

MICROCOPY RESOLUTION TEST CHART  
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This document contains pictorial illustrations and word descriptions of MM&T project accomplishments. Each page lists a project title, funding, results obtained, and illustrates the process, equipment, or end item supported.		

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DRXIB-MT

SUBJECT: MMT Program Accomplishments

SEE DISTRIBUTION



1. Reference AR 700-90, C1, Para 3-3e(5), Logistics, Army Industrial Preparedness Program, dated 15 March 1982.

2. This brochure describes recent accomplishments of the DARCOM Manufacturing Methods and Technology Program. The information is presented in three sections:

Section I - A concise summary of the benefits for each project.

Section II - Charts describing recently completed projects which have the potential to provide benefits.

Section III - Charts describing projects which have been implemented and are providing benefits.

3. Further information on the projects can be obtained from the MMT points of contact found on page 3.

FOR THE DIRECTOR:

*for*   
 JAMES W. CARSTENS  
 Chief, Manufacturing Technology Division

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## INTRODUCTION

1. This brochure describes the results of recently completed projects funded by the Army Manufacturing Methods and Technology Program. The MMT Program is managed by the HQ DARCOM Directorate of Manufacturing Technology and the DARCOM major subordinate commands.

2. Project results which are depicted in this brochure are shown on one page charts. The charts are titled either Accomplishment or Implementation. Accomplishment charts describe projects that are a part of a multi-year effort which either has not yet been completed or has recently been completed but not yet surveyed for implementation. The implementation survey is made within one year after all the projects of an effort have been completed. The charts, titled Implementation, describe work efforts that have been surveyed for implementation. A comparison of these two types of charts is found on the following page.

ACCOMPLISHMENT CHART

IMPLEMENTATION CHART

DARCOM MMT ACCOMPLISHMENT  
(Based on one or more Final RCS 301 Reports  
and satisfactory support data)

DARCOM MMT IMPLEMENTATION  
(Based on having all the Final RCS 301 Reports submitted,  
satisfactory support data and a completed RCS 303 Report)

PROJECT NO: X XX XXXX  
or  
X XX,XX XXXX

EFFORT NO. X XXXX  
(No FY shown)

(One or more FY shown)

RESULTS:

(Verb tense is past for project completion and future for implementation and savings)

BENEFITS:

(Verb tense is present or past for implementation and past, present or future for savings)



MMT POINTS OF CONTACT

<u>COMMAND CODE</u>	<u>REPRESENTATIVE</u>	<u>PHONE</u>
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3 or R	MICOM US Army Missile Command ATTN: DRSMI-RST, Mr. Bobby Park Redstone Arsenal, AL 35898	C: 205 876-2065 AV: 746-2065
4 or T	TACOM US Army Tank-Automotive Command ATTN: DRSTA-RCKM, Mr. Donald Cargo Warren, MI 48090	C: 313 573-6065/5814 AV: 786-6065/5814
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MMT POINTS OF CONTACT

<u>COMMAND CODE</u>	<u>REPRESENTATIVE</u>	<u>PHONE</u>
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6	AMCCOM US Army Armament, Munitions and Chemical Command ATTN: DRSMC-IRW (R), Mr. Arne Madsen Rock Island Arsenal Rock Island, IL 61299	C: 309 794-3166 AV: 793-3166
E	MERADCOM US Army Mobility Equipment R&D Command ATTN: DRDME-UE, Mr. R. Goehner Fort Belvoir, VA 22060	C: 703 664-4221 AV: 354-4221
M	AMSRIC US Army Materials & Mechanics Research Center ATTN: DRXMR-PP, Mr. John Gassner Watertown, MA 02172	C: 617 923-5521 AV: 955-5521

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**SECTION I**

**SUMMARY OF BENEFITS**

ACCOMPLISHMENTS SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
<b>NERADCOM</b>					
E 77,79 3592		INCREASED PERFORMANCE			
<b>DESCOM</b>					
G 80 0001	\$45,000/YR				IMPLEMENTATION AT TOBYHANNA ARMY DEPOT
<b>ERADCOM/CECOM</b>					
2 76 9776		REQUIREMENTS CHANGED			COMMERCIAL APPLICATIONS BY RCA
H 77 9812	\$400/UNIT				IMPLEMENTATION ON RPV, XM 21, XM32 & LASER RANGEFINDERS
1 76,77 7114		REDUCED COST			AIRCRAFT IR SUPPRESSOR APPLICATIONS
1 79.80 7291	\$1.6 MILLION				APACHE AUX POWER UNIT
1 79 7315		IMPROVED PERFORMANCE			POISE GIMBAL COMPONENTS
1 74 8008		REDUCED DIRECT LABOR COST			
1 75,76 8148		IMPROVED MATERIAL TESTING			GEARS
R 81 1021		UPGRADING PROCESS PLANNING			PROCESS PLANNING

ACCOMPLISHMENTS SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
R 79 1041	\$4.5MILLION/3YR				COPPERHEAD, HELLFIRE, LASER SEEKER AND NAVY GUIDED PROJ
3 81 1073		REDUCED INSPECTION TIME			ROCKET LAUNCH TUBES
3 81 1086		CRITICAL MATERIAL REPLACEMENT			TOW MOTOR CASES
R 77,78 3133	\$40,000/RADAR SET				ANTI-TACTICAL MISSILE
R 79 3136	\$1000/GYRO				COPPERHEAD
R 79 3146		INCREASED RELIABILITY & PERFORMANCE			HYBRID CIRCUIT SUBSTRATES
R 77,78 3188		ABILITY TO PRODUCE			INFRARED IMAGING SEEKERS
R 77,79,80 3217	\$14000/TUBE				PATRIOT RADAR
R 79,80 3219		INCREASED YIELD			HYBRID CIRCUITS
3 77,79 3287		19-30% COST REDUCTION			CHAPARRAL

ACCOMPLISHMENTS SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
3 80 3294		IMPROVED PROCESSING			ROCKET MOTOR CASES
R 78,80 3396		REDUCE COST AND IMPROVE RELIABILITY			ROCKET MOTOR NOZZLES
R 79 3410		ESTABLISH CAPABILITY			HEAT PIPES FOR MICROCIRCUITS
R 80 3411	\$3MILLION				NON-PLANAR CIRCUITS
R 78,80 3436		20% COST REDUCTION			PASSIVE OPTICAL SEEKERS
R 79 3438	\$2.5MILLION/YR				WELDED HYBRID CIRCUITS
R 79,80 3445	\$1.2MILLION/YR				OPTICAL COMPONENTS
R 78 3453	\$150/Q SWITCH				DIVADS AND GVLLD
3 78 3454		IMPROVED TESTING			ROLAND
TACOM					
4 74,75,7T 4568		AUTOMATED PROCESS			DARCOM STANDARD SYSTEM
T 77 5014	\$1.0MILLION/YR	IMPROVED QUALITY			CASTINGS
T 78,81 5014	\$1.0MILLION/YR	IMPROVED QUALITY			CASTINGS
T 79 5045		IMPROVED PERFORMANCE			SPALL SUPPRESSIVE ARMOR
T 79 5090		LEAD TIME & COST REDUCTION			MACHINING



ACCOMPLISHMENTS SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
5 77 1327		ESTABLISHED PROCESS			GAS MASK TESTER
5 78 1345		METHODS & PROPERTIES DEFINITION			BIODETECTION TEST & WARNING SYSTEM
5 79 1403	\$269,000/YR	INCREASED SAFETY			SMOKE GRENADES
5 79,80 1903	\$47MILLION				BLU-96B
5 77,78 4000		AUTOMATED SYSTEM			M55 DETONATOR
5 80 4033		REDUCED POLLUTION			SODIUM NITRATE SLUDGE
5 79 4059		ON-LINE TESTING			NITROGUANIDINE
5 79 4064	\$4.5MILLION/YR				TANK CARTRIDGES
5 79,80 4084		LESS COSTLY ALTERNATIVE			MASS EMISSIONS TESTING
5 81 4145	\$250,000/YR				SINGLE BASE PROPELLANT
5 74 4169		PROVIDE CAPABILITY TO PRODUCE			NITROGUANIDINE
5 79 4189		IMPROVED PERFORMANCE			HIGH TEMPERATURE OVENS
5 76,77,78 4228		AUTOMATED MANUFACTURE			PROPELLING CHARGES

ACCOMPLISHMENTS SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
5 75,7T 4252		IMPROVED PROCESS FOR RDX & HMX			HOLSTON AAP
5 77,78 4267		IMPROVED PROCESS			GRANULAR COMP B
5 79 4281-A02	\$57,000/YR	REDUCED ENERGY CONSUMPTION			NITROCELLULOSE BOILING TUBS
5 77,78 4281-A08		27% COST REDUCTION			IOWA AAP
5 78,79 4285		INCREASED SAFETY			BLAST RESISTANT BUILDINGS
5 80 4285		INCREASED SAFETY			BLAST RESISTANT BUILDINGS
5 79 4288		INCREASED SAFETY			SAFE SEPARATION DISTANCES
5 76,7T 4289		INCREASED SAFETY			HAZARD CLASSIFICATION FOR EXPLOSIVES & PROPELLANTS
5 79 4291		INCREASED SAFETY			BLAST RESISTANT PANELS
5 79,80 4322		MINIMIZE MOBILIZATION TIMES			ELECTRONICALLY CONTROLLED FACILITIES
5 79 4335		95% SCRAP REDUCTION			TITANIUM GYROSCOPES
5 77,78 4343		PROCESS UPDATES			NITROCELLULOSE PRODUCTION
5 77 4362		REDUCED COST			COMPOSITION B LOADING
5 78 4449	\$55,000/YR				HOLSTON AAP

ACCOMPLISHMENTS SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
5 77,78,79 4462		INCREASED PRODUCTION			MULTI-BASE PROPELLANTS
5 80 4462		INCREASED EFFICIENCY			MULTI-BASE PROPELLANTS
5 78,79 4466		AUTOMATED MIXER			ALTERNATE FILL EXPLOSIVES
5 78 4472		INCREASED EFFICIENCY			CENTER CORE PROPELLANT BAGS
5 78 4498		IMPROVED SAFETY			SMALL MINES
5 76 6599		INCREASED INSPECTION RELIABILITY			ARTILLERY PROJECTILES
5 76,78, 79,80 6736		ENHANCED READINESS			ARRCOM ELEMENTS
5 79 6736-02		20% COST REDUCTION			DATA ACQUISITION
5 80 6736-03		IMPROVED INFORMATION EXCHANGE			MULTI-SERVICE
6 77,78 7649		COMPUTER AIDED DESIGN			POWDERED METAL FORGINGS
6 79 7724		COMPUTER AIDED MANU- FACTURE			GROUP TECHNOLOGY
6 77,78,79 7726		34% MACHINING COST REDUCTION			106MM RECOILESS RIFLE & 105MM - M68
6 78 7808		FASTER & MORE SENSI- TIVE LEAK DETECTION			SEALED FIRE CONTROL ELEMENTS

ACCOMPLISHMENTS SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
6 80 7926	\$432/BREECH BLOCK				LARGE ORDNANCE COMPONENTS
6 77,78 7943	\$18MILLION/YR				ROCK ISLAND ARSENAL
6 79 7949		REDUCE COST AND LEAD TIME			GROUP TECHNOLOGY AT ROCK ISLAND ARSENAL
6 81 8001		IMPROVED PLATING			CAL 50 BARRELS
6 79,80 8004		EXTENDED SERVICE LIFE			WEAPON COMPONENTS
6 79 8005		LOW COST PLATING			SMALL PLATED PARTS
6 78,79 8017		POLLUTION ABATEMENT			CYANIDE BASED BATHS
6 78 8048		REDUCED INSPECTION TIME			ROTARY FORGE PREFORMS
6 78 8049		REDUCED ENERGY CONSUMPTION			FURNACES & HEAT TREAT LINES
6 79 8104		REDUCE MACHINING TIME			BREECH BLOCKS
6 81 8120		REDUCED TIME & ENERGY CONSUMPTION			ARTILLERY BARRELS
6 80 8209		PROVIDE CAPABILITY TO MANUFACTURE			GRADIENT INDEX OPTICS

IMPLEMENTATION SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
ERADCOM/CECOM					
H 5094	\$13MILLION/5YR AT MOB RATE				BLOCK ORIENTED RANDOM ACCESS MEMORY (BORAM)
2 9751	\$2.7MILLION/YR				LASER RANGE FINDER
2 9778			\$325,000/2YR		AN/TYC 39 MESSAGE SWITCH
2 9834				ESTABLISH SECOND SOURCE	TRANSDUCER DELAY LINES
H 9841			\$2MILLION	500/MO PRODUC- TION RATE	ZINC SELENIDE WINDOWS
AMMRC					
M6350-1646	\$270,000/5YR				AGENT PERMEATION EVALUATION
M6350-1802	\$250,000/5YR			IMPROVED TESTING	FUZES
M6350-2032	\$10,000/DAY		\$120,000 COST AVOIDANCE		AIR FORCE DEPOTS
M6350-2225	\$1.8MILLION/5YR			IMPROVED TESTING	PATRIOT, MLRS & M724/732 FUZES
M6350-2227			\$2MILLION/5YR	IMPROVED RELIA- BILITY AND SAFETY	VIPER
M6350-2233	\$175,000/5YR			REDUCED TEST TIME	TRACK BUSHING
M6350-2403	\$2.5MILLION/5YR			STANDARDIZED METHOD	LARGE CALIBER WEAPONS

IMPLEMENTATION SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
M6350-2426	\$3.15MILLION/5YR			IMPROVED LEAK TESTING	CRYOGENIC COOLERS
M6350-2430	\$750,000/5YR				COMMON MODULES
M6350-2431	\$2.5MILLION/5YR			IMPROVED INSPECTION	MILITARY FABRICS
M6350-2434			\$390,000/5YR	LASER ROD INSPECTION METHOD	AN/GVS-5 LASER RANGE FINDER
M6350-2437	\$605,000/5YR			AUTOMATED TESTING	PATRIOT RADAR
M6350-2440	\$1.5MILLION/5YR				CHAPARRAL & HELLFIRE
M6350-2447	\$720,000/5YR			REDUCED TEST TIME	BIO-ALARMS
M6350-2455	\$843,000/5YR			CRACK DETECTION	105 & 155MM GUN TUBES
M6350-2610	\$115,000/5YR			REFERENCE STANDARDS	SIGNAL SMOKE DYES
M6350-2621	\$1.725MILLION/5YR				THERMOELECTRIC MATERIALS
M6350-2825	\$3.315MILLION/5YR			ACID RATIO TESTING	2.75 IN & DRAGON ROCKETS
MICOM R 3116	\$9.5MILLION				STINGER-POST

