO GROW, EVEN AFTER TWO PREVIOUS MOD EFFORTS TO INCREASE SIZE AND YIELD.

SOLUTION: DEVELOP A CONTINUOUS GROWTH PROCESS BY WHICH CRYSTAL FOULDS OF CONSTANT COMPOSITION CAN MEET THE INCREASED MILITARY REQUIREMENTS IN THE FY 1985-86 TIME-FRAME.
COMPONENT -- MISCELLANEOUS

(554) TITLE -- ROAD AND MIL INFRARED SIGHT

PROBLEM - UNIQUE GEOMETRICAL SHAPE MUST BE FABRICATED AND ASSEMBLED IN SOURCE PRODUCTION. HIGH COST RESULTS FROM EXTENSIVE MANUFACTURING COST AND MARGINAL IN MATERIAL REPRODUCIBILITY.

SOLUTION - ESTABLISH AUTOMATED TECHNIQUE TO PRODUCE EMITTER AND HEATER ELEMENTS. ESTABLISH CONTROL OF PROCESS PARAMETERS THAT WILL RESULT IN IMPROVED YIELD OF REFRACTORY EMITTER.

(554-1) TITLE -- NON-LINEAR GAIN MCP'S FOR 3RL GEN IMAGE INTENSIFIER

PROBLEM - 3RL GEN TUBES REQUIRE NON-LINEAR GAIN MCP'S TO SUPPRESS BRIGHT HORIZON SKY OR OTHER BRIGHT AREAS WHILE PROVIDING FULL GAIN IN DARK SCENE AREAS. PRESENT MANUFACTURING METHODS FOR MCP'S ONLY PRODUCE MCP WITH LINEAR GAIN IN THE NORMAL OPERATING RANGE.

SOLUTION - ESTABLISH A NEW HIGH VOLUME MANUFACTURING PROCESS TO ACCURATELY CONTROL NON-LINEAR GAIN CHARACTERISTICS OF THE MCP WHILE MAINTAINING ALL PARAMETERS SUCH AS LOW NOISE, FLECKS, FIXED PATTERN NOISE AND ION HARDER PROTECTION.

(557) TITLE -- MULTI-SPECTRAL COATINGS

PROBLEM - DOUBLE BAND PASS 1.1/4 AND 3-14 MICRON) MULTI-LAYER COATINGS MUST BE PRODUCED ON VARIOUS OPTICAL MATERIALS. THESE COATINGS MUST MEET MIL-STD-1860 STANDARDS FOR HARDNESS WHICH IS A FUNCTION OF THE PROCESS.

SOLUTION - STRICT PROCESS CONTROL MUST BE ESTABLISHED. MINIMUM TIME BETWEEN LAYER DEPOSITION MUST BE ACHIEVED AND PRODUCTION TECHNIQUES MUST BE DEVELOPED.

(556-2) TITLE -- INTEGRATED OPTICAL BUILDING BLOCK -- PHASE I

PROBLEM - NO PROBLEM GIVEN

SOLUTION - NO SOLUTION GIVEN

COMPONENT -- WINDOWS/LENSES

(557a) TITLE -- PLASTIC IR OPTICAL MATERIAL

PROBLEM - INJECTION MOLDING OF NEW MATERIALS USEFUL IN IR PORTION OF SPECTRUM MUST BE ACCOMPLISHED IN PRODUCTION FACILITIES. OPTICAL ELEMENTS MUST BE LARGE, HOMOGENEOUS AND POSSESS THE PROPER SURFACE FIGURE.

SOLUTION - PRESSURE, TEMPERATURE, COOLING CYCLES, FLOW RATE MUST BE PRECISELY DETERMINED TO INSURE LOW COST PLASTIC OPTICS FOR FLIR LENSES.
<table>
<thead>
<tr>
<th>COMPONENT -- WORMS/LENSES (CONT)</th>
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<tbody>
<tr>
<td>(5150) TITLE -- PLASTIC OBJECTIVE FOR IMHALE INTENSIFIER SYSTEMS</td>
</tr>
<tr>
<td>PROBLEM -- METROLOGY PROBLEMS HAVE SURFACED IN THE MANUFACTURE OF PLASTIC OBJECTIVE LENSES IN THE AN/WS-16 PROGRAM WHICH WILL INCREASE THE UNIT PRODUCTION COST BY FORCING THE USE OF GLASS LENSES, AND ELIMINATE THE WEIGHT ADVANTAGE.</td>
</tr>
<tr>
<td>SOLUTION -- MANUFACTURING METHODS WILL BE ESTABLISHED FOR NEW METROLOGY OF PLASTIC LENS ELEMENTS WHICH WILL BE UTILIZED TO COMPLETE THE MANUFACTURE OF THE SINGLE CAVITY INSERTS REQUIRED FOR PRODUCTION FOR THE AN/WS-6, AN/PVS-7, AND AN/PVS-8.</td>
</tr>
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<td>FUNDING ($000)</td>
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<thead>
<tr>
<th>COMPONENT -- COMPUTER-HELPED FLIR ASPHERIC LENS FABRICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5145) TITLE -- COMPUTER-HELPED FLIR ASPHERIC LENS FABRICATION</td>
</tr>
<tr>
<td>PROBLEM -- ASPHERIC LENSES REQUIRED BY FLIR SENSORS HAVE SEVERE WEIGHT AND SIZE LIMITATIONS AND ARE DIFFICULT TO MANUFACTURE DUE TO THE REPEATED PROCESS OF SURFACE SHAPEING.</td>
</tr>
<tr>
<td>SOLUTION -- PROVIDE MANUFACTURING METHODS FOR PRODUCING ASPHERICAL FLIR LENSES WITH A SINGLE POINT DIAMOND TYPING CAVITY INTEGRATED WITH COMPUTER CONTROLS AND LASER INTERFEROMETRIC FEEDBACK OF CUTTING TOOL Position.</td>
</tr>
<tr>
<td>FUNDING ($000)</td>
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<thead>
<tr>
<th>COMPONENT -- MISCELLANEOUS</th>
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<tbody>
<tr>
<td>(5149) TITLE -- ULTRAWIDE BANDWIDTH SAW DIAPHRAGM LINES</td>
</tr>
<tr>
<td>PROBLEM -- BROADBAND SAW DELAY LINES ARE REQUIRED FOR SIGNAL STORAGE DEVICE BANDWIDTH IS FIXED BY NEED TO STORE SIGNALS FOR A TEN MICROSECOND DURATION FOR SIGNALS RANGING OVER 500 MHz BAND. DEVICE INSERTION LOSS AND MULTIPLE TRANSMIT REFLECTIONS MUST BE MINIMAL</td>
</tr>
<tr>
<td>SOLUTION -- ESTABLISH PRODUCTION CAPABILITY FOR SAW DELAY LINES OPERATING AT 1GHz USING IDENTICAL BROADBAND/PERIODIC INTERDIGITAL TRANSCEIVERS ON LITHIUM NITRATE SUBLATES. HIGH RESOLUTION PHOTOLITHOGRAPHIC FABRICATION WILL USE DIRECT PROJECTION PRINTING.</td>
</tr>
<tr>
<td>FUNDING ($000)</td>
</tr>
</tbody>
</table>
COMPONENT -- MISCELLANEOUS

NO. 1 TITLE - MM RADAR MODULATORS FOR MINI-RF AND TUBES

PROBLEM - MM RADAR MODULATORS CAPABLE OF SURVIVING A RUGGED ENVIRONMENT WITH
HIGH RELIABILITY REQUIRE COMPONENTS OF RUGGED DESIGN, PULSE SHARPENING
TECHNIQUES, PULSE CHARGING, AND NANOSECOND PULSE TRANSFORMER MUST BE
COMBINED INTO ONE UNIT.

SOLUTION - FABRICATE IN QUANTITY MM RADAR MODULATOR UTILIZING RECENT COMPONENT
IMPROVEMENTS TO MEET MILITARY REQUIREMENTS WITH THE BEST EFFICIENCY,
RELIABILITY, COST, WEIGHT POSSIBLE.

************************************************

NO. 2 TITLE - MILLIMETER-WAVE INDIUM PHOSPHIDE GUNN DEVICES

PROBLEM - INADEQUATE CONTROL OF IIP MATERIAL AND DEVICE PROCESSING STEPS
REQUIRING CLOSE TOLERANCES FOR EFFICIENT MM OPERATION RESULTS IN LOW YIELD
HIGH UNIQUNESS AND HIGH UNIT COST FOR MILLIMETER-WAVE INDIUM PHOSPHIDE GUNN
DEVICES.

SOLUTION - PRODUCTION ENGINEERING IN INITIAL MATERIAL PREPARATION,
INJECTION LIMITED CONTACT FORMATION, INTEGRAL HEAT SINK TECHNOLOGY AND
PACKAGING WILL ESTABLISH RHEE TECHNIQUES AND CONTROLS RESULTING IN A COST
REDUCTION OF MORE THAN TEN TO CAT.

NO. 3 TITLE - MILLIMETER WAVE MIXERS AND ARRAYS

PROBLEM - LOW NOISE PHOTOCATHODE MIXER ARRAYS ARE NEEDED FOR RECEIVERS
FOR RADAR ELECTRONIC WARFARE TACTICAL GUIDANCE AND MISSILE GUIDANCE.

SOLUTION - IN SITU CONSTRUCTION OF LENS WILL PROVIDE REPRODUCIBLE UNITS AT
PHOTOCATHODE FROM 2900 TO 37 MM. NEW TECHNOLOGIES TO BE DEVELOPED
INCLUDING LITHOGRAPHY AND PRECISE CONTROL OF MATERIALS GROWING.

NO. 4 TITLE - IMPATT DIODE SOURCES (9A 67)

PROBLEM - NEW RADAR ELECTRONIC SYSTEM OPERATING AT 94 GHZ REQUIRE HIGH
PERFORMANCE LOW COST IMPATT DIODE SOURCES. ADVANCED IMPATT
DIODE FABRICATION TECHNIQUES CURRENTLY UNDER DEVELOPMENT WILL BE
IMPLEMENTED.

SOLUTION - FABRICATION TECHNIQUES INCLUDING MOLECULAR BEAM
EVAPON, UCLING AND STARTING DIODE FABRICATION AND FABRICATION
TECHNOLOGY TO ELIMINATE WAVE PACKAGING WILL BE UTILIZED. HIGHER
YIELD, LOWER COST AND A HIGHER YIELD WILL RESULT.
COMPONENT -- MISCELLANEOUS

(S03) TITLE -- MILLIMETER-WAVE INTEGRATED CIRCUIT TRANSMITTERS

PROBLEM - MILLIMETER WAVE DIELECTRIC WAVEGUIDE INTEGRATED TRANSMITTER MODULES IN THE 40 TO 220 GHz REGION ARE DIFFICULT TO FABRICATE AND LIMITED IN PERFORMANCE. REPRODUCIBLE HIGH PERFORMANCE CHARACTERISTICS ARE DIFFICULT TO ACHIEVE WITH PRESENT DESIGN.

SOLUTION - ESTABLISH IMPROVED DESIGN TECHNIQUES FOR INTEGRATED MILLIMETER WAVE DIELECTRIC WAVEGUIDE STRUCTURES TO THAT RELIABLE, HIGH PERFORMANCE TRANSMITTER MODULES CAN BE FABRICATED IN LARGE QUANTITIES AT MINIMUM COST.

COMPONENT -- SWITCHES

(S031) TITLE -- LONG LIFE SPARK GAP

PROBLEM - LASER PULSERS FOR HANDELING AND DESIGNATORS ARE LIMITED BY SPARK GAP LIFETIMES AND NOT THE LASER. POOR SPARK GAP LIFETIMES DEGRADE SYSTEM RELIABILITY AND INCREASE COST.

SOLUTION - IMPROVE MANUFACTURING TECHNIQUES TO INCORPORATE LOW SHUTTER ELECTRODES INTO SPARK GAPS. IMPROVE TESTING PROCEDURES DURING MANUFACTURE TO ELIMINATE SPARK GAPS WITH POTENTIALLY POOR LIFETIMES.
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>PAGE</th>
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<tbody>
<tr>
<td>General</td>
<td>166</td>
</tr>
<tr>
<td>Testing</td>
<td>166</td>
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</tbody>
</table>
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 FY 73 to 4.5 million dollars in FY 79. 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>
<thead>
<tr>
<th>CATEGORY</th>
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<th>FY03</th>
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</table>
**COMPONENT -- MISCELLANEOUS**

(5052) 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 UPGRADE 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 TURNO 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.

**COMPONENT -- CHEMICAL**

(6352) 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**

(6353) TITLE - MATERIALS TESTING TECHNOLOGY (MMT)

**PROBLEM -** ELECTRONIC ITEMS AND ANCILLARY DEVICES ARE AMONG THE MOST TECHNICALLY SOPHISTICATED AND MISSU-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

(6351) 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.

FUNDING ($1000)

<table>
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<tr>
<th>COMPONENT -- MECHANICAL</th>
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<th>61</th>
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<tr>
<td>(6351) TITLE - MATERIALS TESTING TECHNOLOGY (MTT)</td>
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<td>875</td>
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<td>975</td>
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</table>

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 PROTOCOLS FOR ON-LINE PRODUCTION QUALITY ASSURANCE TESTING.

<table>
<thead>
<tr>
<th>COMPONENT -- NON-DESTRUCTIVE TESTING</th>
<th>PRIOR</th>
<th>61</th>
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<tr>
<td>Bridging</td>
<td>173</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Field Fortifications</td>
<td>173</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>General</td>
<td>174</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Mines</td>
<td>175</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Sources</td>
<td>175</td>
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</table>
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 in both organic and/or metallic matrix appear to 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.
COMPONENT -- REINFORCEMENT

**(5745) TITLE -- ALUMINUM SKIN-GRAFITE/FIBER SANDWICH BRIDGE REINFORCEMENT**

**PROBLEM** -- FORMULATION OF PROCEDURES TO MANUFACTURE ALUMINUM SKIN-GRAFITE/FIBER SANDWICH MATERIAL FOR BRIDGE STRUCTURAL MEMBERS.

**SOLUTION** -- SANDWICH ALUMINUM SKIN-GRAFITE/FIBER ALUMINUM SKIN LAMINATE SHOWS PROMISE OF BEING A STRUCTURE THAT WOULD SATISFY OUR NEEDS IF IT CAN BE ECONOMICALLY MANUFACTURED USING POLYURETHANE CURING ADHESIVES.

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**(5749) TITLE -- KEVLAR CABLE REINFORCEMENT FOR MILITARY BRIDGES**

**PROBLEM** -- TO PROVIDE LIGHT WEIGHT REINFORCEMENT TENSION MEMBER HAVING HIGH TENSILE PROPERTIES AND MODULUS.

**SOLUTION** -- DETERMINE IF KEVLAR MATERIAL CAN BE PRODUCED ON A PRODUCTION BASIS AND MAINTAIN THE HIGH PHYSICAL PROPERTIES REQUIRED IN A REINFORCING MEMBER.

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COMPONENT -- STRUCTURAL MEMBERS

**(5746) TITLE -- METAL MATRIX COMPOSITE MATERIAL**

**PROBLEM** -- CONNECTION OF COMPOSITE MATERIAL IS DIFFICULT IN LINEAR PLANAR COMPONENTS. MECHANICAL CONNECTIONS ARE EXPENSIVE IN BOTH DESIGN AND MATERIAL.