IMPLEMENTATION SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
R 3140			\$4400/TUBE	INCREASED PERFORMANCE	TANK TESTING INSTRUMENTATION
R 3167			\$36,000/YEAR	INCREASED RELIABILITY	CIRCUIT BOARDS
R 3183	\$40MILLION/5YR			INCREASED CAPACITY	FLEXURE ACCELEROMETERS
3 3227				INCREASED YIELD	HYBRID MICROCIRCUITS
R 3272	\$5.9MILLION/10YR			REDUCED WEIGHT AND VOLUME	AN/ALQ 131 & AWACS RADARS
R 3372	\$2MILLION/YR			IMPROVED RELIABILITY	MAGNETIC COMPONENTS
AMMUNITION					
5 1316	\$4.2MILLION/10YR			REDUCE HEALTH HAZARDS	PINE BLUFF ARSENAL
5 1320				ESTABLISH CAPABILITY	PINE BLUFF ARSENAL

IMPLEMENTATION SUMMARY

PROJECT NUMBER	ANTICIPATED BENEFITS		ACTUAL BENEFITS		REMARKS
	\$ SAVINGS	OTHER	\$ SAVINGS	OTHER	
5 3104				ESTABLISH CAPABILITY	FUZE POWER SUPPLIES
5 4041	\$5.2MILLION/10YR			108 INCREMENTS PER MINUTE RATE	MILAN AAP
5 4147	\$2.5MILLION/YR AT MOB RATES			AUTOMATED CONTROL	RADFORD AAP
5 4163			\$5MILLION/YR	INCREASED YIELD	MILAN AAP
5 4215				IMPROVED PROCESS CONTROL AND SAFETY	TNT PRODUCTION
5 4281-802	\$100,000/YR			ENERGY CONSERVATION	SCRANTON AAP
5 77 6200				INCREASED QUALITY	ANACONDA, OLIN & REVERE
5 6682			\$400,000		LOUISIANA & MISSISSIPPI AAP'S
<b>WEAPONS</b>					
6 7727	\$716,000/YR(FYDP) \$10MILLION/YR(MOB)			MATERIAL & ENERGY CONSERVATION	ARTILLERY BARRELS
6 8043				REDUCE MACHINING TIME & ERRORS	DOVETAIL MACHINING



**SECTION II**

**RECENTLY COMPLETED PROJECTS**

# DARCOM MMT ACCOMPLISHMENT

## MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: E 77,79 3592

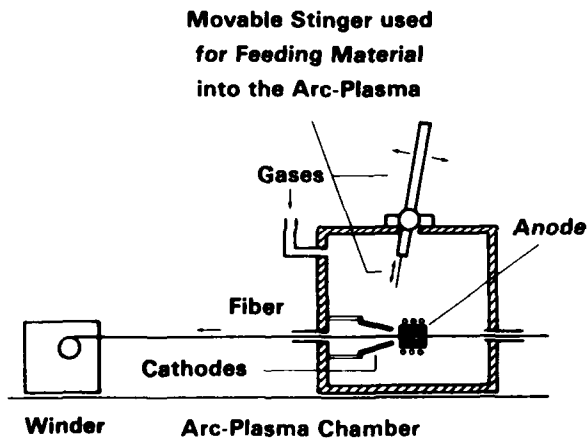
TITLE: IMPROVED GRAPHITE FIBER  
REINFORCEMENT

COST: \$513,000

GOAL: PRODUCE STRONGER, STIFFER FIBERS  
THAN CURRENTLY AVAILABLE

### RESULTS

- AN ARC-PLASMA FIBER TREATMENT FACILITY WAS DEVELOPED THAT HEATS FIBER BUNDLES TO 3100° C AT PROCESS SPEEDS UP TO 100 FEET PER MINUTE.
- BORON TREATMENT WAS USED WHICH INCREASED THE TENSILE STRENGTH TO 450,000 PSI. THIS IS 12 PERCENT GREATER THAN THE UNTREATED COMMERCIAL FIBER.
- IMPLEMENTATION, AFTER COMPLETION OF THE FINAL FY OF WORK, WILL MAKE A SIGNIFICANTLY IMPROVED GRAPHITE FIBER COMMERCIALY AVAILABLE.



FIBER TREATMENT FACILITY

# DARCOM MMT ACCOMPLISHMENT

## DEPOT SYSTEM COMMAND

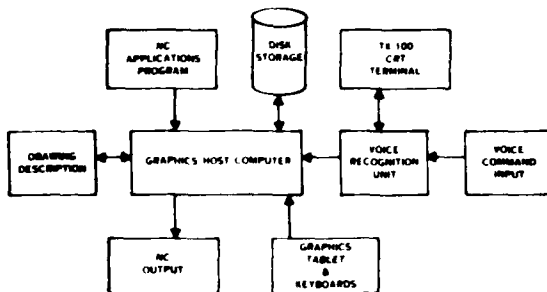
PROJECT NO: G 80 0001

TITLE: VOICE CONTROLLED PROGRAMMING OF COMPUTERS

COST: \$92,000

GOAL: ESTABLISH A CAPABILITY FOR VOICE CONTROLLED PROGRAMMING

### RESULTS



VOICE ASSISTED SYSTEM FOR GRAPHICS AND NUMERICAL CONTROL INFORMATION FLOW

- VOICE INPUT HARDWARE WAS PROCURED AND INTERFACED WITH A CAD/CAM GRAPHIC SYSTEM.
- VOCABULARY AND OPERATOR'S VOICE PATTERN CAN BE STORED IN THE GRAPHIC SYSTEM AND RECALLED ON COMMAND.
- VOICE COMMANDS CAN BE USED TO GENERATE APT SOURCE GEOMETRY, TOOL MOTION, CUTTER LOCATION, AND TOOL INFORMATION.
- NC MACHINE TOOL TAPE PREPARATION COSTS WILL BE INITIALLY REDUCED BY \$45,000/YEAR AT TOBYHANNA ARMY DEPOT.

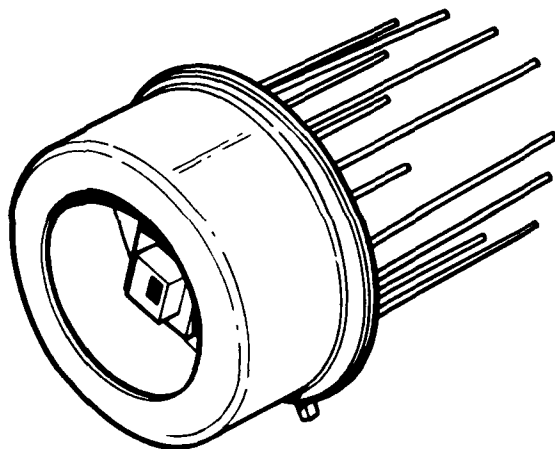
## **DARCOM MMT ACCOMPLISHMENT COMMUNICATIONS & ELECTRONICS COMMAND**

**PROJECT NO: 2 76 9776**

**TITLE: LOW COST HYBRID SILICON  
PHOTODETECTOR MODULES**

**COST: \$446,000**

**GOAL: ESTABLISH MANUFACTURING TECH-  
NIQUES FOR HYBRID PHOTODETECTOR  
MODULES**



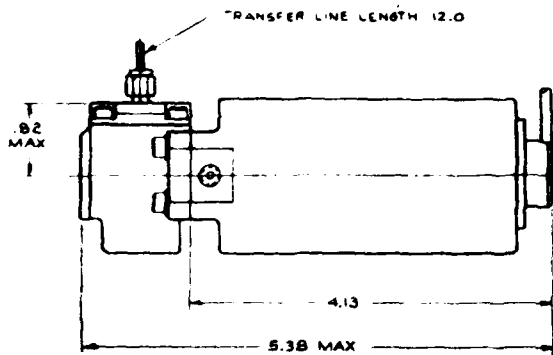
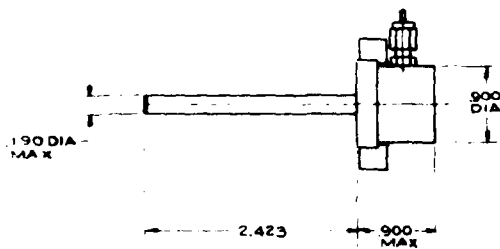
**PHOTODETECTOR MODULE**

### **RESULTS**

- **THE PHOTODETECTOR MODULE MANUFACTURING TECHNIQUES WERE DEVELOPED AND ARE AVAILABLE.**
- **THERE HAS BEEN AN ESTIMATED COST REDUCTION BY A FACTOR OF TEN.**
- **DUE TO SYSTEM REQUIREMENTS CHANGES, THE MODULES ARE NOT CURRENTLY PRODUCED FOR THE ARMY. HOWEVER, THE PROCESSES DEVELOPED ARE USED TO PRODUCE A VARIETY OF COMMERCIAL RCA FIBER OPTIC COMMUNICATION RECEIVERS.**

## DARCOM MMT ACCOMPLISHMENT

### ELECTRONICS RESEARCH & DEVELOPMENT COMMAND



**SPLIT CYCLE STERLING COOLER**

**PROJECT NO: H 77 9812**

**TITLE: SPLIT CYCLE STERLING COOLER**

**COST: \$505,000**

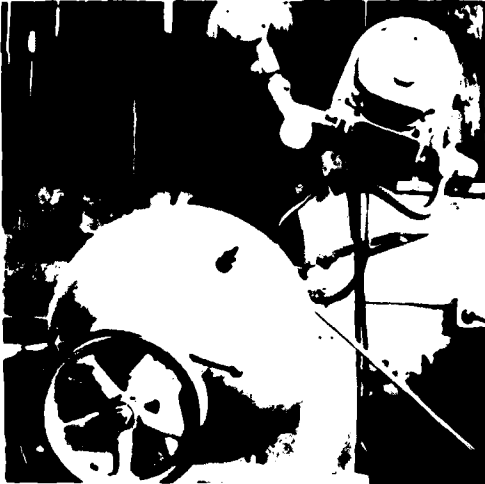
**GOAL: DEVELOP MANUFACTURING TECHNIQUES FOR COOLERS USED WITH INFRARED VIEWING SYSTEMS**

### RESULTS

- **MANUFACTURING TECHNOLOGY RESULTED IN A COOLER WHICH EXCEEDED ALL THE DESIGN SPECIFICATIONS EXCEPT FOR A SHORT 750 HOURS MEAN-TIME-BEFORE-FAILURE. THE DESIGN HAS BEEN FOUND TO BE SUSCEPTIBLE TO THIS PROBLEM.**
- **THE END OF PROJECT UNIT PRICE OF \$4000 IS \$400 LESS THAN ANTICIPATED AT THE OUTSET.**
- **THE RPV, XM21, XM32, AND LASER RANGE FINDER PROGRAMS HAVE USED THESE COOLERS.**

## **DARCOM MMT ACCOMPLISHMENT**

### **AVIATION RESEARCH AND DEVELOPMENT COMMAND**



**SPIN FORMING SUPPRESSOR**

**PROJECT NO: 1 76, 77 7114**

**TITLE: IMPROVED MANUFACTURING TECHNIQUES FOR INFRARED (IR) SUPPRESSION AIRCRAFT COMPONENTS**

**COST: \$343,000**

**GOAL: REDUCE MANUFACTURING COSTS AND IMPROVE ENGINE OPERATING EFFICIENCY**

#### **RESULTS**

- **AN IMPROVED MANUFACTURING METHOD WAS ESTABLISHED FOR PREPARATION OF LOUVERS USED IN THE FILM-COOLED IR SUPPRESSOR**
- **DROP HAMMER FORMING AND BAND SAW CUTTING WERE REPLACED WITH SPIN FORMING AND LASER CUTTING**

**DARCOM MMT ACCOMPLISHMENT  
AVIATION RESEARCH & DEVELOPMENT COMMAND**

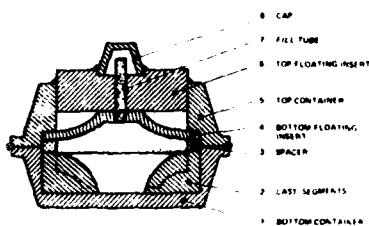
PROJECT NO: 1 79.80 7291

**TITLE: TITANIUM POWDER METAL COMPRESSOR  
IMPELLER**

**COST: \$306.000**

**GOAL: REDUCE MACHINING COSTS OF FORGED  
IMPELLERS**

**RESULTS**



DETAIL	MATERIAL SOURCE
1	BAR OR TUBING AND PLATE
2	INVESTMENT CAST SEGMENTS RELOED INTO A RING
3	PLATE OR TUBING
4	PLATE
5	BAR OR TUBING
6	BAR OR PLATE
7	TUBING
8	BAR

**FLUID DIE - SCHEMATIC**

- **TITANIUM PRE-ALLOYED POWDERS PRODUCED BY THE PLASMA ROTATING ELECTRODE PROCESS WERE CONSOLIDATED BY HOT FORGING.**
- **A FLUID DIE WAS USED IN THE PROCESS WHICH RESULTED IN A DENSITY OVER 99% OF THE THEORETICAL.**
- **UPON SUCCESSFUL COMPLETION AND IMPLEMENTATION OF THE EFFORT, IT IS ESTIMATED THAT OVER \$1.6 MILLION WILL BE SAVED ON THE APACHE AUXILIARY POWER UNIT ALONE.**

## **DARCOM MMT ACCOMPLISHMENT**

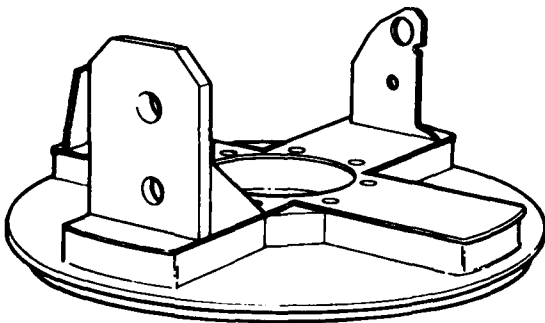
### **AVIATION RESEARCH AND DEVELOPMENT COMMAND**

**PROJECT NO: 1 79 7315**

**TITLE: LOW COST MANUFACTURE OF POISE  
GIMBAL COMPONENTS**

**COST: \$302,000**

**GOAL: ESTABLISH A COST EFFECTIVE  
MANUFACTURING PROCESS FOR  
COMPOSITE GIMBALS**



### **RESULTS**

- **A MANUFACTURING PROCESS WAS ESTABLISHED FOR PRODUCING GRAPHITE/EPOXY COMPOSITE GIMBALS**
- **THE COMPOSITE GIMBALS DEMONSTRATED 1/3 THE WEIGHT, 2X WEIGHT/STIFFNESS, AND 4X DAMPING IMPROVEMENTS COMPARED TO CURRENT ALUMINUM CONSTRUCTION**
- **THE MANUFACTURING PROCESS FOR COMPOSITE GIMBALS WILL RESULT IN LOWER COSTS BECAUSE OF ITS IMPROVED ADAPTABILITY TO THE DESIGN MODIFICATIONS REGULARLY EXPERIENCED WITH THIS TYPE OF COMPONENT**



## **DARCOM MMT ACCOMPLISHMENT**

### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**

**PROJECT NO: 1 74 8008**

**TITLE: BROADGOODS LAYUP SYSTEM  
(CAM RELATED)**

**COST: \$700,000**

**GOAL: REDUCE MANUFACTURING TIME AND  
DIRECT LABOR COST**



**RETROFITTED MILLING MACHINE FOR  
PROTOTYPE COMPOSITE FABRICATION**

### **RESULTS**

- **A 3 AXIS MILLING MACHINE WAS RETROFITTED WITH A COMPUTER NUMERICAL CONTROL MACHINE CONTROL UNIT, TAPE HEAD, AND MOTOR DRIVE SYSTEM.**
- **A SAMPLE PART WAS FABRICATED WITH 3-INCH WIDE GRAPHITE/EPOXY PREPREG TAPE AT ARMY MATERIEL AND MECHANICS RESEARCH CENTER.**
- **PROTOTYPE FABRICATION CAPABILITY HAS BEEN ESTABLISHED.**

## **DARCOM MMT ACCOMPLISHMENT**

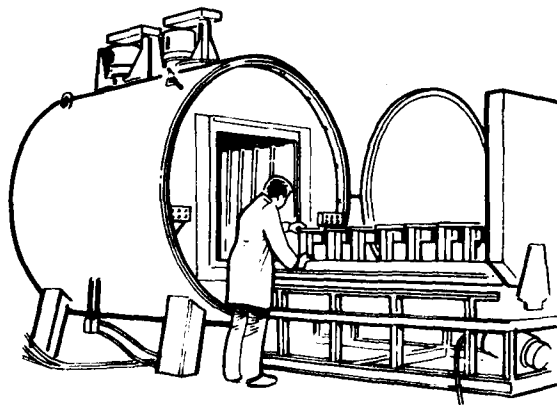
### **AVIATION RESEARCH AND DEVELOPMENT COMMAND**

**PROJECT NO: 1 75,76 8148**

**TITLE: PROCESSING OF ADVANCED GEAR MATERIALS**

**COST: \$345,000**

**GOAL: DEVELOP NON-PROPRIETARY CARBURIZING PROCESS FOR HIGH PERFORMANCE GEARS**



**VACUUM FURNACE**

### **RESULTS**

- **A VACUUM CARBURIZING HEAT TREATMENT WAS DEVELOPED FOR VASCO X2 MATERIAL IN A SPUR GEAR CONFIGURATION**
- **A TECHNIQUE FOR USING ROLLING CONTACT FATIGUE DATA TO PREDICT PITTING FATIGUE LIFE OF GEARS WAS DEVELOPED**
- **A FIBER OPTIC SYSTEM WAS DEVELOPED AND PROVEN SUCCESSFUL. THIS PERMITTED VIEWING THE GEAR TOOTH FACE WHILE STILL ASSEMBLED IN THE FOUR SQUARE DYNAMOMETER**

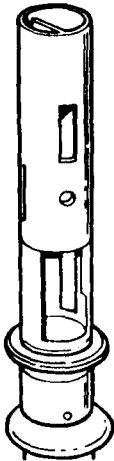
## **DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND**

**PROJECT NO: R 81 1021**

**TITLE: COMPUTERIZED PRODUCTION PROCESS  
PLANNING FOR MACHINED CYLIN-  
DRICAL PARTS (CAM)**

**COST: \$234,000**

**GOAL: UPGRADE A PILOT COMPUTER MAN-  
AGED PROCESS PLANNING (CMPP)  
SYSTEM**



### **RESULTS**

- **THIS PROJECT COMPLETED DEVELOPMENT AND DOCUMENTATION OF A CMPP SYSTEM FOR MACHINED CYLINDRICAL PARTS.**
- **THE CMPP SYSTEM IS BEING USED BY THREE GOVERNMENT CONTRACTORS. IT HAS BEEN USED ON TWO MILITARY AIRCRAFT ENGINES AND HELICOPTER COMPONENTS.**
- **A NUMBER OF PRESENTATIONS AND AN END OF CONTRACT PRESENTATION WERE HELD; OVER 100 REQUESTS FOR THE FINAL REPORT AND 30 REQUESTS FOR THE SOFTWARE HAVE BEEN MADE.**

## **DARCOM MMT ACCOMPLISHMENT**

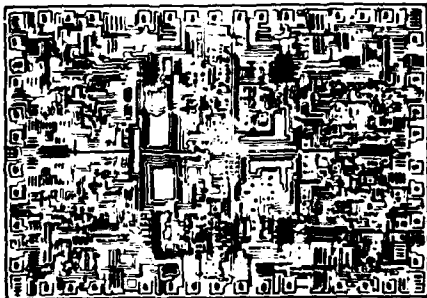
### **MISSILE COMMAND**

**PROJECT NO: R 79 1041**

**TITLE: LARGE SCALE INTEGRATION FABRICATION METHODOLOGY IMPROVEMENT**

**COST: \$1,000,000**

**GOAL: REDUCE COST OF SELECTED CIRCUITS**



**MARTIN MARIETTA PREAMPLIFIER CHIP**

### **RESULTS**

- **MARTIN MARIETTA AND HARRIS SEMICONDUCTOR INCREASED THE YIELD OF PREAMPLIFIER AND LIMIT-SUM CIRCUITS FROM 1-2 PERCENT TO 14-15 PERCENT.**
- **THIS WAS DONE THROUGH PROCESS MODIFICATION, PRODUCIBILITY IMPROVEMENT, TOPOLOGY MODIFICATION, TEST AUTOMATION AND THOROUGH DOCUMENTATION.**
- **CIRCUITS ARE USED IN COPPERHEAD, HELLFIRE LASER SEEKER, AND NAVY GUIDED PROJECTILE. UPON IMPLEMENTATION, SAVINGS CAN APPROXIMATE \$4.5 MILLION OVER THREE YEARS AT PROJECTED RATES.**

## DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND

PROJECT NO: 3 81 1073

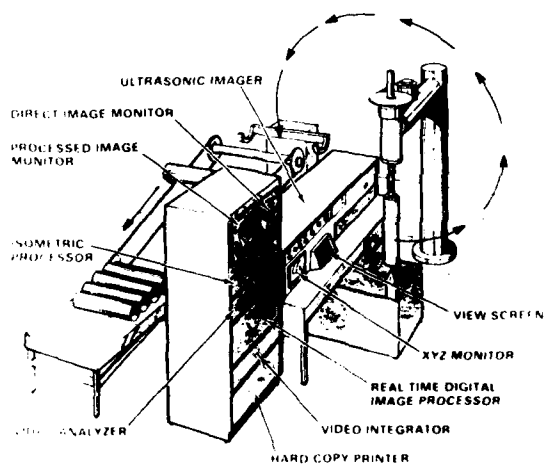
TITLE: REAL TIME ULTRASONIC IMAGING

COST: \$200,000

GOAL: AUTOMATE ULTRASONIC INSPECTION  
OF MATERIEL

### RESULTS

- THIS PROJECT DEMONSTRATED THE CAPABILITY TO LOCATE FLAWS IN COMPOSITE AND METALLIC STRUCTURES USING A REAL TIME ULTRASONIC IMAGING SYSTEM (RTUIS).
- THE SYSTEM CONSISTS OF A REAL TIME ULTRASONIC IMAGER, MATERIEL MANIPULATOR, A SPECIAL SPLIT CAMERA, AND SELECTED VIDEO IMAGE PROCESSING EQUIPMENT.
- THESE RESULTS WILL BE USED TO FABRICATE A PROTOTYPE RTUIS TO INSPECT ROCKET LAUNCH TUBES IN A REDUCED TIME OF POTENTIALLY ONE MINUTE OR LESS.



REAL TIME ULTRASONIC IMAGING SYSTEM  
(RTUIS) CONCEPT

# DARCOM MMT ACCOMPLISHMENT

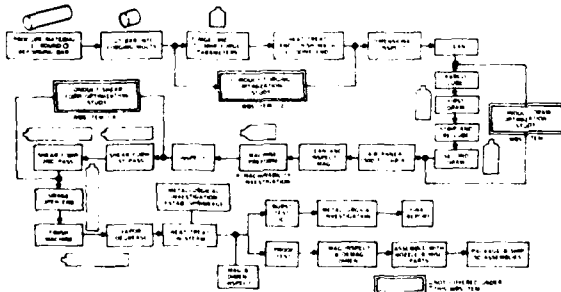
## US ARMY MISSILE COMMAND

**PROJECT NO: 3 81 1086**

**TITLE: COBALT REPLACEMENT IN MARAGING STEEL FOR ROCKET MOTOR COMPONENTS**

**COST: \$300,000**

**GOAL: CONSERVATION OF CRITICAL STRATEGIC MATERIAL**

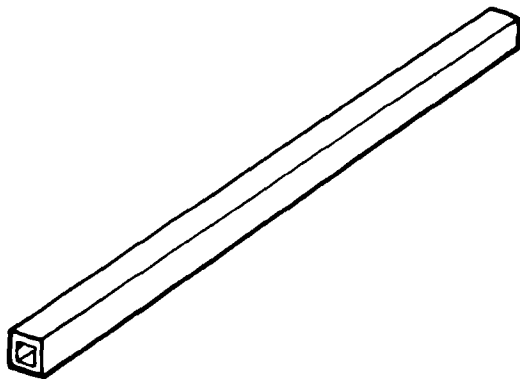


**FREE-CO 250 TOW MOTOR CASE  
PROCESS FLOW CHART**

### RESULTS

- A MANUFACTURING SEQUENCE FOR PRODUCING COBALT FREE (FREE-CO) TOW MISSILE BODIES WAS ESTABLISHED.
- 50 FREE-CO TOW ROCKET MOTOR CASES WERE PRODUCED FOR FURTHER EVALUATION BY MICOM.
- THE APPLICABILITY OF FREE-CO MANUFACTURING TECHNOLOGY TO LARGER SIZE ROCKETS WAS DEMONSTRATED.

## **DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND**



**LITHIUM FERRITE TOROID**

**PROJECT NO: R 77,78 3133**

**TITLE: PRODUCTION OF LITHIUM FERRITE  
PHASE SHIFTER FOR PHASED ARRAY  
RADARS**

**COST: \$530,000**

**GOAL: REDUCE COST BUT RETAIN  
PERFORMANCE OF TOROIDS**

### **RESULTS**

- **METHODS FOR PRODUCTION OF LITHIUM FERRITE FOR PHASE SHIFTER TOROIDS HAVE BEEN DEMONSTRATED IN THE PILOT LINE.**
- **COST SAVINGS OF ABOUT \$8 PER TOROID HAVE BEEN DEMONSTRATED WHICH EQUATES TO ABOUT \$40,000 PER RADAR SET.**
- **THERE IS A HIGH POTENTIAL FOR IMPLEMENTATION IN THE ANTI-TACTICAL MISSILE.**

## **DARCOM MMT ACCOMPLISHMENT**

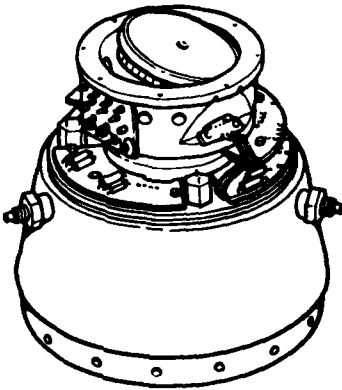
### **MISSILE COMMAND**

**PROJECT NO: R 79 3136**

**TITLE: IMPROVED MANUFACTURING  
PROCESSES FOR COMPLIANT BEARING  
GYROS**

**COST: \$350,000**

**GOAL: IMPROVE AND AUTOMATE THE  
MANUFACTURING OF THIS LOW COST  
ALTERNATE GYRO**



**COPPERHEAD SEEKER HEAD**

### **RESULTS**

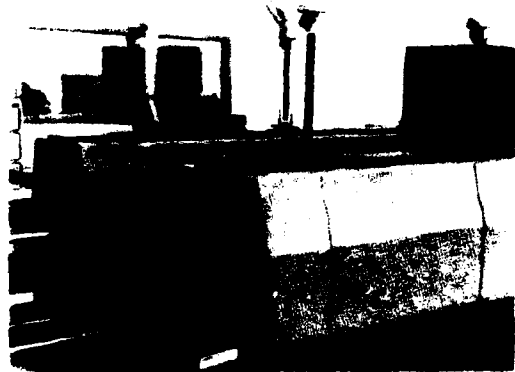
- **A PILOT PRODUCTION LINE WAS ESTABLISHED THAT INCLUDES:**
  - **AUTOMATED DYNAMIC BALANCING OF THE ROTOR.**
  - **INEXPENSIVE MOLDED MAGNET ASSEMBLY.**
  - **MULTICAVITY MOLD FOR THE COMPLIANT LAYER THAT ALLOWS PART INTER-CHANGEABILITY.**
  - **AUTOMATED FINAL TEST.**
  