**SOLUTION** -- IMPROVE HIGH MODULUS FIBER MATERIAL IN GUMTILE METAL WHICH CAN BE WORKED AND CONNECTED WITH STANDARD METHODS.

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**(5761) TITLE -- SIMPLE PLATE WEB FOR BRIDGES**

**PROBLEM** -- HOW TO STABILIZE THIN SHEETS OF ALUMINUM TO CARRY HIGH SHEAR STRESSES WITHOUT BUCKLING.

**SOLUTION** -- CONTROLLED SPACING OF I-PAN SIMPLES OF PLATES AND SPOTWELD TWO PLATES TOGETHER AT CENTER OF SIMPLIES TO FORM A SANDWICH PLATE.

---

**(5766) TITLE -- MULTI HOLLOW SHEAR WEB MODULE**

**PROBLEM** -- TO PROVIDE A LIGHT WEIGH T 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 WEDGING IN UNCURVED STATE DEFLATE MANDREL AND FORCE WOUND MEMBER INTO MOLD HAVING TIGHTLY FITTED WEB SHAPE AND CURVE.
<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>MISCELLANEOUS</th>
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</thead>
<tbody>
<tr>
<td>Title 176</td>
<td>DIGITAL ELEVATION DATA DUPLICATE FACILITY</td>
</tr>
<tr>
<td>Problem</td>
<td>TECHNOLOGY EXITS TO TRANSFER FORMAT OF DIGITAL ELEVATION DATA FROM N-TRACK COMMERCIAL TAPE TO CASSETTES COMPATIBLE WITH THE MULTIFINGER SYSTEM. HOWEVER THIS TECH HAS NOT BEEN INTEGRATED INTO VAN-MOUNTED PORTABLE FIELD FACILITY.</td>
</tr>
<tr>
<td>Solution</td>
<td>A PROTOTYPE VAN-MOUNTED DIGITAL ELEVATION DATA DUPLICATE FACILITY SYSTEM OF EXTRACTING DATA FROM THE DATA N-TRACK TAPE AND TRANSFERRING IT TO THE FINALCASSETTES WILL BE FABRICATED.</td>
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<tr>
<th>COMPONENT</th>
<th>MISCELLANEOUS</th>
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<tbody>
<tr>
<td>Title 177</td>
<td>CONTINUOUS LENGTH FUEL HOSE</td>
</tr>
<tr>
<td>Problem</td>
<td>PRESENT FUEL RESISTANT CONTINUOUS LENGTH HOSE IS MANUFACTURED IN A N-TRACK LENGTH OF HOSE IS FIRST MANUFACTURED THEN SECTIONS ARE SPICED TOGETHER FOR THE DESIRED LENGTH. SPICING IS EXPENSIVE.</td>
</tr>
<tr>
<td>Solution</td>
<td>EXHAUSTIVE HOSE LENGTH OF HOSE WITHOUT SPICING. FIRE HOSE IS PRODUCED BY THIS METHOD. WHICH IS ALSO APPLICABLE TO FUEL HOSE. NON-SPICED, CONTINUOUS HOSE WOULD BE RELIABLE AND LESS EXPENSIVE THAN PRESENT SPICED HOSE.</td>
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<thead>
<tr>
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<th>MISCELLANEOUS</th>
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</thead>
<tbody>
<tr>
<td>Title 178</td>
<td>INTER-IM PRODUCTION METHOD AIR CYCLE CIRCULATOR</td>
</tr>
<tr>
<td>Problem</td>
<td>TECHNICAL INNOVATION HAS PRODUCED AN AIR CYCLE COMPRESSOR-FAN-PUMP. THE FABRICATION TECHNIQUES AND MATERIALS OF CONSTRUCTION USE TO PRODUCE PROOF OF CONCEPT HARDWARE WILL BE UNECONOMICAL FOR FULL SCALE PRODUCTION.</td>
</tr>
<tr>
<td>Solution</td>
<td>DEVELOP NEW MANUFACTURING METHODS TO MACHINE ELLIPTICAL CAM TRACKS INTO TWO PLATES OF COMPRESSOR-FAN-PUMP.</td>
</tr>
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<thead>
<tr>
<th>COMPONENT</th>
<th>MISCELLANEOUS</th>
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<tbody>
<tr>
<td>Title 179</td>
<td>LFCV-35, SHIYI AND FINGER COMPONENTS</td>
</tr>
<tr>
<td>Problem</td>
<td>FABRICATION OF SHIYI, FINGERS AND CONE IS CURRENTLY HIGHLY LABOR INTENSIVE, LEADING TO HIGH COMPONENT REPLACEMENT COSTS.</td>
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<tr>
<td>Solution</td>
<td>DEVELOP MECHANIZED/AUTOMATED FABRICATION TECHNIQUES TO REDUCE MANUFACTURING COSTS.</td>
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MY FIVE YEAR PLAN

FUNDING ($100k)

CATEGOR Y

LAND MINES

COMPONENT -- NEUTRALIZERS

(3796) TITLE -- COMBAT VEHICLE DEGAUSING

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 UNINCARCAGE.

SOLUTION -- CONSTRUCT A PILOT DEGAUSING SYSTEM THAT WILL ALLOW DEVELOPMENT OF A DEGAUSING TECHNIQUE FOR JS ARMED VEHICLES.

CATEGOR Y

POWER SOURCE

COMPONENT -- MISCELLANEOUS

(3572) TITLE -- INTEGRATED POWER SWITCH

PROBLEM -- THE HIGH POWER SWITCHING CAPABILITY REQUIRES IMPROVED COOLING OF THE POWER STAGE. THIS REQUIRES MECHANICAL AND ELECTRICAL CONSIDERATIONS.

SOLUTION -- METHODS MUST BE DEVELOPED TO PRODUCE AND ATTACH HEAT PIPES FOR COOLING DURING QUANTITATIVE PRODUCTION. RELATED ELECTRICAL AND MECHANICAL CHANGES MUST ALSO BE DEVELOPED FOR QUANTITATIVE PRODUCTION.

(3765) 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 INTEGRATING 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 SINK.
COMPONENT -- TURBINES

(3717) TITLE -- HIGH TEMPERATURE NOZZLE FOR 10KW POWER UNIT

PROBLEM -- SUPER ALLOY METALS USED IN HOT COMPONENTS OF GAS TURBINES ARE
LIMITED IN OPERATING TEMPERATURE AND ARE SUBJECT TO PREMATURE FAILURE IN
DUSTY OR CORROSIVE ATMOSPHERE. ALLOY METALS ARE STRATEGIC MATERIALS AND ARE
COSTLY TO MANUFACTURE.

SOLUTION -- DETERMINE METHODS AND TECHNIQUES TO REDUCE THE COST OF
MANUFACTURING HIGH TEMPERATURE CERAMIC MATERIALS WHICH HAVE BEEN FOUND TO
POSSESS HIGH TEMPERATURE RESISTANCE TO DUST ABRASION AND SALT CORROSION.
MATERIALS WILL CONTAIN NO STRATEGIC ELEMENTS.
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<td>Missile Structure</td>
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<td>Propulsion System</td>
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<td>Test Equipment</td>
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US ARMY MISSILE COMMAND
(MICOM)

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 gyros, printed circuits, and seekers. Improvements in the gyro can be made by addressing proposals in new machining methods and assembly techniques. 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.

Proposals in the area of test equipment include work on electrical, x-ray, neutron and hydraulic equipment. Calibration efforts include infrared testing of PC boards, digital fault isolation, and automatic circuit tuning.
### Micos

**Command Funding Summary (Thousands)**

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(1070) TITLE - LOW COST SMALL HOOK CONTAIN/LAUNCHER PODS

PROBLEM - CURRENT LAUNCH PODS ARE EXPENSIVE AND REQUIRE MUCH TO MAINTAIN COST PER COUNT AT AN ACCEPTABLE LEVEL.

SOLUTION - LOW COST PLASTICS WILL BE APPLIED TO THE STRUCTURE. COMMERCIAL GRADE PLASTICS SUCH AS ABS, PVC, AND FOAMS IN FOAMED AND FORMED SHAPES WILL BE CONSIDERED. LONG TERM SERVICE ENVIRONMENT WILL BE EVALUATED BY ACCELERATED AGING AND CRIP TESTING.

(1071) TITLE - RAPID CURE FOAM-IN-PLACE

PROBLEM - PRODUCTION PROCESSES FOR FOAM-IN-PLACE MATERIALS ARE NOT CONDUCIVE FOR HIGH RATE PRODUCTION OF LARGE STRUCTURES. PROBLEMS INCLUDE NON-UNIFORM DENSITY, SLOW FOAMING, AND Voids IN CONSTRUCTED PARTS.

SOLUTION - IMPROVE MFG METHODS REQUIRED TO FABRICATE LARGE, COMPLEX STRUCTURES. THIS WILL INCLUDE OPTIMIZATION OF FOAM PLACEMENT METHODS, TOOLING CONCEPTS, AND MATERIALS SYSTEMS TO SUPPORT HIGH RATE, LOW COST PRODUCTION.

(1085) TITLE - SEMIADHESIVE REEL TO REEL FLEX PRINT PROCESS

PROBLEM - CONVENTIONAL BATCH PROCESSING OF PRINTED WIRING BOARDS IS LABOR INTENSIVE, MAND LABOR IS COSTLY AND SUBJECT TO ERRORS WHICH ADDS REJECT LOSES TO LABOR COSTS.

SOLUTION - A REEL TO REEL MFG PROCESS FOR FLEXBROS WILL PRODUCE COMPLETE FLEXBROS FROM ROLLS OF CLAD STOCK IN A SEQUENTIAL SET OF OPERATIONS. THE OUTPUT CIRCUITS WILL BE FLAT CABLE OR FLEXIBLE CIRCUITRY.

(1071) TITLE - HYBRID INTEGRATED CAD ANI MANUFACTURING (HICAM)

PROBLEM - HYBRID CIRCUIT DESIGN AND MANUFACTURE IS LABOR INTENSIVE. THE CAD DATA BASE HAS NOT BEEN EXTENDED TO MANUFACTURING PROCESS CONTROL.

SOLUTION - ANALYZE FUNCTIONAL FLEX ANI MANUFACTURING PROCESS CONTROLS AND MODIFY THE DESIGN DATA BASE TO MAKE IT CAPABLE OF DEFINING FUNCTIONS, INPUT, OUTPUT, CONTROLS AND INTERFACES. USE ICAM METHODOLOGY TO DEVELOP SYSTEM ARCHITECTURE.
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**CONTINUED**

- **INTERMEDIATES, COMPUTER-AIDED MANUFACTURING (CAMP)**
- **ALTEC** - INTEGRATED CIRCUITS, HYBRID CIRCUITS, PRINTED CIRCUITS AND MINI-CIRCUITS ON A COMPUTER.* THERE IS LITTLE COMPUTERIZED CONTROL OF THE USE OF THESE ITEMS. A MASTER PLAN IS NEEDED TO DEFINE THE NEEDS AND REQUIREMENTS.

- **DEVELOP A MASTER PLAN FOR COMPUTER-AIDED DESIGN AND MANUFACTURING SYSTEMS**. USE AIR FORCE's ICAP AND NASA's IPAD PROGRAMS TO DEFINE ELECTRONIC TECHNOLOGIES TO MAKE INTEGRATED CIRCUITS, HYBRID INTEGRATED CIRCUITS, PRINTED CIRCUITS, AND CABLES.

- **FLAT OF PRECIOUS METALS MICRO-CIRCUIT APPLICATIONS**

- **ELIMINATE USE OF NOBLE METALS IN CIRCUIT APPLICATIONS** BY ESTABLISHING A THICK FILM FABRICATION PROCESS WITH PRECISION PACKAGES.

- **APPLICATION** - USE NON-NOBLE METALS, ELIMINATING THE REQUIREMENTS FOR GOLD, WHICH COULD BE EASILY ESTABLISHABLE BY A DETAILED ANALYSIS OF MATERIAL COMPATIBILITY.

**15.** **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, SOLDERING, AND IDENTIFICATION. HARNESS ASSEMBLY IS DONE BY HAND. PROCEDURES USE SEVERAL WORKSTATIONS AND REPEATED HANDLING.

- **SOLUTION** - A COMPUTER CONTROLLED MANIPULATOR (ARDCO) WITH SIX DEGREES OF FREEDOM INCORPORATES WIRE PREPARATION, HARNESS ASSEMBLY, AND TESTING INTO A SINGLE WORKSTATION. AN INTEGRATED SATELLITE SYSTEM APPROACH WILL INCORPORATE STATE-OF-THE-ART EQUIPMENT AND TECHNIQUES.

**16.** **TITLE** - MISSILE/ROCKET DISPENSING SYSTEM

- **PROBLEM** - DISPENSING UNITS ARE FABRICATED, ASSEMBLED, AND TESTED BY HAND.