- **GYRO COST CAN BE REDUCED FROM \$1400 TO \$434 IF IMPLEMENTED ON COPPERHEAD.**



## **DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND**



**SCREEN PRINTER**



**FIRING FURNACE**

**PROJECT NO: R 79 3146**

**TITLE: FINE LINE HYBRID SUBSTRATES**

**COST: \$350,000**

**GOAL: REDUCE MANUFACTURING COSTS**

### **RESULTS**

- **FINE LINE MULTILAYER SUBSTRATES HALVED MATERIAL COSTS AND ACHIEVED AN AREA REDUCTION OF 2:1.**
- **TOTAL AVERAGE YIELD IN EXCESS OF 71 PERCENT WAS ACHIEVED FOR HYBRIDS WITH THREE METALLIZATION LAYERS, ALL HAVING LINE WIDTHS OF 5 MILS OR LESS.**
- **TECHNOLOGY PROVIDED INCREASED PERFORMANCE AND RELIABILITY**

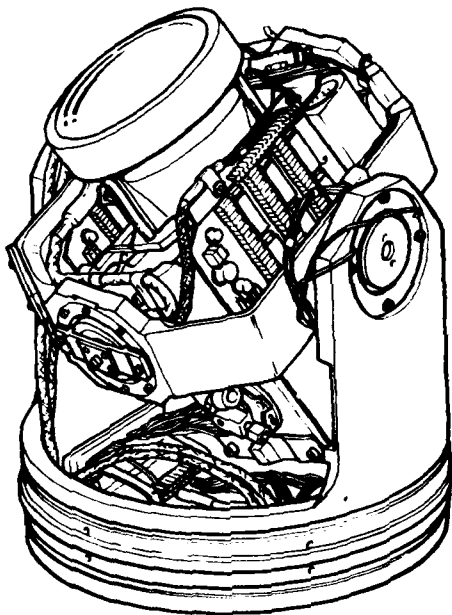
## **DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND**

**PROJECT NO: R 77.78 3188**

**TITLE: INFRARED IMAGING SEEKERS FOR  
THERMAL HOMING MISSILES**

**COST: \$950,000**

**GOAL: REDUCE MANUFACTURING COST OF  
IR IMAGING SEEKERS**



**IR IMAGING SEEKER**

### **RESULTS**

- **PROCESSES WERE DEFINED WHICH ALLOWED THE REPLACEMENT OF MACHINED METAL PARTS WITH INJECTION MOLDED CARBON FIBER FILLED PLASTIC COMPONENTS.**
- **THE ADVANCED PROCESSES ENABLED A LARGE SCALE PRODUCTION UNIT COST OF \$5417, VERY NEAR THE DESIGN-TO-COST TARGET OF \$5160.**
- **A MODIFIED VERSION OF THIS DESIGN MAY ALSO BE IMPLEMENTED BY USAF.**

# DARCOM MMT ACCOMPLISHMENT

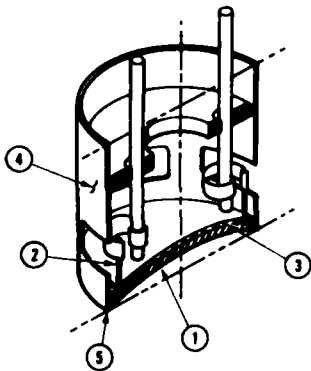
## MISSILE COMMAND

PROJECT NO: R 77,79,80 3217

TITLE: AUTOMATIC PRODUCTION OF TRAVELING WAVE TUBES

COST: \$1,761,000

GOAL: IMPROVE THE MANUFACTURING TECHNIQUES OF TRAVELING WAVE TUBES



- ① TUNGSTEN IRIIDIUM CATHODE
- ② UNCOATED HEATER, WIRE DIA .005 IN
- ③ MOLY NICKEL POTTING
- ④ RHENIUM SUPPORT SLEEVE 0.001 INCH THICK
- ⑤ MOLY NICKEL BRAZE

**CATHODE-HEATER ASSEMBLY  
(METALLIC POTTING DESIGN)**

### RESULTS

- LOWER COST MANUFACTURING TECHNOLOGY HAS BEEN DEVELOPED FOR THE PRODUCTION OF TRAVELING WAVE TUBES.
- THE CURRENT COST OF THE TUBE IS ABOUT \$20,000. LITTON'S COST ANALYSIS PROJECTS A UNIT COST OF \$6,344 FOR THE 6000TH UNIT.
- THE PATRIOT PROGRAM IS CURRENTLY USING THESE TRAVELING WAVE TUBES.

## DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND

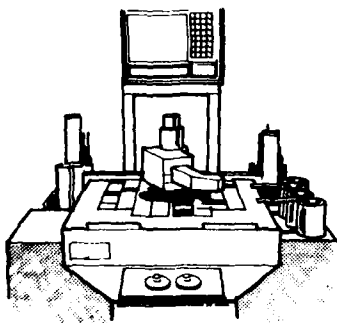


FIGURE 1 - SPAR BASED SYSTEM MOCKUP

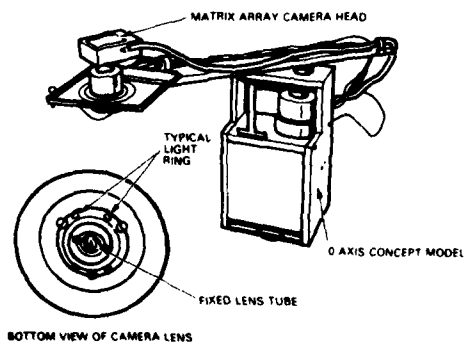


FIGURE 2 - CONCEPT MODEL-T.V. CAMERA  
ASSEMBLY

PROJECT NO: R 79, 80 3219

TITLE: AUTOMATIC POLYMER DIE ATTACHMENT METHODS

COST: \$400,000

GOAL: REDUCE MANUFACTURING COSTS BY INCREASING HYBRID BOND YIELDS

### RESULTS

- AN AUTOMATIC CHIP RECOGNITION SYSTEM WITH IMAGE PROCESSING AND PATTERN RECOGNITION WAS DEVELOPED AND IMPLEMENTED ON AN AUTOMATIC DIE BONDER.
- SYSTEM HAS CAPABILITY OF PROCESSING 25 SUBSTRATES PER HOUR WITH 30 DIE PER SUBSTRATE.
- NEW ATTACHMENT TECHNIQUES INCREASED HYBRID BONDING YIELDS 25 PERCENT. KULICKE & SOFFA IS BUILDING THE PROTOTYPE SYSTEM UNDER MMT FOLLOW-ON PROJECT 3 82 1076.

# DARCOM MMT ACCOMPLISHMENT

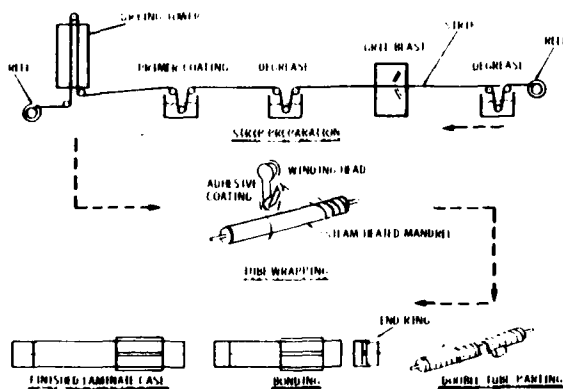
## MISSILE COMMAND

PROJECT NO: 3 7T,79 3287

TITLE: PRODUCTION METHODS FOR LOW COST STRIP LAMINATE MOTOR CASES

COST: \$625,000

GOAL: ESTABLISH STRIP LAMINATE PROCESS FOR ROCKET MOTOR COMPONENTS



STRIP LAMINATE FABRICATION SEQUENCE

### RESULTS

- THE PROJECT PROVED THAT LOW COST CONFIGURATIONS CAN BE ACHIEVED BY A STRIP LAMINATE PROCESS WITH NO PERFORMANCE PENALTIES.
- THE STRIP LAMINATE PROCESS PROVIDES A LOW COST ALTERNATIVE TO THE DESIGN ENGINEER.
- THE STRIP LAMINATE PROCESS COULD LOWER THE CASE COST OF THE CHAPARRAL BY 19 TO 30 PERCENT.

## DARCOM MMT ACCOMPLISHMENT

### MISSILE COMMAND

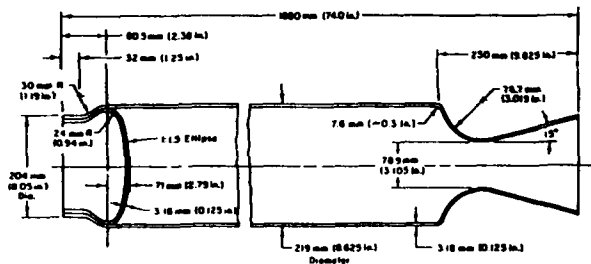
PROJECT NO: 3 80 3294

TITLE: PRODUCTION PROCESS FOR ROTARY  
ROLL FORMING

COST: \$300,000

GOAL: REDUCE MANUFACTURING COSTS

### RESULTS



EXPERIMENTAL MOTOR CASE TARGET DESIGN

- THE PROJECT DEMONSTRATED THAT THE SPINNING PROCESS WITH FULLY AUTOMATIC CYCLE CONTROL IS THE BEST METHOD FOR MANUFACTURING ROCKET MOTOR CASES FROM MILL PRODUCTS.
- THE PROJECT DETERMINED THAT ELECTRICAL RESISTANCE WELDED MECHANICAL TUBING IS ESPECIALLY AMENABLE TO MOTOR CASE MANUFACTURE.
- THE PROJECT RESULTS FORM THE BASIS FOR THE PHASE II (FY81) FOLLOW-ON OF CONCEPT DEMONSTRATION, TESTING, AND THE PREPARATION OF DETAILED MANUFACTURING PROCEDURES.

## DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND

PROJECT NO: R 78,80 3396

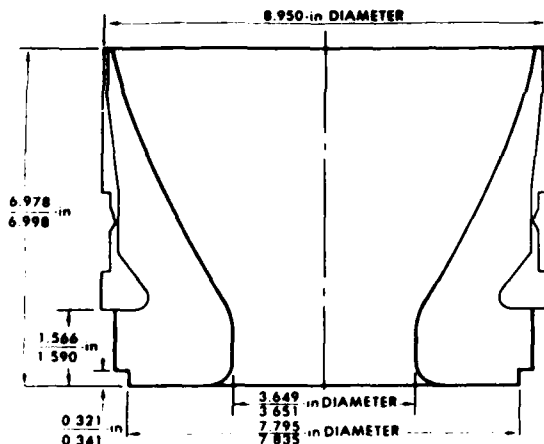
TITLE: LOW COST - ONE PIECE NOZZLES

COST: \$360,000

GOAL: REDUCE PRODUCTION COSTS WITH  
INJECTION MOLDING TECHNIQUES

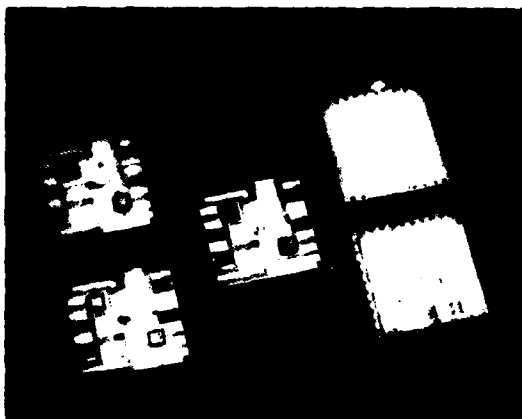
### RESULTS

- TOOLING FOR INJECTION MOLDING MISSILE NOZZLES WAS DESIGNED AND FABRICATED.
- TWENTY NOZZLES WERE MOLDED FROM PHENOLIC MATERIALS AND SUBJECTED TO LAB ANALYSIS AND SIMULATED ROCKET MOTOR ENVIRONMENTS.
- THE MOLDING PROCESS ESTABLISHED FOR THE NOZZLES ALLOWS 10 TIMES FASTER MOLDING RATES THAN THE TRADITIONAL PROCESS.
- UPON IMPLEMENTATION, MANUFACTURING COSTS AND PART RELIABILITY ARE EXPECTED TO SUBSTANTIALLY IMPROVE.



INJECTION MOLDED MLRS NOZZLE

## **DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND**



**FIGURE 1 - EXPERIMENTAL HYBRID PACKAGES  
WITH AND WITHOUT EVAPORATOR WICKS**

**PROJECT NO: R 79 3410**

**TITLE: HEAT PIPES FOR HYBRID MICRO-  
CIRCUITS**

**COST: \$250,000**

**GOAL: ESTABLISH A PRODUCTION CAPABILITY**

### **RESULTS**

- **LOW COST PRODUCTION TECHNIQUES WERE DOCUMENTED FOR FABRICATING HEAT PIPE COOLED MICROCIRCUIT PACKAGES AT A RATE OF 15 PER HOUR.**
- **HEAT PIPE COOLED PACKAGES LOWERED TRANSISTOR CHIP JUNCTION TEMPERATURE 50 PERCENT COMPARED TO NON-HEAT VERSIONS OF THE SAME PACKAGE.**
- **TECHNOLOGY CAN BE USED TO INCREASE POWER DENSITIES, RESULTING IN FEWER CHIPS PER CIRCUIT.**



# DARCOM MMT ACCOMPLISHMENT

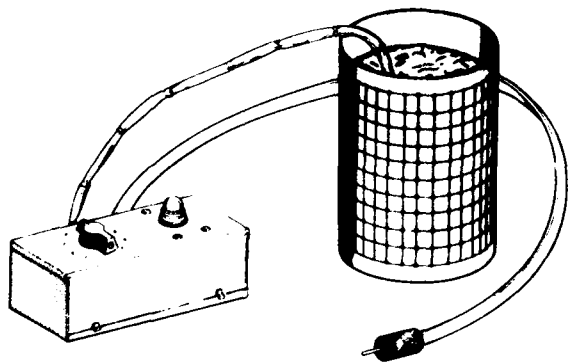
## MISSILE COMMAND

PROJECT NO: R 80 3411

TITLE: MANUFACTURE OF NON-PLANAR  
PRINTED CURCUIT BOARDS

COST: \$220,000

GOAL: ESTABLISH COST EFFECTIVE PROCESSES  
FOR NON-PLANAR CIRCUIT BOARDS



COMPLETED CYLINDRICAL CIRCUIT BOARD

## RESULTS

- PROCEDURES FOR MANUFACTURING THE REFLECTOR AND SPIRAL ELEMENT FOR A CASSEGRAIN TYPE ANTENNA WERE DEVELOPED.
- A MULTILAYER CYLINDRICAL CIRCUIT BOARD INCLUDING A TEST PATTERN WAS PRODUCED.
- THE SELECTED METHOD OF MANUFACTURE WAS TO PROCESS THE BOARD WHILE FLAT, THEN BEND AND CURE IT INTO THE FINAL CONFIGURATION.
- COMPLETION OF THE EFFORT AND IMPLEMENTATION ON THE COPPERHEAD WOULD RESULT IN AN ESTIMATED SAVINGS OF \$3 MILLION.