- **SOLUTION** - ESTABLISH AUTOMATED AND SEMI-AUTOMATED SYSTEM FOR PRODUCING THE DISPENSING DEVICE

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**CATEGORY**

- SURVIVAL
- STRATEGIC
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<td>ELIMINATE THE USE OF GOLD ON COMMERCIAL AND MILITARY HIGH RELIABILITY SWITCH CONTACTS.</td>
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<td>SOLUTION</td>
<td>ESTABLISH A LESS EXPENSIVE METAL OR ALLOY IN PLATING CONTACTS.</td>
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<td>PROBLEM</td>
<td>CURRENT METHODOLOGY FOR THE GENERATION OF PHOTO LITHOGRAPHY EQUIPMENT IS APPROACHING THE DIFFRACTION LIMIT OF LIGHT. THIS CONDITION RESULTS IN POOR PATTERN REPLICATION AND INCREASE IN DEFECTS.</td>
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<td>SOLUTION</td>
<td>ESTABLISH AN X-RAY LITHOGRAPHY PROCESS WHERE REPRODUCTION OF PATTERNS UP TO 1 CM SQUARE ARE ACCURATE.</td>
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<tr>
<td>PROBLEM</td>
<td>DEVELOPMENT OF A 140 GHZ GUIDANCE SYSTEM IS HAMPERED BY HIGH COST AND LOW EFFICIENCY OF THE MACHINED WAVEGUIDE VARACTOR MULTIPLIERS. GUNN OSCILLATORS, THE ONLY PRACTICAL ONE FOR INPUT, HAS 40DBR LINE POWER LEVELS.</td>
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<tr>
<td>SOLUTION</td>
<td>USE THE SEMI-ADHESIVE MFG PROCESS TO ELECTROPLATE SILVER ON LOW LOSS SUBSTRATES TO FORM 1) A LOW FREQUENCY INPUT BAND PASS FILTER MATCHING THE GUNN, 2) A NON LINEAR VARACTOR ELEMENT, AND 3) A HIGH FREQUENCY OUTPUT BAND PASS AT 140 GIGAHERTZ.</td>
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<td>TITLE - FOOD OF QUIET RADAR SIGNAL PROCESSORS USING VLSI TECHNOLOGY</td>
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<tr>
<td>PROBLEM</td>
<td>THE MAN TECH BASE TO FOCUS RADAR SIGNAL PROCESSORS USING VLSI EVERY HIGH SPEED INTEGRATED CIRCUIT DOES NOT EXIST. METHODS USING LSI (LARGE SCALE INTEGRATED) CHIPS ARE INADEQUATE. HOWEVER, SOME TECHNIQUES MAY BE TRANSLATABLE TO VLSI.</td>
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<td>SOLUTION</td>
<td>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.</td>
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<td>TITL: PRODUCTION METHOD FOR A LOW SIFLORE ANTENA NETWORK</td>
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<td>PROBLEM: CURRENT MANUFACTURE OF AIR STEELLINE NETWORKS FOR LOW SIFLORE ANTENNA ARE EXPENSIVE BECAUSE OF MILL BOARD SIZE WITH ACCURATE DIMENSIONAL TOLERANCE REQUIREMENTS.</td>
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<td>SOLUTION: INSTALL A METHODOLOGY REDUCING THE LINE LENGTH TRIMMING, AUTOMATE PLACEMENT AND WELDING OF JUNCTIONS AND THE PLACEMENT OF GROUND PLANE LEADERS REDUCING HAND LABOR.</td>
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<td>PROBLEM: THE ACHIEVEMENT OF A 4STEP PROGRAM INJECTION MOLDING WITHIN A COST ANALYSIS WILL BE NEEDED. DESIGN, FAB, MOLDING GUIDELINES WILL BE DEFINED. QUALIFICATION METHODS WILL BE DEFINED. CURRENT HARDWARE WILL BE PRODUCED AND EVALUATED.</td>
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<td>PROBLEM: MANUFACTURING TECHNOLOGY NEEDED FOR PRODUCTION OF ELECTRO-OPTICAL SYSTEMS IS VERY LIMITED. LITTLE CORRELATION EXISTS BETWEEN COMPONENT SPECIFICATIONS AND THE PARAMETERS THAT IMPROVE SYSTEM PERFORMANCE.</td>
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<td>SOLUTION: ECONOMY OF PRODUCTION, TESTING METHODS, OR TECHNIQUES COULD BE DEVELOPED BY VALIDATING EXISTING SPECIFICATIONS OR REPLACEING EXISTING ONES WITH SPECIFICATIONS THAT ARE BASED ON SYSTEM PERFORMANCE RATHER THAN COMPONENT PERFORMANCE.</td>
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<td>SOLUTION: STRUCTURE COMPUTERIZED MODEL TO CALCULATE THE LABOR CONTENT OF A DESIGN CONCEPT IN STANDARD SETUP AND RUN TIME.</td>
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<td>PROBLEM: THE PRESENT NATIONWIDE PRACTICE FOR THE DISPOSAL OF WASTE PRECIOUS METAL MATERIALS IS TREATMENT IN A CONVENTIONAL WASTE TREATMENT PLANT.</td>
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<td>SOLUTION: DEVELOP ONE OR MORE SYSTEMS THAT WILL RECOVER THESE PRESENTLY DISCARDED MATERIALS IN A SAFELY REUSABLE FORM.</td>
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COMPONENT -- BATTERIES

(5.2.1) TITLE - ENG. ANAL. OF MCC PARAMETERS FOR THERMAL BATTERIES

PROBLEM - SLIGHT VARIATION IN MANUFACTURING PARAMETERS HAVE A GREATLY
MAGNIFIED EFFECT ON FINAL BATTERY PERFORMANCE AND AS A RESULT PROJECTION
PAPERS ARE HIGH.

SOLUTION - OPTIMIZE EACH FACET OF MANUFACTURING TECHNIQUES BY STATISTI- 
CALLY CORRELATING VARIABLE PARAMETERS.

(32F1) TITLE - SILVER ZINC GUIDANCE BATTERIES (CAM)

PROBLEM - ANODE AND CATHODE MANUFACTURING FOR SILVER ZINC BATTERIES IS BASED
ON TWENTY YEAR OLD TECHNIQUES. REQUIREMENTS CALL FOR IN-LINE PRODUCTION AND
ACCEPTANCE TESTS.

SOLUTION - DEVELOP A COMPUTER AIDED MANUFACTURING PROCESS FOR SILVER-ZINC
BATTERIES WITH CONTROLLING SENSORS FOR ACCURATELY MEASURING MATERIALS AND
ELECTROCHEMICAL COMPOSITION.

COMPONENT -- GENERAL

(11.1) TITLE - SINGLE CRYSTAL SILICON FOR VLSI

PROBLEM - SINGLE CRYSTAL SILICON PROCESSES AND MATERIALS ARE CURRENTLY
PROHIBITIVELY.

SOLUTION - ESTABLISH A PROCESS GROWING 2-INCH DIAMETER SINGLE CRYSTALS.

COMPONENT -- HYBRID

(11.6) TITLE - ELECTRICAL VERIFICATION AND TURNT-IN FOR IN-PROCESS HYBR CHIP

PROBLEM - INSTALLATION OF BAD CHIPS IN HYBRID CIRCUITS IS A CONTINUING
PROBLEM. CHIPS ARE TESTED BY PROD CHECKING, BUT WHEN POSSIBLE ARE REMOVED
AND REPLACED. ACCEPTANCE PROCEDURES MUST INCLUDE A LOT ACCEPTANCE PROCEDURE
IN ADDITION TO PRODUX VISUAL INS.

SOLUTION - MODIFY TAPE LEAD CARRIER TO PREVENT INSTALLATION OF BAD CHIPS IN
HYBRID CIRCUITS. DEVELOP THE PROCEDURE TO PROBE CHECK A CHIP AND TO REMOVE IT
FROM HYBRID CIRCUIT EJUCTION IF CHIP IS BAD. ADAPT PROCEDURES TO TEST
EQUIPMENT AND TURNT-IN EQUIPMENT.

(11.6) TITLE - ADDITIVE SINGLE AND MULTILAYER HYBRID CIRCUITRY

PROBLEM - THICK FILM CIRCUITRY USED IN THE SCREEN AND FIRE PROCESS ON CERAMIC
SUBSTRATES. A SEMI-CONDUCTIVE FINE-LINE PROCESS, ELECTROLESS COPPER PLATING,
USED ON FIREGLASS 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.
COMPONENT - HYBRIDS

(10-20) TITLE - AUTOMATIC SEALING OF HYBRIDS

PROBLEM - HYBRID CIRCUIT ASSEMBLIES FOR MILITARY USE REQUIRE HERMETIC SEALING WHICH IS ACCOMPLISHED BY SOLDERING OR WELDING. BOTH TECHNIQUES REQUIRE AN OPERATOR INVOLVING LOST INTENSIVE HANDLING AND SET UP ERRORS.

SOLUTION - ESTABLISH AN AUTOMATIC HERMETIC SEALING SYSTEM USING A COMPUTER OR MICROPROCESSOR BASED ON THE MOLDING EXISTING HERMETIC SEALING EQUIPMENT.

(12-10) TITLE - HYBRID CIRCUIT ASSEMBLY UTILIZING AUTOMATED TECHNIQUES

PROBLEM - ALL HYBRID CIRCUITS ARE PRESENTLY MANUFACTURED IN A LABORATORY ATMOSPHERE BY ONLY A FEW PRODUCERS.

SOLUTION - CONVERT LABORATORY TECHNOLOGIES INTO PRODUCTION WITHOUT UTILIZING AUTOMATIC COMMERCIAL EQUIPMENT.

(31-32) TITLE - PRODUCTION TOOLING TECHNIQUES FOR MOLDED ELECTRONICS

PROBLEM - VERY DEEP HOLE SEALS ASSEMBLY VERY COSTLY.

SOLUTION - DEVELOP FABRICATION TECHNIQUES TO PLACE LEADLESS INVERTED DEVICES (LIDS) AND COMPONENTS DIRECTLY ONTO PRINTED CIRCUIT BOARDS.

(32-35) TITLE - LOW COST HYBRID MICROELECTRONIC CIRCUITS

PROBLEM - DESIGN CRITERIA AND COMPONENT SELECTION AFFECT THE TOTAL HYBRID FABRICATION CYCLE TO A DEGREE THAT CONSTANT MACHINE OPERATOR ATTENTION IS REQUIRED.

SOLUTION - DETERMINE THE COST DRIVER OF HYBRID CIRCUIT FABRICATION AND TEST TO DEFINE FEASIBLE METHODS TO ALLOW MORE ECONOMICAL METHODS FOR MACHINE OPERATIONS.

COMPONENT - INTEGRATED ELECTRONICS

(12-20) TITLE - AUTO TEST MOUNTING & STACKING OF LOCASET WEKAIR DEVICES

PROBLEM - PRESENT METHODS OF MOUNTING AND TESTING DEVICES USING LOCASETS ARE EIGHT HOURS PER CALENDAR DAY THEY WOULD BE WITH AUTOMATED METHODS.

SOLUTION - PROVIDE A SYSTEM THAT WILL AUTOMATICALLYสัปดาห์(279,592),(962,999)
COMPONENT -- INTEGRATED ELECTRONICS (CONTINUED)

(1051) TITLE -- HIGH SPEED PLATING OF CAGE EDGE CONTACTS.

PROBLEM -- MASKING OF THE CONTACTS IS AN EXPENSIVE PROCESS AND REQUIRES A CLEANING PROCESS TO REMOVE THE RESIDUE FROM THE TANK. THE ADJACENT PLATING JUNCTION OF DISSIMILAR METALS REQUIRES STRICT CONTROLS TO PREVENT FAIRLINE CRACKS.

SOLUTION -- DEVELOP HIGH SPEED FULLY PLATING OF THE CONTACTS. THIS WILL ELIMINATE THE REQUIREMENT FOR MASKING, CLEANING TO REMOVE THE MASKING RESIDUE AND REDUCE COST.

(1055) TITLE -- REMOVE GOLD FROM COMPONENT LEADS

PROBLEM -- GOLD PLATING, USED ON MOST ACTIVE DEVICE LEADS MUST BE REMOVED BY MANUALLY DOUBLE SOLDER DIPPING PER MIL STANDARDS. THIS IS SLOW AND COSTLY BUT NECESSARY TO PREVENT GOLD EMBRITTLEMENT OF SOLDER JOINTS WHICH COULD RESULT IN PREMATURE FAILURE.

SOLUTION -- DEVELOP AN AUTOMATED MACHINE FOR REMOVING GOLD FROM COMPONENT LEADS BY THE REQUIRED DOUBLE SOLDER DIP METHOD.

(1058) TITLE -- MINUTIURE COMPONENT PACKAGING

PROBLEM -- ULTRA HIGH DENSITY PCB'S ARE NEEDED AND CAN NOW BE MANUFACTURED WITH 5 MIL LINES AND 5 MIL SPACES. THIS ORDER OF BOARD DENSITY CANNOT BE FULLY UTILIZED WITH A SERIES OF CASES SUCH AS TO-CANS AND DIPS. SINCE THEIR LEAD SPACES REQUIRE TOO MUCH AREA.

SOLUTION -- ADAPT THE HERMETICALLY SEALED (PASSIVATED) CHIP TO THE NEW ULTRA HIGH DENSITY PCB. HYBRID TYPE COMPONENTS WILL REQUIRE LITTLE MODIFICATION. ACTIVE DEVICES - TRANSISTORS ARE INTEGRATED CIRCUITS - WILL REQUIRE PASSIVATION.

(1061) TITLE -- STANDARDIZED MASKING TECHNIQUES FOR PCB ASSEMBLIES

PROBLEM -- NO STANDARDIZED CONFORMAL MASKING TECHNIQUES ARE IN EXISTENCE THROUGHOUT INDUSTRY. MATERIALS AND TECHNIQUES ARE SELECTED BY PERSONNEL ACCORDING TO THEIR OWN JUDGEMENT PRIOR TO CONFORMAL COATING. DAMAGE RESULTS WHEN WRONG JUDGEMENT WAS USED.

SOLUTION -- DEVELOP STANDARDIZED MASKING MATERIALS AND TECHNIQUES BASED UPON WHICH TYPE OF AREAS ON THE PCB ASSEMBLY ARE TO BE FREE OF CONFORMAL COATING. PARAMETERS SUCH AS TERMINAL GEOMETRY, HOLE PATTERNS, HEAT SINK ZONES WILL BE EVALUATED.
### COMPONENT -- INTEGRATED ELECTRONICS (CONTINUED)

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<thead>
<tr>
<th>(1062) TITLE</th>
<th>PREVENTING BRITTLE COPPER CIRCUITRY</th>
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<tbody>
<tr>
<td>PROBLEM</td>
<td>BRITTLE CLADDING FOIL AND BRITTLE ELECTRODEPOSITED COPPER FOR PWB'S IS A PREVALENT PROBLEM. NO PROCEDURE EXISTS FOR THE EARLY DETECTION OF ENHANCEMENT IN COPPER ELECTRODEPOSITS.</td>
</tr>
<tr>
<td>SOLUTION</td>
<td>MEASURE THE DUCTILE-TO-BRITTLE TRANSITION IN COPPER DEPOSITS. THE MEASUREMENT OF BRITTLE TRANSITION PROVIDES A MEANS FOR THE EARLY DETECTION OF THE CHANGE FROM DUCTILE TO BRITTLE.</td>
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<tr>
<th>(1071) TITLE</th>
<th>USE OF ELECTROLESS NICKEL FOIL ON PWB CONNECTORS</th>
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<tbody>
<tr>
<td>PROBLEM</td>
<td>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.</td>
</tr>
<tr>
<td>SOLUTION</td>
<td>NICKEL BONING 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.</td>
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<tr>
<th>(1072) TITLE</th>
<th>MULTIPLE HIGH RELIABILITY LOW VOLUME LSI MFG</th>
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<tr>
<td>PROBLEM</td>
<td>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.</td>
</tr>
<tr>
<td>SOLUTION</td>
<td>ANALYZE ALL LSI RESEARCH RESULTS AND SINGLE OUT NEW PROCESSING TECHNIQUES. ESTABLISH A MILITARY CATEGORIC DESIGN AND PRODUCTION LINE. DEVELOP SOFTWARE FOR CAD OF LSI CIRCUITS. REDUCE VARIATIONS OF SEVERAL CIRCUIT FAMILIES.</td>
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<tr>
<th>(1041) TITLE</th>
<th>ELIMINATE GOLD OR CABLE CONNECTOR PINS</th>
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<tr>
<td>PROBLEM</td>
<td>GOLD FLASH OVER NICKEL PLATE IS STANDARD FOR PINS IN MILITARY CONNECTIONS. GOLD IS EXPENSIVE AND A SUBSTITUTE IS NEEDED.</td>
</tr>
<tr>
<td>SOLUTION</td>
<td>EVALUATE ALLIUM, TiP-VN, Ni-VN AND NICKEL W/ OR WITHOUT Tin OR INLUX AS A LUBRICANT. SET UP FLEX PLATING AND OTHER PROCESS FOR APPLYING THE NEW MATERIALS, CHEMICAL OR ELECTRO PLATING.</td>
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<tr>
<th>(1044) TITLE</th>
<th>PRODUCTION METHODS FOR A MILLIMETER MODULAR TRANSPONDER</th>
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<tr>
<td>PROBLEM</td>
<td>TRANSPONDER REQUIRE HARD FABRICATION LABOR AND ARE HIGH COST. THEY ARE USABLE ONLY ONCE. THEY MUST RECEIVE A GUIDANCE RADAR SIGNAL, BEFORE IT, FORM A COUPPE AND TRANSMIT IT TO THE GUIDANCE RADAR. MUST WITHSTAND A MILITARY ENVIRONMENT.</td>
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<tr>
<td>SOLUTION</td>
<td>A HELI-OPPONDER THAT MINIMIZES MFG COST, MODULARIZES TRANSPONDER SYSTEM EVENTUALLY WOULD REALEASE MODULAR RECORDING MODULAR, DISCONNECTABLE, W/ DISTRIBUTOR, POWER SUPPLY MODULAR, HELI MODULARS TO FIT IN A HELIOPPONDER.</td>
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**FUNDING ($5,000)**
COMPONENT -- INTEGRATED ELECTRONICS (CONTINUED)

(1103) TITLE -- STABLE MATERIALS & MANUFACTURING FOR MULTILAYER PCB

PROBLEM -- MATERIAL FAILURE AND INTERPLANE 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.

(3149) TITLE -- COMPONENT SIDE PRINTED CIRCUIT BOARD SOLFRING

PROBLEM -- THERE IS NO KNOWN METHOD FOR HOLDING COMPONENTS IN ALIGNMENT FOR MOUNTING.

SOLUTION -- REFINED PROGRESS FOR FOIL SIDE MOUNTING OF COMPONENTS TO ACCOMODATE FLEXIBLE CIRCUITS.

(3263) TITLE -- MANUFACTURING COSTS FOR PCB UTILIZING LEADLESS COMPONENTS

PROBLEM -- THE VOLUME, WEIGHT, QUANTITY, RELIABILITY AND COST OF PCB'S USING AXIAL LEADED COMPONENTS CAN BE SUBSTANTIALLY IMPROVED.

SOLUTION -- USE LEADLESS COMPONENTS CURRENTLY AVAILABLE TO REDUCE THE REQUIRED AREA BY A RATIO OF 2 TO 1 WITH A CORRESPONDING WEIGHT REDUCTION. RELIABILITY MAY BE INCREASED DUE TO A REDUCTION IN THE NUMBER OF PLATED THRU HOLES REQUIRED FOR INTERCONNECTIONS.

(3369) TITLE -- UTILIZATION OF LARGE SCALE INTEGRATION (LSI) TECHNIQUES

PROBLEM -- THE DESIGN AND UTILIZATION OF LSI ELECTRONICS IN AN ADVANCED DEVELOPMENT PROGRAM IS NOT FEASIBLE BECAUSE OF THE INABILITY TO MAKE QUICK CHANGE.

SOLUTION -- CONDUCT PROJECT FOR LSI DEVELOPMENT, QUALIFICATION, PRODUCTION ENGINEERING AND PILOT RUN FOR THE STINGER ALTERNATE MISSILE GUIDANCE ELECTRONICS.

(3411) TITLE -- MANUFACTURE OF NON PLANAR FRATHER CIRCUIT BOARDS

PROBLEM -- USE OF FLAT CIRCUIT BOARDS RESULTS IN COMPLEX AND EXPENSIVE INTERCONNECTIONS WITH LOWED RELIABILITY.

SOLUTION -- DEVELP THE PROCESS 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 BARS. A METHOD OF MASS SOLDERING WILL BE DEVELOPED.
COMPONENT -- OPTICS  
(5405) TITLE -- PRECISION MACHINING OF OPTICAL ELEMENTS

PROBLEM -- EXISTING PRECISION MACHINING FACILITIES CANNOT KEEP UP WITH THE DEMAND. MELT OPTICAL DESIGN REQUIREMENTS. MEET PRODUCTION SCHEDULES, AND STAY WITHIN REASONABLE COST BOUNDARIES.

SOLUTION -- INTEGRATE BOTHを作る WELL PROVEN ER&D DEVELOPED SINGLE POINT DIAMOND MACHINING Capabilities AND THE DEVELOPING INTERFEROMETRIC AIDED AND COMPUTER CONTROLLED TECHNOLOGY INTO A MANUFACTURING METHOD.

COMPONENT -- SEEKERS  
(1051) TITLE -- MFG PROCESS FOR INFRARED FOCAL PLANE ARRAY

PROBLEM -- THE GREATEST OPPORTUNITY FOR FABRICATION OF INFRARED FOCAL PLANE ARRAYS IS TO FABRICATE AN ARRAY OF IF DETECTORS TO A SILICON CHARGE COUPLED DEVICE. HOWEVER PROBLEMS ARE ENCOUNTERED IN ACHIEVING A RELIABLE INTERFACE BETWEEN THE CCD AND ARRAY OF DETECTORS.

SOLUTION -- DEVELOP A PROCESS THAT WILL ALLOW AN INDIVIDUAL BUMP ON THE BACKSIDE OF EACH ELEMENT OF AN IF ARRAY WHICH CAN BE JOINED IN GOOD ELECTRICAL AND MECHANICAL CONNECTION WITH THE TERMINAL OF AN ELEMENT OF A CCD SIGNAL PROCESSING ARRAY.

(1064) TITLE -- PRODUCTION OF INFRARED SEEKER ELECTRONICS USING VLSI (CAM)

PROBLEM -- LOW COST, LIGHTWEIGHT, MINIMUM VOLUME GUIDANCE ELECTRONICS ARE REQUIRED FOR FUTURE FIRE AND FH.ART MISSILE SYSTEMS. CURRENT PACKAGING USES DISCRETE COMPONENTS AND HERMETICALLY SEALLED ENCLOSURES WITH CIRCUITS ON PCB BOARDS ON MOTHERBOARDS IN HOUSINGS.

SOLUTION -- USE FOUR OR FIVE STANDARD CHIPS FROM (100 PROGRAM IN VLSI EVERY LARGE SCALE INTEGRATED CIRCUITS) TECHNOLOGY AND DEVELOP MANUFACTURING PROCESSES TO PRODUCE INFRARED IMAGING SEEKER ELECTRONICS USING THIS TECHNOLOGY.

(1073) TITLE -- IMP MFG PROC FOR FOUR-IN DIAMETER FOCAL PLANE ARRAY SEEKERS

PROBLEM -- STABILIZING FOCAL PLANE ARRAY DETECTORS MUST PRODUCTION IN INFRARED SEEKER MECHANICAL COMPLEXITY AND SIZE NOT PREVIOUSLY POSSIBLE. ACHIEVING HIGH PRODUCTION RATE WITH HIGH YIELD IS FABRICATION OF THIS NEW TYPE SEEKERHEAD IS A PROBLEM.

SOLUTION -- ESTABLISH MANUFACTURING PROCEDURES FOR LARGE VOLUME, HIGH YIELD PRODUCTION OF STABILIZING FOCAL PLANE ARRAY DETECTORS AND SMALL DIAMETER SEEKERHEADS.
COMPONENT -- SENSORS

(3120) TITLE -- WIDE AREA MERCUHY-CALCIUM-TELLURIDE LIQUID NITROGEN COUPLER.

PROBLEM -- LARGE AREA MERCUHY-CALCIUM-TELLURIDE LIQUID NITROGEN COUPLER FUNCTION IN SEEKER ARE EXPENSIVE BECAUSE OF HIGH MATERIAL COST AND LOW TELITLY. THE MATERIAL IS HARD TO WORK WITH THE RIGHT CHEMICAL BALANCE, SPLITTING THE IMPLANTATION BECAUSE DIFFUSION AFF TELITY.

SOLUTION -- FIND THE EXACT CHEMISTRY FOR GOOD ELECTRIC OUTPUT. LOOK AT CLOSER LOOP CONTROL OF CRYSTAL PULLING, FINITE 3-WAY CHARACTERIZATION, SAVING, PREDICTING, ION IMPLANTATION, AND TESTING.

(3160) TITLE -- ION IMPLANTED THIN FILM TRANSISTORS

PROBLEM -- PROBLEMS FOR MANUFACTURING THIN FILM TRANSISTORS FOR USE 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.
COMMODITY -- SNSD-S

(CONTINUED)

(10/4) TITLE: PROG METH F/MILIMETER MONOPULSE ANTENNA F/DIR FIRE APPL

PROBLEM = SENSOR ANTENNA SYSTEM NEEDS RELATIVE ALIGNMENT FACTORS BETWEEN
DIELECTRIC LENS, MOVABLE REFLECTOR AND ACTIVE ANTENNA ELEMENT REQUIRING
ANTENNA FEED UNITS BUILT BY MANY.

SOLUTION = ESTABLISH METHODOLOGY FOR CONSTRUCTING MONOPULSE ANTENNA INTO A
COMPATIBLE PACKAGE WITH A 5 MILIMETER BEAM WIDTH AT 94 GHz.

(10/5) 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 SERRING; SAWING
AND TRIANGULATION FOR CUTTING & IN DISCS FROM 3 IN WAFERS. REDUCE STRESS AND
PREVENT FAILURES.

(10/5) TITLE: MFG METH AND TECH F/PIN DIODES AT MILLIMETER WAVE FREQUENCY

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 FEP PRECISE DIMENSIONS.

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 SYST.

(11/5) TITLE: HIGH PERFORMANCE MMW IMPACTS USING THIN SILICON

PROBLEM = COST AND PERFORMANCE OF MILLIMETER WAVE (MMW) IMPATT DIODES HAVE
POOR REPRODUCIBILITY RESULTING IN LOW DEVICE YIELDS.

SOLUTION = ESTABLISH METHODOLOGY THINKING SILICON TO LESS THAN 10 MICRONS AND
DOPING CONTROLS UTILIZING LOW TEMPERATURE PROCESSES.

(11/5) TITLE: IMPROVED SAWDUST DETECTOR FABRICATION FOR INFRARED SEEKERS

PROBLEM = FASCINATING THE DETECTORS INTO A SANDWICH CAUSES LOWER SENSITIVITY,
CROSS TALK, POOR TRANSMISSION, AND PROVIDES A DEFECT TO THICK FOR A COMMON
FOCUS.

SOLUTION = ESTABLISH METHODOLOGY FOR PRODUCING DETECTOR OPERATING IN TWO
SPECTRAL BANDS FROM ONE PIECE OF MATERIAL.
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<tr>
<th>COMPONENT</th>
<th>-- SENSORS</th>
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<tr>
<td>(3/77) TITLE</td>
<td>IMPROVED MANF. PROCESS FOR UNDERFIRE ELECTRONIC SUBSYSTEM</td>
<td>755 375</td>
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<tr>
<td>PROBLEM</td>
<td>PRESENT MANUFACTURING PROCESSES SUBSTANTIALLY INCREASE THE COST OF HOEMING SUBSYSTEMS.</td>
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<tr>
<td>SOLUTION</td>
<td>INVESTIGATE VOLUME METHODS FOR PRODUCING ELECTRONIC HOEMING SUBSYSTEMS.</td>
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<tr>
<td>(3/77) TITLE</td>
<td>AUTOMATIC INERIAL SENSOR FABRICATION</td>
<td>350 350</td>
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<tr>
<td>PROBLEM</td>
<td>INERTIAL SENSOR FABRICATION REQUIRES PRECISION MACHINING AND ASSEMBLY METHODS WITH SEVERAL IERATIONS, ALL OF WHICH INCREASE COST.</td>
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<tr>
<td>SOLUTION</td>
<td>ESTABLISH AUTOMATIC FLUID FILL STATION AND SET UP PILOT STATION FOR AUTOMATIC BALANCING OF GYROS BY LASER REMOVAL OF MATERIAL</td>
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<td>COMPONENT</td>
<td>-- WINDOWS/RADOMES</td>
<td>755</td>
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<tr>
<td>(3/77) TITLE</td>
<td>PRODUCTION OF COMPOSITE RADOM STRUCTURES</td>
<td>755</td>
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<tr>
<td>PROBLEM</td>
<td>THE BASIC MATERIAL FOR COMPOSITE RADOMES IS EXPENSIVE ($25/LB). THE FABRICATION PROCESSES FOR PRODUCING THE RADOM STRUCTURE ARE COMPLEX AND EXPENSIVE, WITH SOME PROCESSES BEING PROPRIETARY.</td>
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<td>SOLUTION</td>
<td>ESTABLISH GLASSFIBER REINFORCED TEFLOM AS A REPLACEMENT FOR THE CURRENT DUAL WALL FOAMED PROPRIETARY MATERIAL (TURVO). OPTIMUM PROCESSING WILL BE SELECTED BASED ON MECHANICAL PROPERTIES AND SLED TEST RESULTS AND WILL BE SCALABLE.</td>
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<tr>
<td>(3/77) TITLE</td>
<td>IMPROVED FABRICATION OF ECMF RADAR MODULES</td>
<td>495 370</td>
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<tr>
<td>PROBLEM</td>
<td>DOM PHASED ARRAY RADARS TYPICALLY REQUIRE 25,000 RADIATING ELEMENTS PER SYSTEM. MANUFACTURING PROCESSES ARE NEEDED TO ASSEMBLE THESE ELEMENTS INTO STANDARD CLUSTERS (MODULES) WHICH WILL BE USED AS THE BASIC BUILDING BLOCK FOR THE DOMED RADAR SYST.</td>
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<tr>
<td>SOLUTION</td>
<td>MANUFACTURING TECHNIQUE INCLUDING ETCHING, PUNCHING, MOLDING AND FORMING WILL BE ESTABLISHED FOR PHASED LINE CIRCUITS AND GROUND PLANS. SOFTWARE WILL BE DEVELOPED FOR NUMERICAL CONTROLLED PLANAR PRINTING, ETCHING, MASK PUNCHING AND TESTING.</td>
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<tr>
<td>(3/77) TITLE</td>
<td>RF AND LASER HARDENING OF MISSILE DOMES</td>
<td>440 421</td>
</tr>
<tr>
<td>PROBLEM</td>
<td>CURRENT DOMES ARE SUSCEPTIBLE TO DAMAGE BY LASER ENERGY AND ALSO PERMIT LASER AND RADIO FREQUENCY ENERGY TO DAMAGE THE DETECTOR.</td>
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<tr>
<td>SOLUTION</td>
<td>DEVELOP A SPRAYING METHOD TO APPLY INOXIUM BRAZER FIBERGLASS AND 사랑의 MATERIAL TO THE INSIDE IF THE GLASS OR PLASTIC RADOME. USE COATINGS THAT PASS ONLY UP TO .15 MICRON WAVELENGTH.</td>
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COMPONENT -- WINDOWS/ADOMES

(2176) TITLE -- MANUFACTURE OF SILICON NITRIDE ADOMES

PROBLEM -- THERE IS NO EXISTING ECONOMICAL MANUFACTURING PROCESSES FOR LARGE
ADOMES FROM CURRENT MATERIALS.

SOLUTION -- SLIPCAST SILICON POWDER AND FIRE THE ADOME IN A NITROGEN
ATMOSPHERE.

(5946) TITLE -- IMPROVED PROCESSES FOR MIRRORS AND WINDOWS FOR HE LASERS

PROBLEM -- MIRRORS AND WINDOWS FOR HIGH ENERGY LASER APPLICATION ARE EXPENSIVE
TO FABRICATE AND HAVE FOGGED REFLECTIVITY.

SOLUTION -- ESTABLISH METHODS FOR PRODUCING MIRRORS AND
WINDOWS AT LOWER COST AND GREATER UNIFORMITY.