## **DARCOM MMT ACCOMPLISHMENT**

### **MISSILE COMMAND**

**PROJECT NO: R 78, 80 3436**

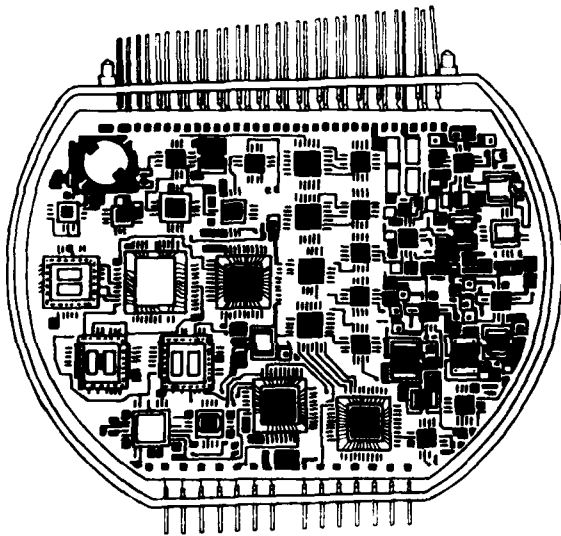
**TITLE: LARGE SCALE HYBRID MICROCIRCUITS**

**COST: \$1,000,000**

**GOAL: INCREASE HYBRID CIRCUIT YIELDS AND RELIABILITY**

### **RESULTS**

- **MICROCIRCUITS WITH 10 MIL LINES AND 150-12.5 MIL DIAMETER VIAS FOR 4 TO 6 LAYERS CAN BE PRODUCED WITH 60 PERCENT INITIAL YIELDS.**
- **BUMPED TAPE CARRIERS WITH PLASTIC SLIDE TEST BEDS WERE DEMONSTRATED WITH IN-PROCESS FUNCTIONAL TESTING.**
- **USE OF KRYPTON-85 REDUCED THE LEAK TEST TIME FROM 28 HOURS TO 1-1/2 HOURS.**
- **A COST REDUCTION OF 20 PERCENT IS ANTICIPATED FOR PASSIVE OPTICAL SEEKER PRODUCTION.**



**HYBRID MICROCIRCUIT USING BTAB TECHNOLOGY**

## **DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND**

**PROJECT NO: R 79 3438**

**TITLE: DELIDDING AND RESEALING HYBRID  
MICROCIRCUIT PACKAGES**

**COST: \$200,000**

**GOAL: REDUCE MATERIAL AND LABOR  
MANUFACTURING COSTS**



**HYBRID PACKAGE ABOUT TO BE MACHINED**

### **RESULTS**

- **SAWING EQUIPMENT AND PROCESSES WERE DEVELOPED AND REFINED TO DELID AND RESEAL BOTH BUTTERFLY AND BATHTUB HYBRID MICROCIRCUIT PACKAGES.**
- **QUALIFICATION TESTING PER MIL-STD-883 VERIFIED THAT HYBRID PERFORMANCE WAS NOT DEGRADED AFTER REWORK AND RESEAL.**
- **THIS REWORK CAPABILITY WILL INCREASE WELDED HYBRID PACKAGE YIELD 30 PERCENT AND CAN PROVIDE POTENTIAL SAVINGS OF \$2.5 MILLION PER YEAR.**

## DARCOM MMT ACCOMPLISHMENT MISSILE COMMAND

PROJECT NO: R 79.80 3445

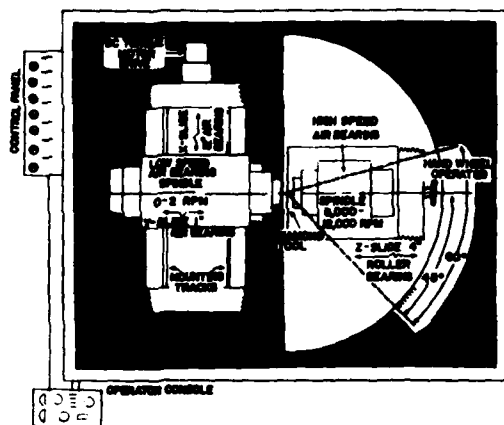
TITLE: PRECISION MACHINING OF OPTICAL  
COMPONENTS

COST: \$700,000

GOAL: DEVELOP MASS PRODUCTION TECHNIQUES  
FOR OPTICAL COMPONENTS

### RESULTS

- A SURVEY OF DOD APPLICATIONS FOR OPTICAL COMPONENTS WAS CONDUCTED.
- SPECIFICATIONS WERE DEVELOPED AND PERSONNEL WERE TRAINED IN THE OPERATION OF PRECISION DIAMOND TURNING EQUIPMENT.
- MANUFACTURING PROCESSES WERE ESTABLISHED AND PROOF PARTS WERE PRODUCED.
- WHEN IMPLEMENTED WITH SUPPORTING FACILITIES, IT IS ESTIMATED THAT \$1.2 MILLION PER YEAR WILL BE SAVED.



PRECISION DIAMOND TURNING MACHINE

## DARCOM MMT ACCOMPLISHMENT

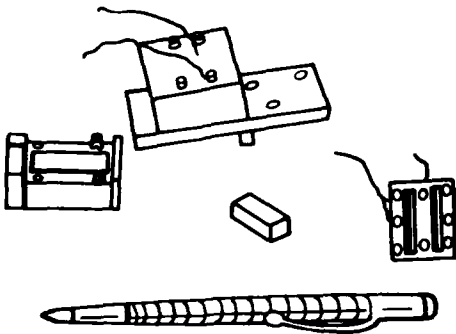
### MISSILE COMMAND

PROJECT NO: R 78 3453

TITLE: IMPROVED PRODUCTION TECHNIQUES  
FOR GROUND LASER LOCATOR

COST: \$211,000

GOAL: DEMONSTRATE HIGH PRODUCTION  
RATE MANUFACTURING METHODS FOR  
LASER Q-SWITCHES



EXPLODED VIEW OF Q-SWITCH

### RESULTS

- IMPROVED MANUFACTURING PROCESSES HAVE BEEN DEMONSTRATED IN A PRODUCTION FACILITY CAPABLE OF PRODUCING 250 LITHIUM NIOBATE Q-SWITCHES PER MONTH.
- COMPANIES SUCH AS HUGHES, ILS AND FERRANTI PURCHASE THESE Q-SWITCHES TO SUPPORT TRAM, A6, GLLD, GVLLD, MULE AND DIVAD.
- AS A MINIMUM, COST SAVINGS OF \$150 PER Q-SWITCH FOR THE DIVAD PROGRAM AND \$70 PER Q-SWITCH FOR THE GVLLD WILL BE EXPERIENCED.

# DARCOM MMT ACCOMPLISHMENT

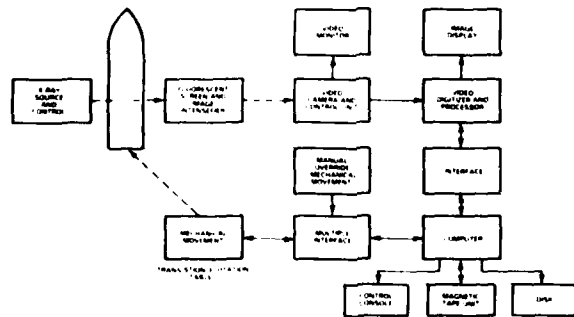
## MISSILE COMMAND

PROJECT NO: 3 78 3454

TITLE: LOW COST - HI VOLUME RADIOGRAPHIC INSPECTION

COST: \$200,000

GOAL: DEVELOP A NONFILM RADIOLOGIC INSPECTION SYSTEM



**NONFILM RADIOLOGIC INSPECTION SYSTEM CONCEPT**

### RESULTS

- THIS PROJECT PRODUCED A NONFILM RADIOLOGIC INSPECTION SYSTEM FOR EVALUATING HIGH PRODUCTION VOLUME MISSILE COMPONENTS.
- THIS SYSTEM FEATURES REAL-TIME X-RAY, DIGITAL IMAGE ENHANCEMENT, REMOTE PART POSITIONING, AND COMPUTER AIDED OPERATIONS.
- THE ROLAND MISSILE FINAL ASSEMBLY INSPECTION WAS CHOSEN FOR IMPLEMENTATION. ONCE THIS TECHNOLOGY IS IMPLEMENTED, A POTENTIAL COST REDUCTION OF 8:1 AND TIME REDUCTION OF 5:1 IS ANTICIPATED IN THE INSPECTION OPERATION.

# DARCOM MMT ACCOMPLISHMENT

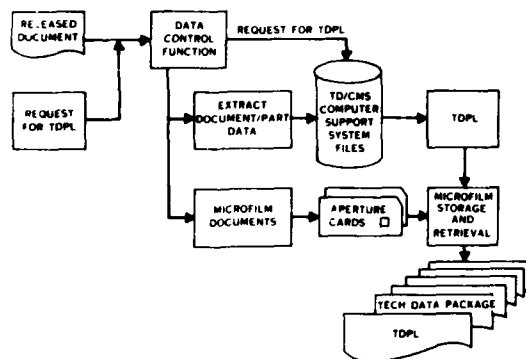
## TANK-AUTOMOTIVE COMMAND

**PROJECT NO: 4 74,75,7T 4568**

**TITLE: TECHNICAL DATA/CONFIGURATION  
MANAGEMENT SYSTEM (TD/CMS)**

**COST: \$820,000**

**GOAL: IMPROVE THE EFFECTIVENESS OF  
TACOM TD/CMS AND ESTABLISH  
DARCOM STANDARD TD/CMS**



**STORAGE AND RETRIEVAL OF  
TECHNICAL DOCUMENTS ON MICROFILM**

### RESULTS

- **THE TD/CMS WAS MANDATED AS A DARCOM STANDARD SYSTEM BY ALL MAJOR SUBORDINATE COMMANDS IN 1977.**
- **THE TECHNICAL DATA FOR 15 TRACKED COMBAT VEHICLE SYSTEMS WERE REVIEWED AND VALIDATED.**
- **AUTOMATIC GENERATION OF TECHNICAL DATA PACKAGES WAS ESTABLISHED TO SUPPORT PROCUREMENT ACTIONS.**

## DARCOM MMT ACCOMPLISHMENT TANK & AUTOMOTIVE COMMAND

PROJECT NO: T 77 5014

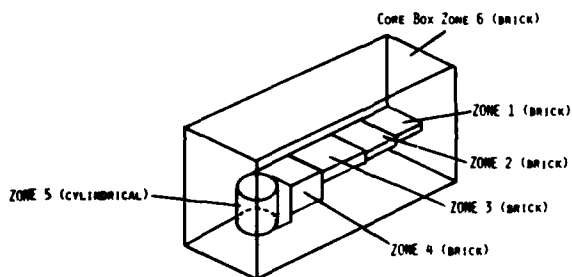
TITLE: IMPROVED FOUNDRY CASTING PROCESSES

COST: \$560,000

GOAL: REDUCE COSTS FOR CASTINGS

### RESULTS

- COMPUTER PROCEDURES WERE SUCCESSFULLY ESTABLISHED FOR SIMULATING THE CASTING SOLIDIFICATION PROCESS.
- TEST CASTINGS WERE FABRICATED AT BLAW-KNOX. SIMULATION RESULTS WERE FOUND TO BE IN GOOD AGREEMENT WITH TEST RESULTS.
- UPON IMPLEMENTATION, HIGHER QUALITY CASTINGS ARE EXPECTED AND AN ESTIMATED \$1 MILLION PER YEAR WILL RESULT FROM A REDUCTION IN SCRAP.



DRAG PORTION OF STEPPED PLATE CASTING  
MODEL USED FOR MESH GENERATION



## DARCOM MMT ACCOMPLISHMENT TANK-AUTOMOTIVE COMMAND

PROJECT NO: T 78,81 5014

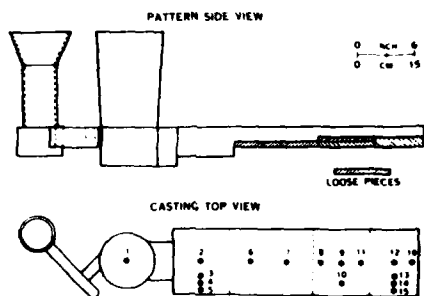
TITLE: IMPROVED FOUNDRY CASTING PROCESS

COST: \$465,000

GOAL: REDUCE COSTS FOR CASTINGS

### RESULTS

- COMPUTER PROCEDURES WERE ESTABLISHED TO SIMULATE CASTING SOLIDIFICATION IN THE NO-BAKE SAND AND GREEN SAND PROCESSES.
- TEST CASTINGS WERE FABRICATED AT TWO PRODUCTION FOUNDRIES. SIMULATION RESULTS WERE IN AGREEMENT WITH TEST RESULTS.
- UPON IMPLEMENTATION, HIGHER QUALITY CASTINGS ARE EXPECTED. AN ESTIMATED \$1 MILLION PER YEAR WILL RESULT FROM A REDUCTION IN SCRAP.