(6146) TITLE -- IMPROVED PCML MATERIALS

PROBLEM -- THE CURRENT PROCESS FOR THE PRODUCTION OF SILICON NITRIDE, A BATCH
PROCESS, STARTS WITH HIGH PURITY SILICON AND TAKES PLACE AT 1400 C IN AN
OXGEN FREE ATMOSPHERE FOR SEVERAL DAYS.

SOLUTION -- THE PROPOSED PROCESS, RECENTLY DEVELOPED AT AMMS, USES LOW GRADE
Ferro-Silicon AND OPERATES AT 1350-1350 C IN A CONTINUOUS PROCESS. THE
MATERIAL PRODUCED IS EQUAL TO CURRENTLY PRODUCED SILICON NITRIDE.

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COMPONENT -- AIRFRAMES/COMPOSITES

(7726) TITLE -- WIF PROCESSES FOR FUSED SILICA FIBERS

PROBLEM -- THERE IS NO COMMERCIAL SOURCE FOR HIGH PURITY FUSED SILICA FIBERS.

SOLUTION -- SCALE-UP PROCESSES USED FOR FIBER OPTICS APPLICATIONS AND SET UP A
MINI PRODUCTION LINE TO PRODUCE FUSED FIBERS OF STRUCTURAL QUALITY.

(7316) TITLE -- LOW COST WIF TECHNIQUES FOR HI PRODUCTION MISSILE VANS (CAM)

SOLUTION -- METAL CONTROL VANS/FINS AND MISSILE FAIRINGS CAUSE HIGH
REPAIR AND MANUFACTURING COSTS AND LONG LEAD TIME.

FUNDING ($000)

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(5516) TITLE -- AUTOMATION OF COMPOSITE MATERIALS OFFER AN OPPORTUNITY TO MEET LOW
WEIGHT AND PRODUCTION EFFORT PROVIDES FOR AUTOMATION OF
WEIGHT REDUCTION INTEGRATED INTO AN MC FAB LAYING MACHINE.
COMPONENT -- AIRFRAMES-COMPOSITES (CONTINUED)

<table>
<thead>
<tr>
<th>ICOS</th>
<th>TITLE</th>
<th>LOW COST CARBON-CARBON NOSE TIPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBLEM</td>
<td>THE WEAVING PROCESS TO FABRICATE CARBON-CARBON NOSE TIP PREFORMS IS LABOR INTENSIVE BECAUSE OF THE FINISHING CENTER-TO-CENTER YARN SPACINGS. IN ADDITION, PREFORMS USE EXPENSIVE GRAPHITE YARN AND REQUIRE LONG IMPREGNATION TIMES.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION</td>
<td>DEVELOP OPTIMAL MANUFACTURING PROCEDURES FROM LOWER COST MATERIALS, SUCH AS E-RESIN AND T-300 CARBON FIBERS. UTILIZATION OF SHORTER DENSIFICATION CYCLES PREFORMS, AND FIPER SPACING WII PROVIDE THE MEANS FOR REDUCING CYCLE TIMES.</td>
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<table>
<thead>
<tr>
<th>ICOS</th>
<th>TITLE</th>
<th>HIGH ANGLE TAPE WRAPPED HEATSHIELDS</th>
</tr>
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<tbody>
<tr>
<td>PROBLEM</td>
<td>DATA HAS SHOWN THAT THE FRICTION PERFORMANCE OF TAPE WRAPPED HEATSHIELDS IMPROVES AS THE SHIMPLE ANGLE INCREASES ABOVE 30 DEGREES. CURRENT PFG TECHNIQUES DO NOT LEAD THEMSELVES TO HIGH WRAP-ANGLE HEATSHIELDS.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION</td>
<td>DEVELOP IMPROVED WRAPPING TECHNIQUES TO CURRENT TAPE WRAPPING EQUIPMENT AND PROCESSING TECHNOLOGY.</td>
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</tbody>
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COMPONENT -- COMPONENTS

<table>
<thead>
<tr>
<th>ICOS</th>
<th>TITLE</th>
<th>REAL TIME ULTRASONIC IMAGING</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBLEM</td>
<td>EXISTING ACOUSTICAL HологOGRAPH INSPECTION SYSTEMS PRODUCE UNSATISFACTORY VITTO IMAGES DUE TO POOR RESOLUTION, SIGNAL NOISE, AND LOW SPATIAL FREQUENCY</td>
<td></td>
</tr>
<tr>
<td>SOLUTION</td>
<td>A 5 CHANNEL FILELINE PROCESSOR WITH ASSOCIATED 512X512B MEMORIES WITH 1 MS FRAME/SEC DISPLAY CAPABILITY. THIS SYS WOULD ELIMINATE AERRATION, IMPROVING CONTRAST, AND REDUCE SIGNAL NOISE.</td>
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<thead>
<tr>
<th>ICOS</th>
<th>TITLE</th>
<th>MANUFACTURING TECHNOLOGY FOR DIF CASTING</th>
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<tbody>
<tr>
<td>PROBLEM</td>
<td>WEIGHT AND SPACE CONSTRAINTS HAVE RESULTED IN COMPLEX AND HIGH DENSITY CONFIGURATIONS OF METAL PARTS WHICH ARE MACHINED.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION</td>
<td>ESTABLISH AND PROVE-OUT DIF CASTING TECHNOLOGIES FOR THESE COMPLEX CONFIGURATIONS.</td>
<td></td>
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COMPONENT -- FORMING

<table>
<thead>
<tr>
<th>ICOS</th>
<th>TITLE</th>
<th>CONFORM EXTRUSION PROCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROBLEM</td>
<td>CONSIDERABLE COSTS ARE INCURRED IN TRANSPORTATION, DAMAGE AND LOSS OF SEMI-FINISHED PARTS.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION</td>
<td>AN INVESTIGATION OF CONFORMAL PARTS ARE DETERMINED IF THEY CAN BE PRODUCED BY CONFORMAL PROCESS.</td>
<td></td>
</tr>
</tbody>
</table>
COMPONENT -- MACHINING

(1071) TITLE -- COMPUTERIZED PROC. PROC. PLAN FOR MACH CYLINDRICAL PARTS (CAM)

PROBLEM - PRESENT MANUAL METHOD FOR PRODUCTION PROCESS PLANNING OF MACHINED CYLINDRICAL METAL COMPONENTS ARE INADEQUATE DUE TO HIGH PROCESS PLANNING COSTS AND A LACK OF STANDARDIZATION.

SOLUTION - DEVELOP A COMPUTER SOFTWARE SYSTEM FOR PROCESS PLANNING OF MACHINED CYLINDRICAL PARTS. THE SYSTEM WILL BE MANUFACTURER-INDEPENDENT AND WILL INCORPORATE PROCESS DECISION MODELING.

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**CATEGORY**

**PROPULSION SYSTEM**

---------

COMPONENT -- MOTOR CASES

(1074) TITLE -- OPTIMIZED MANDREL FAB AND UTILIZATION F/COMP MOTOR CASES

PROBLEM - OPTIMIZING PRODUCTION PROCEDURES TO OBTAIN LOWEST UNIT COST WHILE MAINTAINING RELIABILITY IN FABRICATION.

SOLUTION - ESTABLISH PRODUCTION PROCEDURES AND PRODUCTION RATES FOR MANDREL FABRICATION. THIS WILL PROVIDE PRODUCTION ENGINEERING DATA ESSENTIAL TO CURRENT AND FUTURE MOTOR COMPONENT REQUIREMENTS.

(1074) 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.

(1324) TITLE -- PRODUCTION PROCESS FOR ROTARY ROLL FORMING

PROBLEM - MECHANICALLY JOINING OF WELDING A CONVENTIONAL CLOSURE TO COMMERCIAL TUBING IS EXPENSIVE.

SOLUTION - DEVELOP METHODS FOR PRODUCING INTEGRAL NOZZLES WITH TUBULAR PRODUCTS USING ROTARY ROLL FORMING TECHNIQUES.

---------
COMPONENT -- MOTOR CASES

(1019) TITLE - THERMO-MECMEICAL METHODS FOR HIGH STRENGTH STEEL MOTOR CASES

PROBLEM - THE MANUFACTURING PROCESSES FOR HIGH STRENGTH ROCKET MOTOR CASES FOR THE MLRS (FORMERLY GRS) RESULT IN A RESIDUAL STRESS PATTERN (RADIAL) THAT DOES NOT TAKE FULL ADVANTAGE OF THE MATERIAL PROPERTIES.

SOLUTION - THIS PROGRAM WOULD DEVELOP AUTOMATED PROCESSES TO PERFORM THERMO-MECMEICAL FABRICATION OF THE STEEL MOTOR CASES. THIS PROCESS WILL PRODUCE A MORE DESIRABLE STRESS PATTERN FOR INCREASED PERFORMANCE.

COMPONENT -- MOTOR COMPONENTS

(1016) TITLE - PRODUCTION METHODS FOR WST TURBINE ROTORS

PROBLEM - TURBINE ROTORS ARE SUBJECT TO STRESS AND FATIGUE LEVELS AS ENGINE THRUST INCREASES.

SOLUTION - IMPLEMENT FUTURE PRODUCTION PROGRAM TO ESTABLISH COST EFFECTIVE PRODUCTION AND TEST TECHNIQUES TO FABRICATE TURBINE ROTORS WITH INCREASED STRESS AND FATIGUE LEVELS.

(1015) TITLE - LOW COST BRAIDED ROCKET MOTOR COMPONENTS

PROBLEM - ROCKET MOTOR CASES TO MEET DESIGN-TO-COST PRODUCTION GOALS HAVE DICTATED REEVALUATION OF MATERIALS AND PROCESSES. MISSILE CASES COMPARE 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.

(1017) TITLE - REPLACEMENT OF ASBESTOS IN ROCKET MOTOR INSULATIONS

PROBLEM - PRESENT ASBESTOS CONTAINING INSULATORS CAN NO LONGER BE MANUFACTURED AFTER 1970 DUE TO THEM BEING IDENTIFIED AS A CARCINOGEN. THUS THE COST HAS LEFT THE CAPABILITY OF USING INSULATING MATERIALS THAT HAS PROVEN TO BE AN EXCELLENT THERMAL BARRIER.

SOLUTION - FILLER MATERIALS OTHER THAN ASBESTOS ARE AVAILABLE. FIBER GLASS AND SILICA HAVE BEEN USED IN SPECIALIZED APPLICATIONS AND COLUMS SHOW PROMISING MATERIALS SITES AND MOTOR TEST VERIFICATION MUST BE DONE BEFORE A SUBSTITUTE MATERIAL CAN BE USED.

(1018) TITLE - COAL AS REPLACEMENT IN MARAGING STEEL FOR ROCKET MOTOR COMPONENTS

PROBLEM - CURRENT HIGH PERFORMANCE ROCKET MOTOR COMPONENTS UTILIZE MARAGING STEELS IN LARGE QUANTITIES. COAL, ONE OF THE KEY INGREDIENTS COMES FROM POLITICAL-ALLY SENSITIVE AREAS AND IS BECOMING DIFFICULT TO OBTAIN.

SOLUTION - OPTIMIZE MILL PROCEDURES AND EVALUATE IN A ROCKET MOTOR THE NEW COAL AS A REPLACEMENT STEEL ALLOY.
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<tr>
<th>COMPONENT — MOTOR COMPONENTS</th>
<th>(CONTINUED)</th>
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<tbody>
<tr>
<td><strong>(1057)</strong> TITLE — APPLICATION OF COMMERCIAL GRADE KEVLAR TO ROCKET MOTOR COMP</td>
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<tr>
<td><strong>PROBLEM</strong> - CURRENT MILITARY ROCKET MOTOR COMPONENTS USE KEVLAR 49 FIBER IN LARGE QUANTITIES; THIS AEROSPACE GRADE IS VERY COSTLY.</td>
<td></td>
</tr>
<tr>
<td><strong>SOLUTION</strong> - OPTIMIZE MILL PROCEDURES AND MOTOR COMPONENT PROCESSING METHODOLOGY FOR COMMERCIAL GRADE KEVLAR ARE EVALUATE THE PERFORMANCE IN A ROCKET MOTOR COMPONENT ENVIRONMENT</td>
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<thead>
<tr>
<th>COMPONENT — NOZZLES</th>
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<tbody>
<tr>
<td><strong>(3423)</strong> TITLE — LOW COST/HIGH PERFORMANCE FIBROUS GRAPHITE ROCKET NOZZLES</td>
<td>300 602</td>
</tr>
<tr>
<td><strong>PROBLEM</strong> - ROCKET SYSTEMS USING HIGH PERFORMANCE CARBON/CONIN OR PYROLYTIC GRAPHITE NOZZLES INCUR HIGH COMPONENT COST.</td>
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<tr>
<td><strong>SOLUTION</strong> - THIS PROJECT WILL SCALE UP THE FIBROUS GRAPHITE PROCESS TO MAKE FULL-SCALE NOZZLE COMPONENTS AND WILL EXTEND NOZZLE TEST DATA.</td>
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<thead>
<tr>
<th>COMPONENT — PROPELLANTS</th>
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<tr>
<td><strong>(1055)</strong> TITLE — DEMONSTRATION OF LOW COST CARBON FIBER MODIFIER</td>
<td>750</td>
</tr>
<tr>
<td><strong>PROBLEM</strong> - NHC IS USED AS A BALLISTIC MODIFIER FOR SOLID ROCKET PROPELLANTS BUT IS VERY EXPENSIVE DUE TO A LOW YIELD PROCESS.</td>
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</tr>
<tr>
<td><strong>SOLUTION</strong> - INVESTIGATE ALKyne PROCESS FOR PRODUCTION OF NHC TO REDUCE NET PRODUCT COST.</td>
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</tr>
<tr>
<td><strong>(1057)</strong> TITLE — LOW COST EXTRUSIBLE PYROTECHNIC PELLETING PROCESS</td>
<td>650</td>
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<tr>
<td><strong>PROBLEM</strong> - PELLETING OPERATION IS A FUNCTION OF PELLET SIZE: THE SMALLER THE PELLET THE GREATER THE COST.</td>
<td></td>
</tr>
<tr>
<td><strong>SOLUTION</strong> - DEVELOP EXTRUSIBLE COMPOSITIONS WITH THE SAME IGNITION CHARACTERISTICS AS PELLETS; DESIGN CONTINUOUS OPERATION TO PRODUCE VARIOUS SIZED PELLETS.</td>
<td></td>
</tr>
<tr>
<td><strong>(1065)</strong> TITLE — PROD OF NITRO POLYMERS FOR SMOKLESS PROPELLANTS</td>
<td>650</td>
</tr>
<tr>
<td><strong>PROBLEM</strong> - NITROCELLULOSE PLASTICIZER HINDER HAS A VERY LIMITED FLEXIBILITY FOR FORMULATION OF SMOKLESS PROPELLANT COMPOSITIONS.</td>
<td></td>
</tr>
<tr>
<td><strong>SOLUTION</strong> - MAKE PRODUCTION OF POLYETHYLENE GLYCOL NITRAMINE POLYMER COMMERCIALLY AVAILABLE.</td>
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</tr>
</tbody>
</table>
COMPONENT -- PROPELLANTS

(1544) TITLE -- CONTINUOUS PROCESS FOR PROPELLANT MANUFACTURE

PROBLEM - PROPELLANT MANUFACTURE IS GENERALLY A BATCH PROCESS WITH INHERENT PROBLEMS. CURE ACCELERATORS MUST BE AVOIDED SINCE THEY SHORTEN BOLT LIFE. THE PROCESS HAS HIGH LABOR REQUIREMENTS. HIGH VISCOSITIES RESULT IN DISCARDING THE BATCH.