**TEST PLATE PATTERN SIDE  
VIEW AND CASTING TOP VIEW  
INDICATING THERMOCOUPLE POSITIONS**

## **DARCOM MMT ACCOMPLISHMENT**

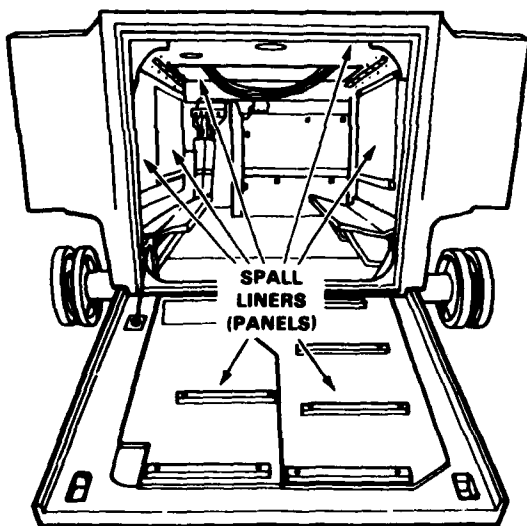
### **TANK-AUTOMOTIVE COMMAND**

**PROJECT NO: T 79 5045**

**TITLE: SPALL SUPPRESSIVE ARMOR FOR  
COMBAT VEHICLES**

**COST: \$150,000**

**GOAL: IMPROVE SAFETY OF COMBAT VEHICLES**



**INTERIOR AND EXTERIOR (REAR)  
M113A1/A2 CARRIER**

### **RESULTS**

- **A METHOD OF ATTACHMENT FOR AN INTERNAL SPALL LINER SYSTEM WAS DEVELOPED FOR THE M113A1/A2 CARRIER.**
- **THREE LINER KITS WERE FABRICATED FOR INSTALLATION IN TEST VEHICLES.**
- **AFTER EVALUATION OF THE SYSTEM DURING THE SECOND YEAR OF THE PROGRAM, IMPLEMENTATION WILL RESULT IN A CARRIER LESS PRONE TO CASUALTIES FROM SPALLING EFFECTS.**

# DARCOM MMT ACCOMPLISHMENT

## TANK-AUTOMOTIVE COMMAND

**PROJECT NO: T 79 5090**

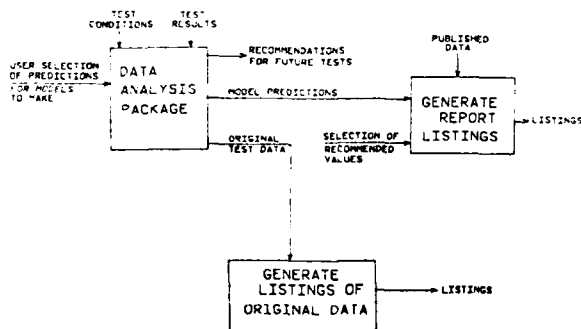
**TITLE: IMPROVED AND COST EFFECTIVE MACHINING TECHNIQUES**

**COST: \$446,000**

**GOAL: REDUCE MANUFACTURING COSTS**

### RESULTS

- A HANDBOOK OF RECOMMENDED STARTING POINTS FOR CUTTING CONDITIONS WAS DEVELOPED
- THE DATA ENABLES SELECTION OF THE MOST EFFICIENT AND LEAST EXPENSIVE TOOLING FOR MACHINING OPERATIONS
- LEAD TIME OF COMPONENTS WILL BE IMPROVED WHILE TOTAL COST IS REDUCED



**MACHINING DATA STORAGE SYSTEM**

# DARCOM MMT ACCOMPLISHMENT

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 77 1327

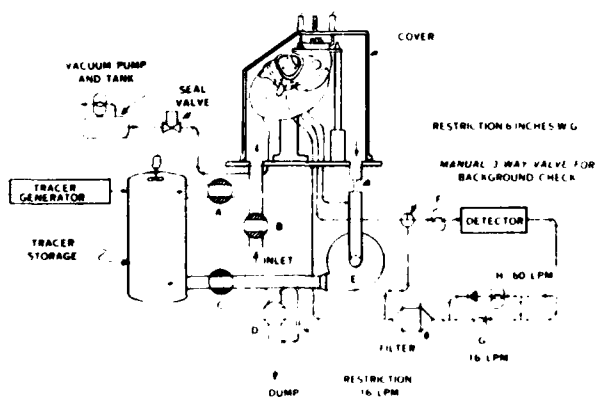
TITLE: IMPROVED GAS MASK LEAKAGE TESTING

COST: \$305,000

GOAL: ESTABLISH A MORE RELIABLE, SENSITIVE, AND COMPACT GAS MASK TESTER

### RESULTS

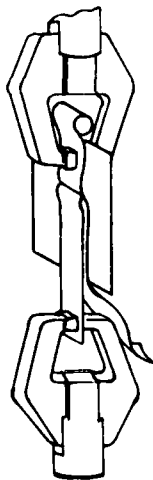
- A PROTOTYPE GAS MASK LEAKAGE TESTER WAS DEVELOPED WHICH EXHIBITED INCREASED RELIABILITY AND ACCURACY.
- FUTURE MASK TESTERS WILL BE DESIGNED BASED ON DATA GENERATED DURING THIS PROJECT.



GAS MASK TESTER

# **DARCOM MMT ACCOMPLISHMENT**

## **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**



**TAPE SPECIMEN DURING TACK TEST**

**PROJECT NO: 5 78 1345**

**TITLE: MT FOR BIO-DETECTION AND WARNING SYSTEM (BDWS)**

**COST: \$480,000**

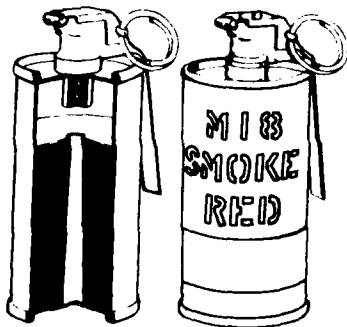
**GOAL: ESTABLISH A PILOT FACILITY FOR MANUFACTURE OF TAPE FOR THE XM19 REFILL KIT**

### **RESULTS**

- **THE MANUFACTURING METHODS AND PHYSICAL PROPERTIES OF TAPE COATING WERE DEVELOPED.**
- **THE PHYSICAL PROPERTIES AND SPECIFICATIONS DEVELOPED WERE USED AS A GUIDE TO SUCCESSFULLY PRODUCE TAPES ON A LARGER PILOT SCALE UNIT.**

## DARCOM MMT ACCOMPLISHMENT

### ARMAMENT RESEARCH AND DEVELOPMENT COMMAND



ITEM	M18 GRENADE
TYPE	CORE BURNING
COLORS	RED, VIOLET, GREEN, YELLOW
SIZE	2.5 INCH DIAMETER, 4.5 INCHES LONG
WEIGHT (TOTAL)	1.07 LB
(MIX)	.73 LB
FUZE	M201A1 PYROTECHNIC FUZE
BURNING TIME	50-80 SECONDS

PROJECT NO: 5 79 1403

TITLE: SUBSTITUTION OF NON-TOXIC DYES IN SMOKE GRENADES

COST: \$315,000

GOAL: SUBSTITUTE NON-CARCINOGENIC, NON-MUTAGENIC, AND MINIMALLY TOXIC DYES FOR USE IN SMOKE GRENADES

### RESULTS

- NON-CARCINOGENIC DYES WERE SUCCESSFULLY SUBSTITUTED INTO YELLOW AND GREEN M18 GRENADES.
- PERFORMANCE AND HAZARDS TESTING INDICATED THAT THE NEW FORMULATIONS WERE SAFE AND EFFECTIVE.
- ADDITIONAL BENEFIT GAINED IN COST SAVINGS OF \$293,680/YEAR DUE TO LOWER DYE COSTS.

## **DARCOM MMT ACCOMPLISHMENT ARMAMENT READINESS COMMAND**

**PROJECT NO: 5 79,80 1903**

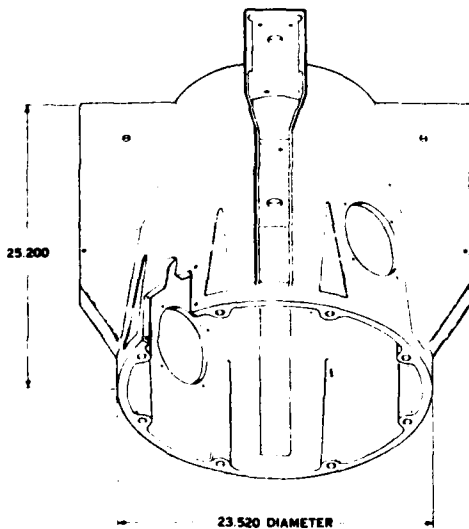
**TITLE: DIE CAST TAIL CONE AND ONE-PIECE  
SKIN FOR BLU-96/B**

**COST: \$1,628,000**

**GOAL: REDUCE MANUFACTURING COSTS**

### **RESULTS**

- **THE 92 POUND TRIM WEIGHT TAIL CONE WAS THE LARGEST PART EVER SUCCESSFULLY DIE CAST FOR A WEAPONS SYSTEM**
- **THE 97 TON DIE SET WAS THE FIRST TO BE DESIGNED WITH THE AID OF A COMPUTER**
- **A \$47,000,000 SAVINGS IS ESTIMATED ON A PRODUCTION RUN OF 100,000 COMPONENTS, IF THE BLU-96/B IS PLACED INTO PRODUCTION**



**TAIL CONE**

## **DARCOM MMT ACCOMPLISHMENT**

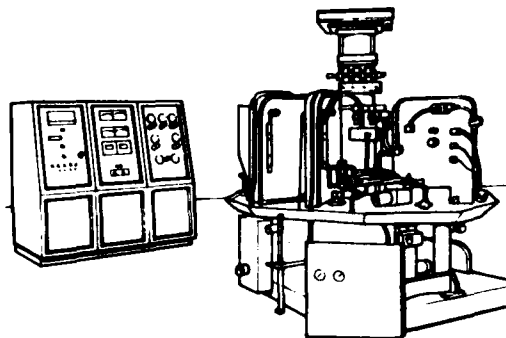
### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**

**PROJECT NO: 5 77,78 4000**

**TITLE: AUTOMATED M55 DETONATOR  
PRODUCTION EQUIPMENT**

**COST: \$2,182,900**

**GOAL: DEVELOP FULLY AUTOMATED SYSTEM  
FOR M55 STAB DETONATORS**



**MULTI-TOOL LOADER**

### **RESULTS**

- **AN AUTOMATIC INSPECTION MODULE FOR INSPECTING DETONATOR CUPS WAS BUILT.**
- **AN IMPROVED ASPIRATOR AND AUTOMATIC LACQUER DISPENSING SYSTEMS WERE ESTABLISHED.**
- **THE MULTI-TOOL LOADER AT IOWA AAP WAS IMPROVED AND REFINED.**
- **AUTOMATIC PACKOUT MODULE AND MATERIAL HANDLING SYSTEM CONCEPTS WERE ESTABLISHED.**
- **PARAMETERS FOR ULTRASONIC SEALING OF DETONATORS WERE ESTABLISHED.**



## **DARCOM MMT ACCOMPLISHMENT**

### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**

**PROJECT NO: 5 80 4033**

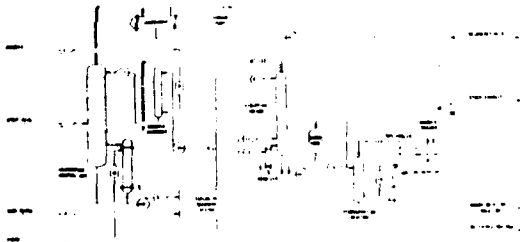
**TITLE: CAUSTIC RECOVERY FROM SODIUM  
NITRATE SLUDGE**

**COST: \$153,000**

**GOAL: ESTABLISH OPTIMUM PROCESS FOR  
SODIUM NITRATE SLUDGE DISPOSAL**

#### **RESULTS**

- **THE USE OF AMMONIA FOR NEUTRALIZATION FOLLOWED BY CATALYTIC HYDROGENATION WAS SELECTED FOR FURTHER EVALUATION IN A FOLLOW-ON PROJECT.**
- **THE USE OF INCINERATION FOR DISPOSAL OF THE SPENT ACID SLUDGE WAS FOUND TO BE A VIABLE CONCEPT BUT REQUIRED A LARGER CAPITAL INVESTMENT.**



**NEUTRALIZATION AND  
HYDROGENATION PROCESS**

# DARCOM MMT ACCOMPLISHMENT

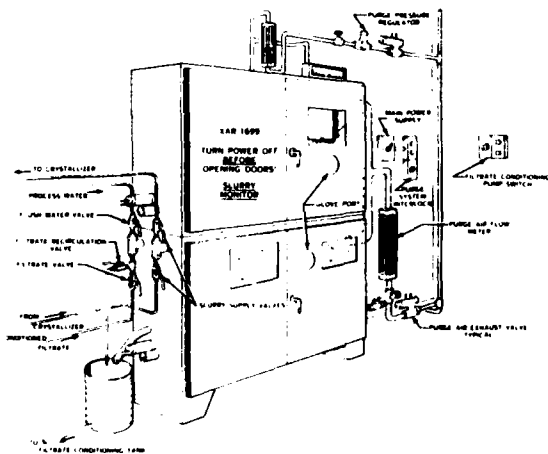
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 79 4059

TITLE: OPTIMIZATION OF NITROGUANIDINE IN  
M30 PROPELLANT

COST: \$271,000

GOAL: PROVIDE ON-LINE PARTICLE SIZE  
ANALYSIS



SLURRY MONITOR

### RESULTS

- DRY POWDER AND SLURRY NITROGUANIDINE MONITORS WERE EVALUATED
- A CORRELATION BETWEEN THE SLURRY MONITOR AND THE CURRENTLY SPECIFIED METHOD OF PARTICLE SIZE ANALYSIS WAS ESTABLISHED
- APPLICABILITY OF THE SLURRY MONITOR FOR PROCESS CONTROL IN THE CRYSTALLIZING OPERATION WAS ESTABLISHED

# DARCOM MMT ACCOMPLISHMENT

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 79 4064

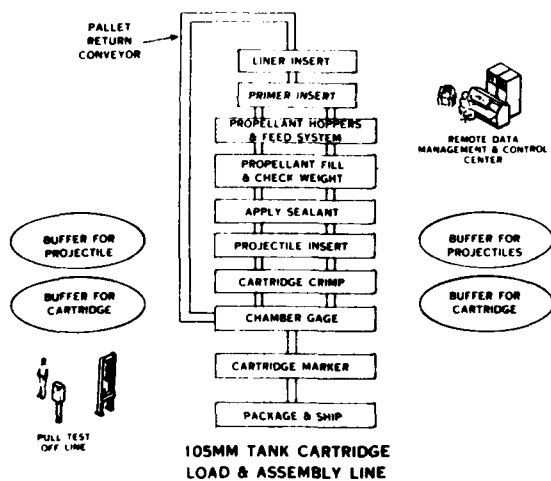
TITLE: AUTOMATED ASSEMBLY OF TANK CARTRIDGES

COST: \$1,320,000

GOAL: REDUCE MANUFACTURING COSTS AND IMPROVE SAFETY

### RESULTS

- A PRODUCTION SYSTEM FOR THE AUTOMATED LOAD AND ASSEMBLY OF A FAMILY OF 105MM TANK CARTRIDGES WAS DESIGNED.
- THE LINER-TO-CASE ASSEMBLY SUBSYSTEM WAS EXPERIMENTALLY MODELED. A DETAILED TECHNICAL DATA PACKAGE ON THIS SUBSYSTEM WAS PREPARED.
- FOLLOW-ON EFFORTS WILL IMPLEMENT THE RESULTS OF THIS PROJECT. AN ESTIMATED ANNUAL SAVINGS OF \$4.5 MILLION CAN BE ACHIEVED THROUGH THE TOTAL SYSTEM UNDER PEACETIME PRODUCTION.