SOLUTION - A CONTINUOUS MIXING AND MOLD LOADING PROCESS WILL REDUCE PRODUCTION LABOR AND FACILITIES, AND IMPROVE PROPELLANT QUALITY AND RELIABILITY. SAFETY PROBLEMS RELATED TO QUANTITY DISTANCES CAN BE MINIMIZED.

(3517) TITLE -- CASTING OF PROPELLANTS

PROBLEM - THE END BUILDING SUSTAIN CHAIN FOR STINGER IS PRESENTLY CAST AND CURVED. MACHINED, IN HOLLOW WITH 200-400 WHICH IS FOSSDI TO EXTERIOR OF GRAIN.

SOLUTION - DEVELOP CAST-IN-BOOT PROCESS TO CAST CHAIN DIRECTLY INTO INHIBITOR BOOT.

(3346) TITLE -- NON-DESTRUCTIVE TESTING (NDT) OF PROPELLANTS

PROBLEM - THE FULL COMPLEMENT OF NDT TEST BY CURRENT METHODS IS TOO EXPENSIVE TO BE USED.

SOLUTION - DEVELOP A COMPUTERIZED SYSTEM FOR THE ASSESSMENT OF NDT DATA.

(3444) TITLE -- MANUFACTURE OF ULTRAFINE IIUMIUM PERCHLORATE

PROBLEM - PURING RATES OF SPECIFIC SYSTEMS WILL OFTEN BE OUT OF SPECIFICATIONS BECAUSE OF THE SLAP MANUFACTURE AND REPRODUCIBILITY PROBLEMS.

SOLUTION - THIS PROJECT WILL ESTABLISH A REPRODUCIBLE METHOD OF GRINDING USUAL, EVALUATE THE QUALITY AND REPRODUCIBILITY IN HIGH RATE COMPOSITE PROPELLANT FORMULATIONS AND ESTABLISH QUALITY CONTROL AND PROCESS SPECIFICATIONS.

(3447) TITLE -- SCALE UP AND LUMO FOR THE NFCC OF CARBONATE FROM WASTE PROP

PROBLEM - THE PRODUCTION OF NFCC CARBONATE (NFCC) RESULTS IN UP TO 10% REJECTED MATERIAL BECAUSE IT WILL NOT MEET HALLISTIC RATE REQUIREMENTS.

SOLUTION - THE SCRAP PROPELLANT CAN BE DISSOLVED IN FENTANE, DRIED AND DISTILLED TO PURIFY IT. THE NFCC THAT WOULD BE SCRAPED IS THUS RECOVERABLE. THIS PROJECT WILL CALL UP THE LABORATORY PROCESS SUCH THAT THE TOTAL PRODUCTION CAN BE INCREASED.

(3448) TITLE -- RECOVERY OF LIPOFLATE IN THE MANUFACTURE OF NFCC

PROBLEM - THERE IS AN 1% LOSS OF UNREACTED LIPOFLATE FROM THE PROCESS USED TO PRODUCE NFCC.

SOLUTION - RECOVER AND RECYCLE THE LIPOFLATE WITH A DIMETHYLACETYL CHLORIDE PROCESS.
**COMPONENT -- PROPELLANTS**

(3449) TITLE -- OPTIONAL PROPELLANT INGREDIENTS

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<td>250</td>
<td>431</td>
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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 ISOPHRONONE DIISOCYANATE (IPDI) CAN BE MADE IN A BATCH PROCESS WITHOUT USING PHOSGENE. THIS LABORATORY PROCESS WILL BE SCALED UP.

(3456) TITLE -- SCALE UP & DEMONSTRATION OF A PROCESS FOR DICORATE

PROBLEM - THE PRESENT PROCESS IS A BATCH OPERATION AND BECAUSE OF THE DIFFICULTY IN CONTROLLING THE CHEMISTRY THE BATCHES ARE SMALL RESULTING IN HIGH LABOR COSTS.

SOLUTION - IT IS ESTIMATED THAT DICORATE CAN BE PRODUCED USING INEXPENSIVE RAW MATERIALS - FORMALDEHYDE METHANOL AND SODIUM HYDROXIDE IN A SIMPLE CONTINUOUS PROCESS THAT IS EASILY CONTROLLED. A PILOT FACILITY WILL BE BUILT TO DEVELOP THE PROCESSES.

**COMPONENT -- ELECTRICAL TEST EQUIPMENT**

(3116) TITLE -- ENGINEERING FOR CALIBRATION EQUIPMENT

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<td>337</td>
<td>661</td>
<td>800</td>
<td>800</td>
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</table>

PROBLEM - MEASUREMENT SCIENCES OF 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.

**COMPONENT -- ELECTRONIC COMPONENTS**

(3161) TITLE -- ELECTRICAL TEST AND SCREENING OF CHIPS

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<thead>
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<th>PRIOR</th>
<th>F1</th>
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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.
COMPONENT -- ELECTRONIC COMPONENTS

(10.76) 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 -- MULTIPLY EXISTING OPTICAL PATTERN RECOGNITION EQUIPMENT FOR COMPONENT AND ADD NOU ALIGNMENT TO RECOGNIZE AN AVERAGE 50 TO 55 DIFFERENT DEVICES PER SUBSTRATE.

(10.25) TITLE -- AUTOMATI TESTING OF SUBSTRATES

PROBLEM -- MULTILAYER HYBRID SUBSTRATE TEST METHODS ARE MECHANICAL, USING A MICROFIVE 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.

(32.1) TITLE -- HIGH TEMPERATURE OPERATING TESTS FOR MICROCIIRCUITS

PROBLEM -- LIFE TESTS ON SEMICONDUCTOR DEVICES ARE IMPractical DUE TO THE HUNDREDS OF THOUSANDS OF TEST HOURS REQUIRED.

SOLUTION -- IMPLEMENT HIGH TEMPERATURE OPERATING TESTS AS EARLY IN THE MANUFACTURING CYCLE AS FEASIBLE.

(35.2) TITLE -- INFRARED ELEMENT TESTING

PROBLEM -- A SYSTEM OPTICAL ELEMENTS ARE SPECIFIED IN TERMS OF MIL-O-13850 WHICH REQUIRED SUBJECTIVE JUDGMENT.

SOLUTION -- ESTABLISH A SUPPLEMENT TO MIL-O-13850, OPTICAL DESIGN GUIDANCE FOR FUNCTION TESTING, STANDARD TESTS AND EQUIPMENT.

COMPONENT -- GENERAL

(10.52) TITLE -- ACOUSTIC EMISSION OF METAL CASE WELD FABRICATION

PROBLEM -- FABRICATION OF ROCKET MOTOR CASES BY MELT AND WELD PROCESS IS UNATTRACTION BECAUSE OF HIGH COST FROM EXTENSIVE NON-DESTRUCTIVE INSPECTION TECHNIQUES REQUIRED. A TECHNIQUE IS TO DETECT EFFECTS AS THEY FORM THUS PERMITTING IMMEDIATE REPAIR.

SOLUTION -- DEVELOP AN ONLINE, REAL TIME ACOUSTIC EMISSION WELD MONITORING TECHNIQUE. THIS PROJECT WILL EXTEND THE RESULTS OF AN MTT PROJECT TO THE FULL PRODUCTION CONFIGURATION.
COMPONENT -- GENERAL

(continued)

(1074) TITLE - CHEMICAL CHARACTERIZATION BY SPECTROSCOPY

PROBLEM - INFRARED ANALYSIS OF COMPOSITE RESIN CONSTITUENTS SEPARATED BY HIGH PRESSURE LIQUID CHROMATOGRAPHY (HPLC) IS LABOR INTENSIVE AND THUS EXPENSIVE.

SOLUTION - AUTOMATE THE COLLECTION, PREPARATION, AND INFRARED ANALYSIS OF RESIN CONSTITUENTS SEPARATED BY HPLC.

COMPONENT -- X-RAY AND X-RAY

(3241) TITLE - AUTOMATIC X-RAY HEADER TESTING EQUIPMENT FOR 3D X-RAYS

PROBLEM - X-RAY IS LIMITED TO A TWO DIMENSIONAL FORMAT AND IS DEPENDENT ON THE TRAINING AND JUDGEMENT OF THE INSPECTOR.

SOLUTION - AUTOMATE THE ANALYSIS OF X-RAY RESULTS AND PROVIDE DEPTH PERSPECTIVE BY PARALLEL OR HOLOGRAPHIC TECHNIQUES.
TANK-AUTOMOTIVE COMMAND
(TACOM)
<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Armor</td>
<td>210</td>
</tr>
<tr>
<td>Body Frame</td>
<td>212</td>
</tr>
<tr>
<td>Drive Systems</td>
<td>215</td>
</tr>
<tr>
<td>General</td>
<td>218</td>
</tr>
<tr>
<td>Suspension System</td>
<td>221</td>
</tr>
<tr>
<td>Track</td>
<td>223</td>
</tr>
</tbody>
</table>
US ARMY TANK-AUTOMOTIVE COMMAND

(TACOM)

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, combination type armor and the application of spall suppressive armor to the interior walls of combat vehicles 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.

In general support of combat and tactical vehicles, TACOM is actively pursuing manufacturing technology in various areas. Projects are included for non-corrosive materials, chemical joining techniques, use of advanced microprocessors and multiplexing, high speed machining, and flexible machining pilot lines for batch production. Several projects are also proposed for the CAM area; these include a new machinery and equipment data base, computer simulation of production, application of adaptive control technology to vehicle components, and extension of CAD/CAM principles to spare parts manufacture.

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 advanced casting techniques for integrally cast compressors, automated assembly line welding techniques, 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 general, rubber pads, shoes, track sprockets, wedges and suspension components. 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, suspension systems, and seats and fuel tanks. Within these areas, work will be accomplished in elastic reservoir molding of reinforced trailer module bodies to reduce weight and costs, rapid curing automotive paints, new fungicidal paints, automated and computer controlled processes for joining metals with adhesives, plastic cab tops, maintenance free batteries with high impact resistance, and non-corrosive, lightweight non-structural tactical vehicle components.
<table>
<thead>
<tr>
<th>Category</th>
<th>FY81</th>
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COMMAND FUNDING
(THOUSANDS)

SUMMARY
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<td>TITLE: ATTACHMENT OF COMBUSTION AIRPLANE TO CURRENT VEHICLES</td>
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<td>6 (5.6) TITLE -- HIGH DEPOSITION WELDING PROCESSES FOR ARMOR</td>
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<td>PROBLEM -- WELDING IS LABOR INTENSIVE AND HIGH COST IT IS A MAJOR COST DRIVER IN ARMOR VEHICLE MANUFACTURE.</td>
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<td>SOLUTION -- HIGH DEPOSITION WELDING PROCESSES WILL PERMIT WELDING TO BE ACCOMPLISHED MORE RAPIDLY THEREBY REDUCING MANPOWER REQUIREMENTS AND INCREASING PRODUCTIVITY.</td>
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<td>PROBLEM -- MATERIALS AND MANUFACTURING PROCESSES EMPLOYED IN THE MFG OF THE XM-1 CAN BE IMPROVED BY INCORPORATING NEW TECHNOLOGIES TO THE CURRENT SYSTEM. THIS WILL ENABLE THE XM-1 TO BE MANUFACTURED MORE ECONOMICALLY.</td>
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<td>SOLUTION -- IMPROVE PROCESSES FOR XM-1 YFC. THESE INCLUDE THERMAL CUTTING, AUTOMATED METALLIZING, HI-CAST HP TUNGSTEN NOZZLES, RSR NICKEL BASE SUPER ALLOYS, MONOCRYSTAL ALLOYS, CERAMIC COMPOSITES, THERMALLY ASSISTED MACHINING, ETC.</td>
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<td>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.</td>
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<td>SOLUTION -- IMPROVE PROCESSES FOR FVS MFG. THESE INCLUDE CAST ALUM COMPONENTS, LATERAL HEAT TREAT, SELF THREADING FASTENERS, ADHESIVE BONDING, PLASMA ARC WELDING, ETC.</td>
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<td>20 (1) TITLE -- PROVIDE PROTOTYPE ROBOTS FOR AUTOMATED BLAST CLEANING</td>
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<td>PROBLEM -- MULLS OF VEHICLES ARE BLAST CLEANED TO REMOVE OIL, PAINT AND RUST PRIOR TO PAINTING. THE CURRENT METHOD IS MANUAL, LABOR INTENSIVE, TIME CONSUMING, AND CREATES AN UNHEALTHY SITUATION FOR THE WORKERS.</td>
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<td>SOLUTION -- A FASTER, MORE PRODUCTIVE, AND MORE PRECISE BLAST CLEANING OPERATION WILL BE DEVELOPED USING INDUSTRIAL ROBOTS. A ROBOT SYSTEM USING THESE ROBOTS CONCURRENTLY WILL BE DESIGNED, INSTALLED, DEBUGGED, AND PROVEN OUT.</td>
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<td>24 (5) TITLE -- JOINING DISSIMILAR METALS</td>
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<td>PROBLEM -- CURRENT JOINING TECHNIQUES MISTY EMPLOY ONE TYPE OF METAL FOR WELDING.</td>
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<td>SOLUTION -- JOINING DISSIMILAR METALS WILL BE INVESTIGATED. COMBINATION MECHANICAL AND WELD JOINTS WILL ALSO BE STUDIED.</td>
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<td><strong>(6.14) TITLE - FOUNDRY CASTING PROCESSES USING FLUID FLOW &amp; THERMAL ANALYSIS</strong></td>
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<td>PROBLEM - FOUNDRY CASTING PROCESSES ARE WASTEFUL OF RAW MATERIALS AND ENERGY.</td>
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<td>SOLUTION - OPTIMIZE CASTING PROCESSES BY DIGITAL COMPUTER ANALYSIS OF ADVANCED FLUID FLOW AND THERMAL ACTIVITY.</td>
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<td><strong>(6.15) TITLE - HEAVY ALUMINUM PLATE FABRICATION</strong></td>
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<td>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.</td>
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<tr>
<td>SOLUTION - ESTABLISH THE CAPABILITY TO CUT HEAVY ALUMINUM PLATE RAPIDLY USING PLASMA ARC WITH NUMERICAL CONTROLS. PROCESS PARAMETERS WILL BE ESTABLISHED FOR HIGH DEPOSITION WELDING PROCESSES.</td>
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<td><strong>(6.16) TITLE - WELDING SYSTEMS INTEGRATION</strong></td>
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<td>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.</td>
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<td>SOLUTION - UNDERWRITE A COORDINATE PROGRAM TO INTEGRATE EXISTING EXPERTISE AND TECHNOLOGY TO ADDRESS ONE APPLICATION (MI HULL). EXPERTISE WILL BE IN AREAS OF WELDING PROCESS CONTROL, SENSOR TECHNOLOGY, STRESS ANALYSIS, AND COMPUTER CONTROL.</td>
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<td><strong>(6.17) TITLE - PERMANENT SPLIT MOLD FOR NET SHAPE STEEL CASTINGS</strong></td>
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<td>PROBLEM - MANY PARTS UNIQUE TO THE ARMY NEEDS ARE FORGINGS WHICH REQUIRE EXPENSIVE AND EXTENSIVE MACHINING TO FINISH.</td>
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<td>SOLUTION - PERMANENT PLASTIC CASTING PROCESS IS ABLE TO PRODUCE CLOSE TOLERANCES, THEREBY REDUCING OR ELIMINATING MANY COSTLY FINISHING OPERATIONS.</td>
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<td><strong>(6.18) TITLE - ACQUISITION AND AUTOMATION OF ACOUSTIC EMISSION WELD MONITORING</strong></td>
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<td>PROBLEM - IN PROCESSES OF HEAVY WELDING SUCH AS WITH ARMOR, RADIOGRAPHIC INSPECTION METHODS ARE COSTLY AND NOT TOTALLY RELIABLE</td>
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<td>SOLUTION - ACOUSTIC EMISSION USE WITH HIGH EFFICIENCY, MONITOR WELD QUALITY AS THE WELD IS MADE. REPAIRS MAY BE MADE IMMEDIATELY.</td>
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* CATEGORY

**100% FRML**

* CATEGORY
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COMPONENT -- LIGHTWEIGHT/COMPOSITE STRUCTURES

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COMPONENT -- LIGHTWEIGHT/COMPOSITE STRUCTURES (CONTINUED)

(6205) TITLE--LIGHTWEIGHT TILT-UP HOOD/ENGINE ASSEMBLY

PROBLEM--CURRENT HOOD/ENGINE ASSEMBLY MADE FROM STEEL STAMPINGS ARE TOO
HEAVY FOR ONE MAN TO LIFT.