**LINER-TO-CASE ASSEMBLY  
PRODUCTION LINE**

# DARCOM MMT ACCOMPLISHMENT

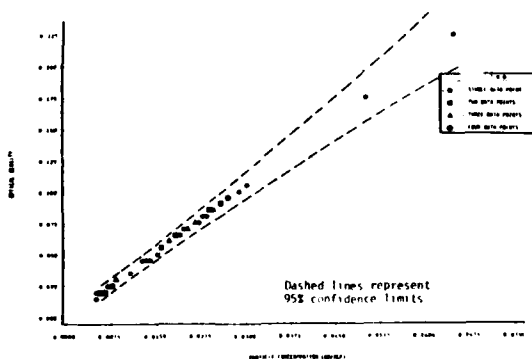
## US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

**PROJECT NO: 5 79,80 4084**

**TITLE: OPACITY/MASS EMISSION  
CORRELATION STUDY**

**COST: \$212,000**

**GOAL: ESTABLISH A CORRELATION UTILIZING  
INEXPENSIVE, COMMERCIALY  
AVAILABLE MONITORING EQUIPMENT**



**LINEAR MODEL FOR PARTICLE CONCENTRATION VS. OPTICAL DENSITY FOR ALL DATA COLLECTED**

### RESULTS

- **THE RELATIONSHIP BETWEEN PARTICLE CONCENTRATION AND OPACITY WAS ESTABLISHED.**
- **AN EMPIRICAL EQUATION WAS DEVELOPED FOR PREDICTING ESTIMATES OF PARTICLE CONCENTRATIONS.**
- **A LESS COSTLY ALTERNATIVE TO THE TRADITIONAL MASS EMISSIONS TESTING METHOD HAS BEEN DEMONSTRATED.**

## DARCOM MMT ACCOMPLISHMENT

### ARMAMENT RESEARCH & DEVELOPMENT COMMAND

PROJECT NO: 5 81 4145

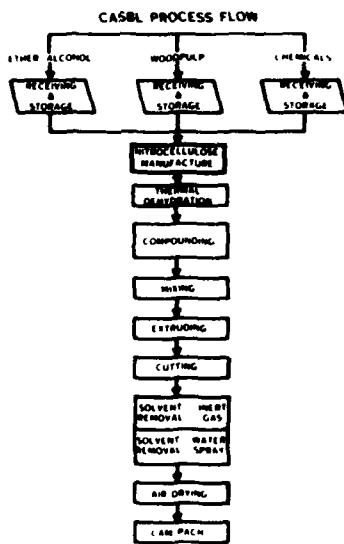
TITLE: CONTROL DRYING FOR AUTOMATED  
SINGLE BASE PROPELLANT MFG

COST: \$327,000

GOAL: DEVELOP ON-LINE MONITORING OF  
PROCESS DRYING STREAMS

### RESULTS

- TO CONTROL MOISTURE AND VOLATILES CONTENT OF PROPELLANT, A GAS CHROMATOGRAPHIC SYSTEM WAS PROCURED FOR MONITORING SOLVENT RECOVERY AND WATER DRY OPERATIONS.
- LABORATORY EVALUATION OF 4 CONDENSATE FLOWMETERS WAS COMPLETED.
- IF FUTURE INSTALLATION AND PROVEOUT OF THE EQUIPMENT IS SUCCESSFUL, IT IS ESTIMATED THAT A YEARLY SAVINGS OF \$250,000 CAN BE ACHIEVED.



CASBL PROCESS FLOW

# DARCOM MMT ACCOMPLISHMENT

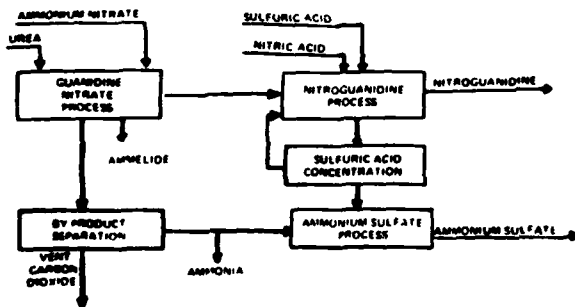
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 74 4169

TITLE: ESTABLISHMENT OF AN IMPROVED  
PROCESS FOR THE MANUFACTURE OF  
NITROGUANIDINE

COST: \$403,000

GOAL: PROVIDE DESIGN CRITERIA FOR  
DOMESTIC NITROGUANIDINE  
MANUFACTURING FACILITY



NITROGUANIDINE VIA THE UREA/  
AMMONIUM NITRATE PROCESS

### RESULTS

- ESTABLISHED TECHNOLOGY AND PILOT FACILITY FOR NITROGUANIDINE VIA THE UREA/AMMONIUM NITRATE PROCESS.
- UPDATED THE PROCESS ENGINEERING DESIGN FOR NITROGUANIDINE VIA THE BRITISH AQUEOUS FUSION PROCESS.

## **DARCOM MMT ACCOMPLISHMENT**

### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**

**PROJECT NO: 5 79 4189**

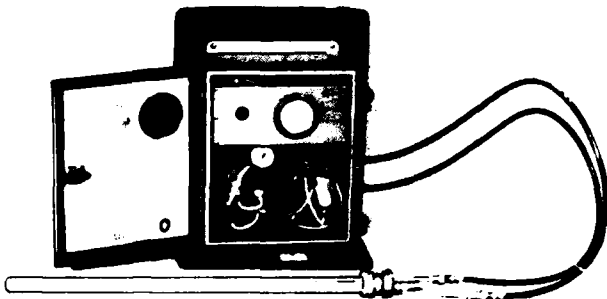
**TITLE: HIGH FRAGMENTATION STEEL  
PRODUCTION PROCESS**

**COST: \$633,000**

**GOAL: OPTIMIZE PRODUCTION PROCESS**

#### **RESULTS**

- **THE PURCHASE AND CHARACTERIZATION OF HF1 STEEL FOR FUTURE YEARS' PROCESS OPTIMIZATION INVESTIGATIONS WAS COMPLETED**
- **A FLUIDIC HIGH TEMPERATURE SENSOR AND PROBE WAS DEVELOPED FOR MORE ACCURATE FURNACE CONTROL**



**FLUIDIC HIGH TEMPERATURE SENSOR**

# **DARCOM MMT ACCOMPLISHMENT**

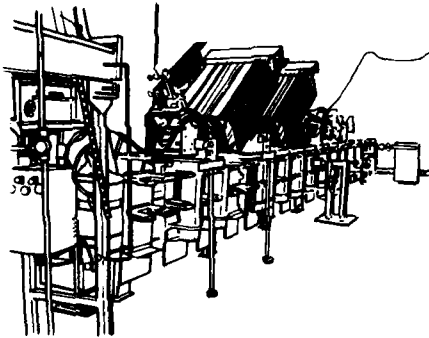
## **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**

**PROJECT NO: 5 76.77.78 4228**

**TITLE: AUTOMATED BAG LOADING, CHARGE ASSEMBLY AND PACKOUT FOR THE 155MM AND 8-INCH PROPELLING CHARGES**

**COST: \$2,721,400**

**GOAL: AUTOMATE LOAD, ASSEMBLY, AND PACK OF PROPELLING CHARGES**



**PACKOUT LINE STATIONS**

### **RESULTS**

- **THE FOLLOWING MAJOR SUB-SYSTEMS OF THE AUTOMATED SYSTEM WERE ESTABLISHED: BAG LOADING CAROUSEL, CHARGE ASSEMBLY MACHINE, PACKOUT LINE, BULK-FILL SCALE, CONTROL CONSOLE, AND CONVEYOR SYSTEM.**
- **OPERATION OF THE CHARGE ASSEMBLY MACHINE, PACKOUT LINE, AND CANISTER PRINTER WERE SATISFACTORY AND RECOMMENDED FOR INSTALLATION.**



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# DARCOM MMT ACCOMPLISHMENT

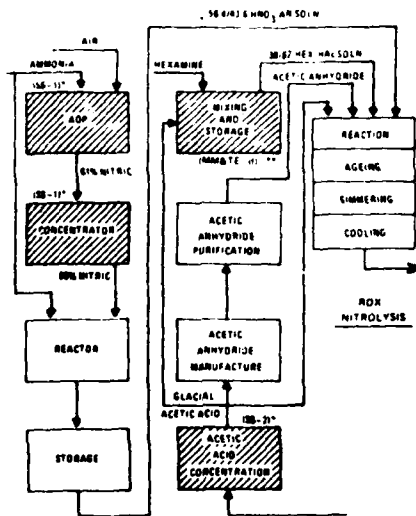
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 75,7T 4252

TITLE: IMPROVE PRESENT PROCESS FOR THE MANUFACTURE OF RDX AND HMX

COST: \$940,000

GOAL: ESTABLISH PROCESS IMPROVEMENTS IN THE MANUFACTURE OF RDX AND HMX



RDX NITROLYSIS PROCESS

### RESULTS

- THE FOLLOWING PROCESS IMPROVEMENTS WERE IDENTIFIED: THE FIRST AGING PERIOD OF THE BATCH HMX PROCESS WAS ELIMINATED, A REDUCTION IN THE SIMMER TIME WAS ACHIEVED, AND THE ADDITION OF HEXAMINE TO THE REACTOR HEEL INCREASED HMX YIELDS.
- THE IMPROVEMENTS CITED ABOVE WERE IMPLEMENTED AT HOLSTON AAP IN 1982.

## DARCOM MMT ACCOMPLISHMENT

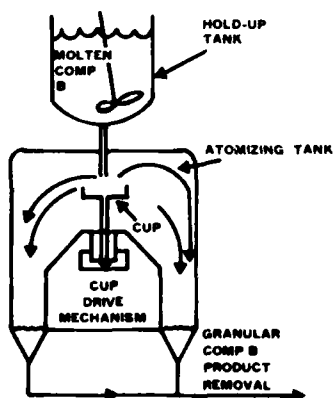
### ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 77,78 4267

TITLE: CONTINUOUS PROCESS FOR GRANULAR COMPOSITION B

COST: \$712,000

GOAL: DESIGN, PROCURE, INSTALL, AND OPERATE EQUIPMENT FOR PRODUCING GRANULAR COMPOSITION B



ROTATING CUP

### RESULTS

- A ROTATING CUP TECHNOLOGY WAS SELECTED FOR THE PRILLING OF COMPOSITION B.
- GRANULAR COMPOSITION B PRESENTS NO IMPACT HAZARD WHEN DROPPED FROM A PRILLING TOWER.
- PROTOTYPE EQUIPMENT WILL BE PROCURED AND EVALUATED IN A FOLLOW-ON PROJECT.

# DARCOM MMT ACCOMPLISHMENT

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 79 4281-A02

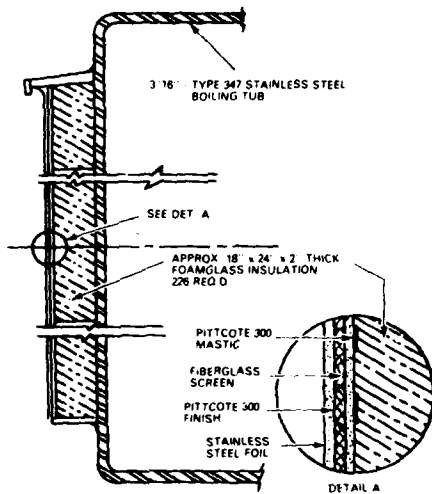
TITLE: OPTIMIZED INSULATION

COST: \$193,000

GOAL: REDUCE ENERGY CONSUMPTION

### RESULTS

- SEVERAL INSULATING MATERIALS WERE EVALUATED WITH FOAMGLASS BEING THE ONLY ONE TO MEET ALL REQUIREMENTS.
- ONE STAINLESS STEEL NITROCELLULOSE BOILING TUB WAS INSULATED FOR EVALUATION OF ENERGY SAVINGS DURING BOILING AND POACHING OPERATIONS.
- INSULATING THE TUB SIDES REDUCED STEAM USAGE BY 344 LB/HR OVER THE UNINSULATED TUB.
- WITH DUAL TEMPERATURE SENSOR AUTOMATIC EQUIPMENT, STEAM USAGE WAS REDUCED BY 120 LB/HR OVER THE UNINSULATED MANUALLY CONTROLLED TUB.
- ANNUAL SAVINGS OF \$57,000 CAN BE ACHIEVED AT CURRENT PRODUCT LEVELS.



BOILING TUB INSULATION DETAILS



## DARCOM MMT ACCOMPLISHMENT

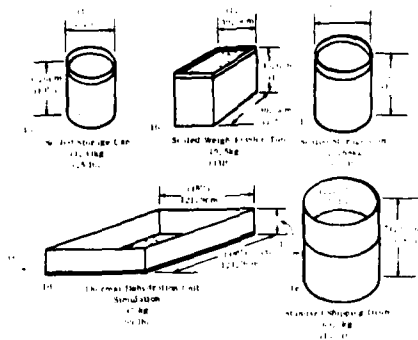
### ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 78, 79 4285

TITLE: TNT EQUIVALENCY TESTING FOR SAFETY  
ENGINEERING

COST: \$807,100

GOAL: DEVELOP DESIGN STANDARDS FOR  
HARDENING PROTECTIVE STRUCTURES



TEST CONTAINER CONFIGURATIONS  
FOR NITROCELLULOSE

### RESULTS

- THE TNT EQUIVALENCIES FOR NITROCELLULOSE, COMPOSITION C-4/A-3, BALL POWDER WC844, LX14, 155-MM M483 PROJECTILE, M42 GRENADE TRAY, AND HMX WERE DETERMINED.
- THE EQUIVALENCY RESULTS WERE USED TO CALCULATE LOADS ON PROTECTIVE WALLS FOR THESE ENERGETIC MATERIALS.
- THIS DATA, WHEN USED WITH DARCOM 385-100 AND TM5-1300, ENABLES THE DESIGN OF WALLS WHICH WILL RESIST BLAST EFFECTS.