SOLUTION--REDUCE WEIGHT BY MANUFACTURING ITEMS FROM LIGHTWEIGHT FORMABLE
PLASTIC.

(6255) TITLE--EXPLOSIVE BONDING OF COMPOSITE MATERIALS

PROBLEM--REQUIREMENTS TO BOND ALTERNATE FLIES OF STEEL AND ALUMINIUM MAY BE
MET ONLY BY CUMBERSOME, EXPENSIVE AND SLOW PROCESSES.

SOLUTION--EXPLOSIVE BONDING BONDS STEEL AND ALUMINIUM QUICKLY, RELIABLY, AND
CAN BE APPLIED TO ARMOR FABRICATION.

COMPONENT -- MISCELLANEOUS COMPONENTS

(5819) TITLE--TACTICAL VEHICLE STORAGE BATTERY

PROBLEM--THE MAJOR CAUSE OF TACTICAL VEHICLE BATTERY FAILURE IS BATTERY
CONTAINER LEAKAGE.

SOLUTION--PROVIDE NEW HIGH IMPACT PLASTIC CONTAINER TO INCREASE FIELD
PERFORMANCE REQUIREMENTS AND TO ACCOMMODATE THE MAINTENANCE FREE CONCEPT
ALREADY RELAIS TO IN LARGER MILITARY BATTERY SIZES.

(5669) TITLE--THREADED FASTENER-LOCKING ADHESIVES AND SEALANTS

PROBLEM--VIBRATION AND SHOCK IN MILITARY VEHICLE OPERATION DEFEATS MANY OF
THE MOST EFFICIENT LOCKING MEANS FOR THREADED FASTENERS.

SOLUTION--DETERMINE AND APPLY OPTIMIZED AVAILABLE THREAD SEALING COMPONENTS
FOR USE IN VEHICLE MANUFACTURE.

(6044) TITLE--ADHESIVES FOR TACTICAL VEHICLE ATTACHMENTS

PROBLEM--THE FEASIBILITY OF USING ADHESIVES IN PLACE OF WELDING HAS BEEN
ESTABLISHED, BUT WORK NEEDS TO BE DONE TO ESTABLISH OPTIMUM ADHESIVES AND
CONDITIONS FOR ITS APPLICATION IN THE PRODUCTION ENVIRONMENT.

SOLUTION--ESTABLISH A PROCESS FOR APPLYING ADHESIVE BONDING TO THE ATTACHMENT
OF ITEMS TO ARMORED VEHICLES.
COMPONENT -- STRUCTURAL MEMBERS

A579 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.

A607 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 -- SUSPENSION SYSTEM

A402 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 58 DOLLARS PER HOUR.

* CATEGORY *
** DRIVE SYSTEM *

COMPONENT -- ENGINE

A7115 TITLE - XM1 COMBAT VEHICLE-AGT156 TURBINE ENGINE

PROBLEM - THE NEED TO REDUCE COST (MANUFACTURING AND LIFE CYCLE COSTS) AND
IMPROVE PERFORMANCE OF THE ENGINE REQUIRES THE USE OF NEWER AND INNOVATIVE
TECHNOLOGY.

SOLUTION - NEW PROCESSES AND TECHNOLOGIES, BETTER HIGH TEMP MATERIALS, AND
REDUCED LABOR INTENSIVE MANUFACTURING OPERATIONS WILL ACHIEVE LOWER COSTS,
IMPROVED PERFORMANCE AND FUEL EFFICIENCY.
<table>
<thead>
<tr>
<th>TITLE</th>
<th>FUNDING (S&amp;D)</th>
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<tbody>
<tr>
<td>(5555) TITLE - MANUFACTURE OF ENGINE COMPONENTS OF CERAMIC</td>
<td></td>
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<tr>
<td>PROBLEM - FABRICATION OF HIGH EFFICIENCY, HIGH TEMPERATURE DIESEL ENGINES REQUIRES ADVANCED MATERIALS. ENGINES FABRICATED WITH CERAMIC COMPONENTS HAVE BEEN DEMONSTRATED IN AND OUT MANUFACTURING METHODS FOR SERIAL PRODUCTION COMPONENTS ARE LACKING.*</td>
<td></td>
</tr>
<tr>
<td>SOLUTION - RECENT RESEARCH EFFORTS INDICATE THAT ENGINE COMPONENTS FROM HIGH-STRENGTH STRUCTURAL CERAMIC (SILICON CARBIDE) ARE FEASIBLE. THIS EFFORT WILL ESTABLISH QUANTITY PRODUCTION OF CERAMIC COMPONENTS OF CONSISTENT QUALITY.*</td>
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<tr>
<td>(5609) TITLE - PROD TECH FOR FAB OF TURBINE ENGINE RECUPERATOR</td>
<td></td>
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<tr>
<td>PROBLEM - CURRENT METHOD REQUIRES A LARGE NUMBER OF WELDS TO FABRICATE COMPONENT.</td>
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<tr>
<td>SOLUTION - ESTABLISH PROCEDURE UTILIZING A LASER BEAM TO GREATLY INCREASE WELDING SPEED.</td>
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<tr>
<td>(5747) TITLE - INTEGRALLY CAST LOW COST COMPRESSOR</td>
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<tr>
<td>PROBLEM - TURBINE BLADES AND DISCS MUST HAVE ADEQUATE LOW AND HIGH CYCLE FATIGUE PROPERTIES. AXIAL COMPRESSOR STAGES ARE DESIGNED AS SEPARATELY BLADED ASSEMBLIES.</td>
<td></td>
</tr>
<tr>
<td>SOLUTION - INTEGRALLY CAST THE AXIAL COMPRESSOR STAGES AND THE CENTRIFUGAL ROTOR TO ELIMINATE MANY COSTLY MACHINING OPERATIONS.</td>
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<tr>
<td>(5749) TITLE - AUTOMATED COMPUTER CONTROL LASER MACHINING</td>
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<tr>
<td>PROBLEM - CONVENTIONAL MACHINING OF TOUGH METAL TO MACHINE MATERIALS IS VERY EXPENSIVE. RAPID TOOL WEAR AND LOCALIZED HEATING OF THE WORKPIECE IMPACT REPAIR RATES AND METALLURGICAL CHARACTERISTICS.</td>
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<tr>
<td>SOLUTION - THIS PROGRAM WILL DEVELOP TECHNIQUES FOR LASER MACHINING BY NUMERICAL CONTROL.</td>
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<tr>
<td>(6010) TITLE - JOINING OF ATTACHMENTS TO CERAMICS</td>
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<tr>
<td>PROBLEM - CURRENT METHOD OF JOINING METALS TO CERAMIC JOINTS ARE NOT RELIABLE AND HAVE POOR LIFE.</td>
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<tr>
<td>SOLUTION - INVESTIGATE USE OF JOINTS THAT ARE COMPLIANT OR USE INTERMEDIATE CONNECTING PHASE.</td>
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<tr>
<td>(6019) TITLE - GRAIN BOUNDARY IMPROVEMENT PROCESSING FOR CERAMICS</td>
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<tr>
<td>PROBLEM - EFFECT OF HIGH TEMPERATURE ON CERAMICS GRAIN BOUNDARIES LIMIT THEIR APPLICATION.</td>
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<tr>
<td>SOLUTION - UPSCALE DEVELOPED TECHNIQUES FOR DEVELOPING A NON-GLASS BOUNDARY OR ELIMINATE THE GRAIN BOUNDARY PHASE.</td>
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</tbody>
</table>
(6020) TITLE - PRODUCTION OF REINFORCED CERAMIC COMBUSTORS

PROBLEM - TECHNIQUE FOR LARGE SCALE PRODUCTION OF COMBUSTORS NOT AVAILABLE. THESE COMBUSTORS IMPROVE ENGINE PERFORMANCE GREATLY.

SOLUTION - UPScale LABORATORY PROVEN TECHNIQUE FOR FABRICATING COMBUSTOR FOR PRODUCTION.

(6020) 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 TESTING WIRES HARNESS AND ENGINES WILL BE ACCOMPLISHED. AUTOMATION OF INSPECTION RECORDS WILL BE ACCOMPLISHED.

(6020) TITLE - PRODUCTION OF IMPROVED ANTI-CORROSIVE MATERIALS

PROBLEM - TO INCREASE THE EFFICIENCY OF TURBINE ENGINES CREEP RESISTANT NON-CORRODING, HIGH TEMPERATURE STRENGTH MATERIALS ARE REQUIRED. PRESENTLY EXPENSIVE METALLIC SUPERALLOYS AND CERAMICS ARE BEING USED.

SOLUTION - IN MECHANICAL ALLOYING, METAL POWDERS ARE COLD WELDED IN HIGH-Energy MILLS. THE PROPERTIES OF THESE ALLOYS ARE SUPERIOR OVERALL TO THE PRESENTLY USED MATERIALS. MANUFACTURING TECHNIQUES FOR MASS PRODUCTION WILL BE ESTABLISHED.

(6020) TITLE - SIMPLIFIED TEST EQUIP FOR INT COMB ENGINES(SITE/ICE)

PROBLEM - SUITABLE TRANSUCERS AND SENSORS ARE NOT READILY AVAILABLE FOR INSTALLATION ON MILITARY VEHICLES FOR BUILT-IN DIAGNOSTICS.

SOLUTION - TRANSUCERS ARE TO BE DEVELOPED TO FULFILL THE NEEDS FOR DIAGNOSTIC CAPABILITY.

(6020) TITLE - LASER VIBRATION DEPOT INSPECTION SYSTEM

PROBLEM - FOR DEPOT OVERHAUL WORK IN POWER TRAIN COMPONENTS, NO DEVICE IS ON HAND FOR DIAGNOSING CAUSES OF VIBRATION, AND THE RESULTANT DAMAGE TO ENGINES.

SOLUTION - LASER VIBRATION SENSORS DEVICES CAN BE DEVELOPED FOR OVERHAUL INSPECTION DIAGNOSTICS. THEY HAVE BEEN PROVEN IN SIMILAR APPLICATIONS.
**COMPONENT -- ENGINE**

**(7063) TITLE -- AUTOMATED DYNAMOMETER CONTROL FOR STANDARDIZED INSPECTION TESTING**

**PROBLEM** - ALL ENGINES ARE TORN DOWN WHILE 20% COULD BE RESTORED TO OPERATION WITHOUT PHYSICAL TEAR-DOWN. TEAR-DOWN IS 1/3 COST OF OVERHAUL. ALL ENGINES REQUIRE A 4-HOUR DYNAMOMETER OPERATIONAL TEST CYCLE.

**SOLUTION** - AUTOMATE CURRENT MANUALLY OPERATED DYNAMOMETER TEST CELLS ALLOWING PREHOLE INSPECTION WITHOUT TEAR-DOWN AND REDUCING REBUILT ENGINE RUN-IN TIME BY EIGHTY PERCENT.

**COMPONENT -- TRANSMISSION**

**(5065) 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.

**(5064) TITLE -- GEAR DIE DESIGN AND MFG UTILIZING COMPUTER TECHNOLOGY (CAD)**

**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 DIMENSIONALLY BUT IS PRESENTED AS REQUIREMENTS FOR TOOTH HAVING PATTERNS.

**SOLUTION** - THIS PROGRAM WILL ELIMINATE THE CURRENT TRIAL AND ERROR METHODS BY UTILIZING CAD/CAM METHODS AND INTERACTIVE GRAPHICS TECHNIQUES. EXCESSIVE SCRAPS, UNEXPECTED DIE WEAR AND BREAKAGE, AND THE HIGH COST OF FORGING DIES WILL BE ADDRESSED.

**(5063) TITLE -- UPGRADE OF ADVANCED METAL MOLDING MATERIALS**

**PROBLEM** - POWDER METALS PROCESSES HAVE NOT BEEN UTILIZED IN LARGE COMPONENTS

**SOLUTION** - ESTABLISH PROCESSES WHICH PRODUCE HIGH DENSITY HIGH-STRENGTH LARGE COMPLEX SHAPES.

**(5066) TITLE -- SURFACE HARDENING AND ALLYLING OF TRASNSMISSION WITH LASERS**

**PROBLEM** - FLAME AND INCREASED HARDENING IS EMPLOYED TO SURFACE HARDEN VEHICLE TRANSMISSION PARTS. THESE PROCESSES ARE INEFFICIENT.

**SOLUTION** - ESTABLISH PARAMETERS AND CONTROLS NEEDED FOR LASER SURFACE HARDENING.
COMPONENT -- MISCELLANEOUS

(507) TITLE -- MANUFACTURING TECHNOLOGY--FABRICATION

PROBLEM - MATERIALS AND MANUFACTURING PROCESSES EMPLOYED IN THE REBUILD
FUNCTIONS OF THE DEPOTS CAN BE IMPROVED AND MADE MORE EFFICIENT BY
INTEGRATING NEW TECHNOLOGIES.

SOLUTION - INTRODUCE NEWER STATE-OF-THE-ART METHODS OF MANUFACTURING INTO
DEPOT OPERATIONS.

(508) TITLE -- SURFACE TREATMENT OF COMPONENTS

PROBLEM - PERFORMANCE OF MANY ITEMS IS DEPENDENT ON ITS SURFACE CONDITION.
NEW METHODS OF ALTERING SURFACES ARE NOT BEING EMPLOYED.

SOLUTION - ESTABLISH TECHNIQUES FOR ALTERING MATERIAL SURFACE CONDITIONS SO AS
TO IMPROVE PERFORMANCE AND/OR REDUCE COST.

(509) TITLE -- MOLDED PLASTIC ORDNANCE ELECTRICAL CONNECTORS

PROBLEM - METALLIC SHELL ELECTRICAL CONNECTORS ARE COSTLY AND SUSCEPTIBLE TO
CORROSION AND OTHER PROBLEMS.

SOLUTION - DEVELOP A MEANS OF MANUFACTURING CONNECTORS WITH PLASTIC REPLACEMENT
METAL SHELLS.

(510) TITLE -- IMPROVED HIGH STRENGTH ALUMINUM COMPONENTS

PROBLEM - COMMERCIALLY AVAILABLE HIGH STRENGTH ALUMINUM ALLOYS NEED
IMPROVEMENT IN DUCTILITY AND ENERGY DENSITY.

SOLUTION - ESTABLISH PRODUCTION PROCESSES UTILIZING ADVANCES IN BOTH METAL
SOLIDIFICATION AND THERMAL MECHANICAL WORKING OF ALUMINUM ALLOYS.

(508/1) TITLE -- FLEXIBLE MACHINING SYSTEM TOOL LINE FOR TCV COMPONENT

PROBLEM - PARTS FOR TRACKED COMBAT VEHICLES ARE TYPICALLY NOT MANUFACTURED IN
LARGE QUANTITIES, BECAUSE OF THIS, MANY TECHNOLOGIES THAT RESULT IN
LOWER FNF COSTS ARE NOT USED.

SOLUTION - THE ADVANTAGES OF FMS CAN BE REALIZED IN PRODUCING MEDIUM
QUANTITY SIZE PARTS BY A CONCEPT KNOWN AS A FLEXIBLE MACHINING SYSTEM, THIS
PROJECT WILL ADVANCE THE FMS TECHNOLOGY MAKING IT FEASIBLE TO UTILIZE FMS
FOR THE PRODUCTION OF ARMY MATERIEL.

(510) TITLE -- IMPROVED AND COST EFFECTIVE MACHINING TECHNOLOGY

PROBLEM - MACHINE DATA ON NEWER MATERIALS AND NEW REMOVAL RATES ARE NOT
ESTABLISHED.

SOLUTION - ESTABLISH DATA WHERE THE NEW MACHINING EQUIPMENT MAY BE UTILIZED
WITH MAXIMUM EFFICIENCY.
(6015) TITLE - MANUFACTURING METHODS FOR HIGH SPEED MACHINING FERROUS ALLOY

PROBLEM - FAST CHIP REMOVAL FOR FERROUS ALLOYS HAS NOT BEEN ESTABLISHED FOR
PRODUCTION.

SOLUTION - ESTABLISH FAST CHIP REMOVAL FOR PRODUCTION CONDITIONS.

(6014) TITLE - AUTOMATED PRODUCTION OF MULTILAYER NETWORKS FOR COMBAT VEH

PROBLEM - ADVANCED TECHNOLOGIES FOR ELECTRICAL POWER DISTRIBUTION AND VEHICLE
CONTROL WILL USE ADVANCED MICROPROCESSORS AND MULTILAYER AND INTRODUCE
A NEW ASSEMBLY TECHNIQUE.

SOLUTION - COMPUTER AIDED DESIGN AND MANUFACTURING WILL BE APPLIED TO ASSEMBLY
OF THE COMPLEX ELECTRONIC SYSTEM.

(6025) TITLE - MANUFACTURING LASER FACILITY

PROBLEM - THE FEASIBILITY OF USING LASERS FOR METAL PROCESSING IS
ESTABLISHED, IMPLEMENTATION IS IMPOSED BY THE COST OF FACILITIZATION.

SOLUTION - ESTABLISH A FACILITY TO IMPLEMENT LASER TECHNOLOGY IN PRODUCTION.

(6020) TITLE - COMPUTER SIMULATION OF TV MANUFACTURING PROCESSES

PROBLEM - THE LONG LEAD TIMES RELATE TO THE MATERIAL ACQUISITION PROCESS OF
TRUCKING COMBAT VEHICLES (COW) DO NOT ALLOW COMPONENTS TO REFLECT THE LATEST
TECHNOLOGIES. THIS LEADS TO DELAYS AND EXCESSIVE COSTS.

SOLUTION - SIMULATING THE MANUFACTURING PROCESS DURING THE VEHICLE DEVELOPMENT
PHASE WILL IDENTIFY TOOLS, OPTIMIZE MANUFACTURING PROCESSES, OPTIMIZE
PRODUCTION LINE, AND POTENTIAL PRODUCTION PROBLEMS. IT WILL ASSIST
INNOVATION AND PROVIDE FOR ACCURATE PLANNING.

(6040) TITLE - APPLICATION OF ADAPTIVE CONTROL

PROBLEM - SENSORS WHICH RECOGNIZE AND SIGNAL PHENOMENAL CHANGES HAVE BEEN
DEVELOPED AND DEMONSTRATED. APPLICATIONS OF THESE TO ADAPTIVE CONTROL CAN
ADVANCE AUTOMATION TO THE LEVEL OF "PUSH BUTTON" FACTORIES, BUT LITTLE OR
NOTHING HAS BEEN DONE IN THIS AREA.

SOLUTION - STATE-OF-THE-ART SENSORS WILL BE ADAPTED TO A CNC MACHINING CENTER
TO ADVANCE ITS PERFORMANCE BEYOND PRESENT LEVELS OF EFFICIENCY. THIS WILL
PROVIDE A PROVEN CAPABILITY WHICH CAN BE EMPLOYED ON OTHER MACHINES.
CONTINUING

TITLES:

1. EFFECTIVE PARTS: MANUFACTURE IN CANADA

THE CANADIAN PARTS FILE (CPF) CONTAINS VEHICLES AND PARTS IN SMALL QUANTITIES, AND IN A LIMITED NUMBER. THIS PROCEDURE PRACTICE RESULTS IN HIGH COSTS AND DELAYS DUE TO EXTERNAL DELIVERY SCHEDULES.

SOLUTION - THE CPF IS AVAILABLE AND IS DEVELOPING A NUMBER OF CANADIAN PARTS FILE (CPF) ADDED TO THE MANUFACTURE OF ITEMS FOR INITIAL ACQUISITION. THE PRODUCTION OF THESE PARTS WOULD BE ADVISIBLE TO CPF AT PARTS ACQUISITION TO PREVENT EXTERNAL PROCUREMENT.

2. TITLE: ADVANCED METALLURGY SYSTEM: INTEGRATION

PROBLEM - THE METALLURGY METHODS USED IN MILITARY VEHICLE MANUFACTURE, IN GENERAL, FAILS RATE GAUGE, TYPICALLY EMPLOYED, THIS IS REPRESENTS A SUBSTANTIAL PART OF THE COST OF MILITARY VEHICLES.

SOLUTION - THE ADVENT OF RECENT TECHNOLOGY (ELECTRONIC AND LASER) WILL BE AN EFFECTIVE VEHICLE MANUFACTURING UTILITY. TOPIC: PHOTOGRAPHY WILL BE ALTERED TO MEET THE DEPLOYMENT REQUIREMENTS OF COMPONENTS SUCH AS TURBINE BLADES.

3. TITLE: EJECTION CASTING TECHNOLOGY FOR ALUMINUM COMPONENTS

PROBLEM - ALUMINUM CASTINGS REQUIRE LARGE AND EXPENSIVE INCISIONS WHICH UTILIZE LARGE AMOUNTS OF MATERIAL WHICH ARE NOT RECOVERED FROM THE CASTINGS AND ARE USED AS SCRAP WELLS. THIS CONTRIBUDES TO INCREASE COST IN COST OF ITEM.

SOLUTION - IT IS PROPOSING MANUFACTURING PROCESSES UTILIZING LOW PRESSURE CASTING TECHNOLOGY, THEREBY ELIMINATING THE NEED FOR INCISION GATING AND TOTALLY ELIMINATING SCRAP WELLS.

4. TITLE: LIGHTWEIGHT 2 WHEEL VEHICLES FOR TRACKED COMBAT VEHICLES

PROBLEM - TRACKED VEHICLES, FOR HEAVY MACHINERY, ARE HARD TO MANUFACTURE DUE TO THE HARDWARE TCM MANUFACTURING REQUIREMENTS AND THE REQUIREMENT FOR INCISION CASTING. THIS RESULTS IN VARIOUS PROBLEMS, SUCH AS INCREASED COSTS AND AUTOMATED LEAFING IS COSTLY.

SOLUTION - IT IS PROPOSING MANUFACTURING TECHNOLOGY THAT UTILIZES INCISION CASTING EQUIPMENT USING TCMs. THIS ALLOWS REDUCTION OF LEAFING COSTS AND TCMs COSTS IN PATIENTS. THIS TECHNOLOGY WILL BE EXPERIMENTAL AT FIRST, BUT WILL BE IMPROVED AND
### Component: Final Drive

**Title:** Automated Gear Inspection of Final Drive

**Problem:** The detection of specific faults and malfunctions in gears is critical to ensure the reliability and longevity of the vehicle's drivetrain. Current methods are labor-intensive and time-consuming.

**Solution:** Implement automated gear inspection technology, which can detect faults and malfunctions more accurately and efficiently, reducing maintenance costs and increasing vehicle reliability.

### Component: Suspension

**Title:** Springs from Carbon-Fiber Composite Materials

**Problem:** Steel springs are heavy and subject to fatigue, while carbon fiber composites are lighter and have better fatigue resistance.

**Solution:** Develop a technology to manufacture leaf springs from carbon-fiber composite materials, allowing for mass production and enhanced performance.

### Component: Torsion Bars

**Title:** Developing Torsion Bars from High-Strength Steel

**Problem:** Existing alloy steel torsion bars are heat treated to a maximum working hardness, which causes large diameter bars to inherently interfere with design limits and increase weight.

**Solution:** Establish methods for manufacturing torsion bars utilizing creep-resistant high-strength materials.

### Component: Suspension Systems

**Title:** Production Techniques for Lighter Vehicle Suspension Systems

**Problem:** Suspension systems of current 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: Manufacturing Process for Metal Matrix Composites

**Title:** Manufacturing Process for Metal Matrix Composites

**Problem:** Metal matrix composites (MMCs) can offer significant performance benefits, but the fabrication methods for production must be developed to meet cost and performance requirements.

**Solution:** Develop an automated process to enhance MMC production methods.
COMPONENT -- wheel

1. "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.

2. "Title: "Tire Preservation Coating"
   - Problem: Tire deterioration from age and weather causes intolerable waste.
   - Solution: Preservative coatings are known products and need to be evaluated and incorporated into the Army's inventory.

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COMPONENT -- rubber track

1 (a) "Title: "Rubber Injection Molding of Double pin track"
   - Problem: Rebuild of track blocks for combat vehicles is currently being accomplished with injection techniques. This requires the bonding of raw rubber to the track pin. This equipment will require two hours.
   - Solution: Establish an automatic (Kohler) injection molding process that will complete the rubber track installation of the track pin in ten minutes or less.

1 (d) "Title: "Water Jet Material Removal System"
   - Problem: Current production method of removing rubber from track components is labor intensive and presents environmental and safety hazards to the worker.
   - Solution: Design, build, and fabricate a prototype production high pressure water jet system to remove the rubber from the track components.

2 (a) "Title: "Rubber for Military Track"
   - Problem: Track life is held at its present level by failure of rubber components such as bushings, pins, and blocks.
   - Solution: Establish fabrication techniques for newly developed elastomer compounds for tracks.
<table>
<thead>
<tr>
<th>COMPONENT -- SHOES</th>
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<tr>
<td><strong>(96.4)</strong> TITLE -- AUTOMATED DISASSEMBLY OF DOUBLE PIN TRACK</td>
</tr>
<tr>
<td>PROBLEM -- DISASSEMBLY OF DOUBLE PIN TRACK SHOE SET ASSEMBLIES IS CURRENTLY LABOR INTENSIVE USING MANUAL HAND TOOLS RESULTING IN LOW PRODUCTIVITY.</td>
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<tr>
<td>SOLUTION -- ESTABLISH AN AUTOMATED DISASSEMBLY PROCESS FOR DOUBLE PIN TRACK SHOE ASSEMBLIES.</td>
</tr>
<tr>
<td><strong>(96.5)</strong> TITLE -- HIGH DENSITY POWDER METAL PARTS FOR COMBAT VEHICLES</td>
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<tr>
<td>PROBLEM -- TRACK COMPONENTS WEAR EXCESSIVELY REQUIRING THE TRACK TO BE ADJUSTED AND/OR REPLACED FREQUENTLY.</td>
</tr>
<tr>
<td>SOLUTION -- FABRICATE COMPONENTS BY COMPACTING WITH WEAR ALLOYS FROM POWDER.</td>
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<tr>
<td><strong>(96.6)</strong> TITLE -- HARD FACING OF TRACK SHOES</td>
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<tr>
<td>PROBLEM -- NO DEFINITE PROCEDURE FOR 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>
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<tr>
<td>SOLUTION -- THE TRACK SHOE GROUSER WILL BE BUILT UP BY DEPOSITION USING A HARD FACING PROCESS, THE PROCESS WILL BE AUTOMATED AND TOOLING WILL BE DESIGNED TO ALLOW THE EQUIPMENT TO FOLLOW THE CONTOURS OF THE TRACK SHOE GROUSERS.</td>
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<tr>
<td><strong>(96.7)</strong> TITLE -- FABRICATION TECHNIQUES FOR NON METALLIC TRACK</td>
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<tr>
<td>PROBLEM -- CURRIER METALLIC TRACK CONTRIBUTES A LARGE PERCENTAGE OF TOTAL VEHICLE WEIGHT.</td>
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<tr>
<td>SOLUTION -- VALIDATE FABRICATION FEASIBILITY FOR BUILDING AN ALL PLASTIC COMBAT VEHICLE TRACK</td>
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<tr>
<td><strong>(96.8)</strong> TITLE -- LASER SURFACE HARDENING STEEL VEHICLE COMPONENTS</td>
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<tr>
<td>PROBLEM -- PRESENT METHODS OF SURFACE HARDENING INPUT HEAT OVER LARGE SURFACE AREA.</td>
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<tr>
<td>SOLUTION -- ESTABLISH LASER BEAM HARDENING PROCEDURES WITH ITS ATTENDANT FINE BEAM SMALL AREAS RAPID HEATING.</td>
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<tr>
<td><strong>(96.9)</strong> TITLE -- SHOTCasting PRESSURE CASTING FOR COMBAT VEHICLE PARTS</td>
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<tr>
<td>PROBLEM -- PRESSURE CASTING UTILIZING INTERNAL REINFORCEMENTS HAVE NOT BEEN DEVELOPED.</td>
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<tr>
<td>SOLUTION -- PRODUCTION TECHNIQUES WILL BE DEVELOPED TO PRODUCE CASTINGS OF STEEL PARTS WITH REINFORCEMENTS.</td>
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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.
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**CATEGORY:** TESTING

**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 DT evaluation process. Acceptance test procedures are required to verify for hardware specification compliance.

**Solution** — Maintain test operation's 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 govt tests routine. Pd's 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.
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.

The scope of the MMT Program covers all three of the military services. Within the Army, the Office of Manufacturing Technology (OMT) 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 OMT 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 for 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, one programmed year and three 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 1980, the Army began the first quarter of FY81.

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 during the annual MTAG conference. At this gathering the current program, the latest budget project and the Program Plan are discussed.
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 what Congress will appropriate each year.
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 actually funding individual projects include technical, operational, and economical feasibility. 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 factors are all evaluated.

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
AR 11-28, Economic Analysis and Program Evaluation for Resources Management
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