# DARCOM MMT ACCOMPLISHMENT

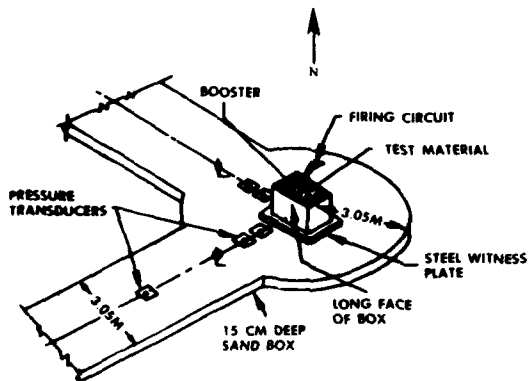
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 80 4285

TITLE: TNT EQUIVALENCY TESTING FOR  
SAFETY ENGINEERING

COST: \$407,600

GOAL: DEVELOP DESIGN STANDARDS FOR  
HARDENING PROTECTIVE STRUCTURES



TYPICAL CHARGE PLACEMENT FOR  
RDX EQUIVALENCY TESTS

### RESULTS

- THE TNT EQUIVALENCIES FOR DIGL-RP PROPELLANT, JA-2 PROPELLANT, CYCLOTOL 70/30, RDX, AND PBX C-203 WERE DETERMINED.
- THE EQUIVALENCY RESULTS WERE USED TO CALCULATE LOADS ON PROTECTIVE WALLS FOR THE ENERGETIC MATERIALS.
- THIS DATA WHEN USED WITH DRMCR 385-100 AND TM5-1300 ENABLES THE DESIGN OF WALLS WHICH WILL RESIST BLAST EFFECTS.

# DARCOM MMT ACCOMPLISHMENT

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 79 4288

TITLE: EXPLOSIVE SAFE SEPARATION AND SENSITIVITY CRITERIA

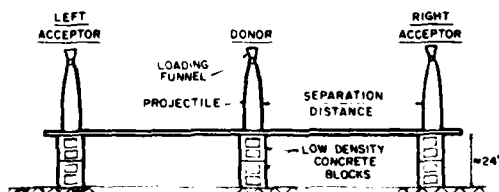
COST: \$637,500

GOAL: IMPROVE SAFETY BY DETERMINING SAFE SEPARATION CRITERIA

### RESULTS

- THE SAFE SEPARATION DISTANCES FOR 155-MM M795 HE AND M549 HE ROCKET ASSISTED PROJECTILES AND BLU BOMBLETS WERE DETERMINED.
- SAFETY CRITERIA WERE INTEGRATED INTO DARCOM 385-100 DOCUMENT.
- THESE SAFETY CRITERIA WERE APPLIED TO THE DESIGN OF THE LAP LINE AT MISSISSIPPI AAP AND EXISTING LAP LINES AT MILAN AAP, LONE STAR AAP, AND KANSAS AAP.

EACH PROJECTILE CONTAINS  
23.5 LBS (11.02 KG) TNT,  
TYPE I, SPEC. MIL-T-248



PROJECTILE TEST LAYOUT



# DARCOM MMT ACCOMPLISHMENT

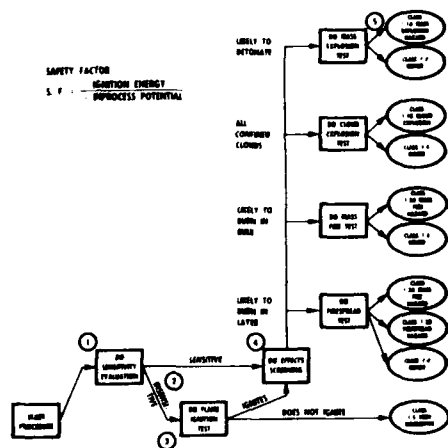
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 76, 7T 4289

TITLE: HAZARDS CLASSIFICATION STUDIES OF EXPLOSIVES AND PROPELLANTS

COST: \$315,000

GOAL: ESTABLISH A HAZARDS CLASSIFICATION PROCEDURE FOR EXPLOSIVES AND PROPELLANTS



### RESULTS

- FRICTION, IMPACT, ELECTROSTATIC DISCHARGE, AND HEAT WERE IDENTIFIED AS THE MOST COMMON CAUSATIVE ACCIDENT STIMULI.
- SMALL SCALE TESTS WERE USED TO ESTABLISH SENSITIVITY CRITERIA FOR FOUR MATERIALS.
- THE HAZARD CLASSIFICATION PROCEDURES WERE INTEGRATED INTO EXISTING SAFETY DOCUMENTS.

# DARCOM MMT ACCOMPLISHMENT

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 79 4291

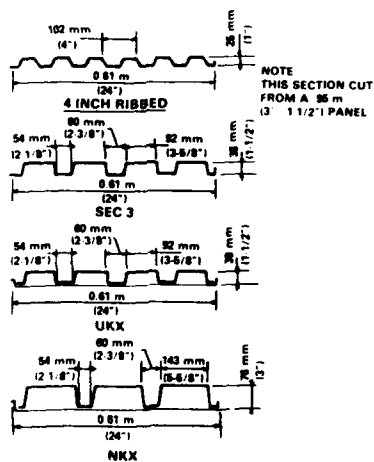
TITLE: BLAST EFFECTS IN THE MUNITION  
PLANT ENVIRONMENT

COST: \$235,000

GOAL: ESTABLISH DESIGN STANDARDS FOR  
STEEL PANELS TO WITHSTAND  
EXPLOSIVE BLASTS

### RESULTS

- THE BLAST CAPACITY OF COLD-FORMED STEEL PANELS WAS DETERMINED.
- THE STEEL PANELS EXHIBITED GREATER BLAST CAPACITY THAN PREDICTED BY PREVIOUS CRITERIA.
- THIS DATA WAS USED TO UPDATE THE SAFETY DOCUMENT TM 5-1300.



**CROSS SECTIONS OF  
COLD-FORMED STEEL PANELS**

# DARCOM MMT ACCOMPLISHMENT

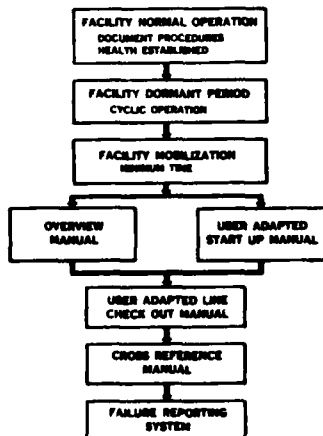
## ARMAMENT RESEARCH & DEVELOPMENT COMMAND

PROJECT NO: 5 79.80 4322

TITLE: SYSTEM CHARACTERIZATION OF ELECTRONICALLY CONTROLLED FACILITIES

COST: \$1,121,000

GOAL: ESTABLISH CRITERIA FOR REACTIVATING ELECTRONIC COMPONENTS



LAYAWAY AND MOBILIZATION PLAN (LAMP)  
ELECTRONIC PROCESS CONTROL SYSTEM

### RESULTS

- REACTIVATION DOCUMENTATION WAS PREPARED FOR INDUSTRIAL ELECTRONIC CONTROL SYSTEMS AT INDIANA, SUNFLOWER, AND VOLUNTEER AAP'S.
- THE REACTIVATION METHODOLOGY AT VOLUNTEER WAS ESTABLISHED SO A THIRD PARTY OPERATIONAL PROCEDURE IS PRACTICAL.
- UPON TOTAL IMPLEMENTATION, THE ESTABLISHED METHODS WILL MINIMIZE MOBILIZATION TIMES THROUGH THE APPLICATION OF USER ADAPTED PROCEDURES.

# DARCOM MMT ACCOMPLISHMENT

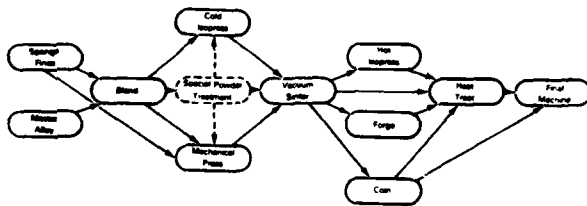
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

**PROJECT NO: 5 79 4335**

**TITLE: ALTERNATIVE PROCESS FOR TITANIUM GYROSCOPES**

**COST: \$451,000**

**GOAL: REDUCE MACHINING COSTS**



**OPERATION AVAILABLE FOR  
POWDERED METALLURGY PROCESSING**

### RESULTS

- **A HOT ISOSTATIC PRESSING TECHNIQUE WAS DEVELOPED AND TESTED TO PRODUCE THE FIVE GYRO PARTS**
- **A TECHNICAL DATA PACKAGE IS AVAILABLE IN CASE OF A STEEP RISE IN WROUGHT TITANIUM BAR STOCK COSTS**
- **SCRAP WAS REDUCED BY 96 PERCENT OVER CONVENTIONAL METHODS**

# **DARCOM MMT ACCOMPLISHMENT**

## **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**



**TYPICAL WOODPULP MICROPHOTOGRAPH (100X)**

**PROJECT NO: 5 77,78 4343**

**TITLE: IMPROVED NITROCELLULOSE PROCESS CONTROLS**

**COST: \$315,300**

**GOAL: UPDATE EXISTING PROCESS CONTROLS**

### **RESULTS**

- **THE WOODPULP VARIABLES WHICH AFFECT THE CHARACTERISTICS OF THE NITROCELLULOSE WERE DETERMINED**
- **THE CONTINUOUS NITRATION PROCESS WAS EVALUATED**
- **NO SIGNIFICANT DIFFERENCES IN THE FINAL NITROCELLULOSE RESULTED FROM THE USE OF DIFFERENT WOODPULPS**

## **DARCOM MMT ACCOMPLISHMENT ARMAMENT READINESS COMMAND**

**PROJECT NO: 5 77 4362**

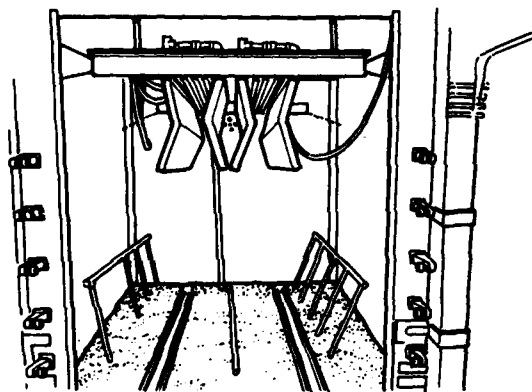
**TITLE: CONTINUOUS AUTOMATED POST CYCLIC  
CONDITIONING FACILITY FOR LARGE  
CALIBER COMP B LOADED  
PROJECTILES**

**COST: \$490,000**

**GOAL: REDUCE MANUFACTURING COSTS**

### **RESULTS**

- **THE IMPROVED PROCESS RESULTS IN 50% IN  
PROCESS TIME SAVINGS.**
- **THE CAST QUALITY WAS GREATLY IMPROVED.**
- **THE LAP COST WAS REDUCED BY ONE  
OPERATION AND BY ONE PERSON.**



**CONTROLLED COOLING BAY WITH UNIVERSAL  
STEAM THERMAL PANELS**

## **DARCOM MMT ACCOMPLISHMENT**

### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**



**EXTRUDED COMPOSITION C-4 EXITING  
THE DIE HEAD**

**PROJECT NO: 5 78 4449**

**TITLE: PROCESS IMPROVEMENT FOR  
COMPOSITION C-4**

**COST: \$120,000**

**GOAL: REDUCE THE COST OF PRODUCING  
COMPOSITION C-4**

#### **RESULTS**

- **NOMINAL CLASS 1/CLASS 5 RDX COULD BE USED IN LIEU OF A SPECIFIC GRANULATION CLASS 1/CLASS 5 RDX IN THE MANUFACTURE OF CLASS 3 COMPOSITION C-4.**
- **THE SPECIFICATION FOR COMPOSITION C-4 WAS AMENDED TO INCLUDE USE OF NOMINAL RDX.**
- **A COST SAVINGS OF \$55,000/YEAR (1981 DOLLARS) WAS REALIZED AT HOLSTON AAP.**

# DARCOM MMT ACCOMPLISHMENT

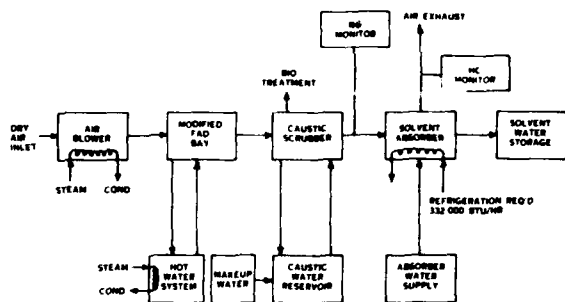
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 77,78,79 4462

TITLE: MODERNIZED FORCED AIR DRYER (FAD)  
FOR MULTI-BASE PROPELLANTS

COST: \$1,297,000

GOAL: ESTABLISH PROTOTYPE AND DESIGN  
CRITERIA FOR MODERNIZED FAD



MODERNIZED FAD PROCESS

## RESULTS

- A SCRUBBING SYSTEM FOR REMOVAL OF NITROGLYCERIN AND SOLVENT VAPORS WAS COMPLETED.
- A PROTOTYPE MODERNIZED FAD HOUSE WAS CONSTRUCTED.
- PROPELLANT DRYING MAY NOW BE DONE IN LARGER QUANTITIES AT A LOWER AIR FLOW RATE.
- PROJECT 5 80 4462 WILL DEBUG AND EVALUATE THE FINAL DESIGN.



# DARCOM MMT ACCOMPLISHMENT

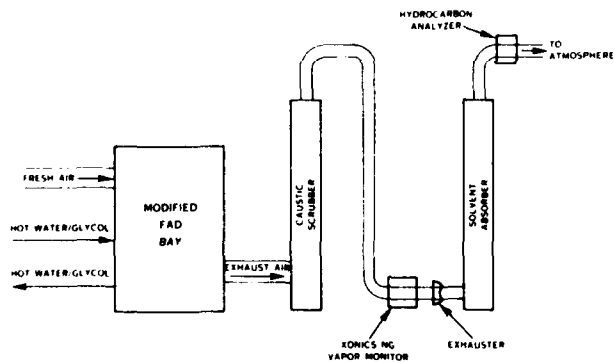
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 80 4462

TITLE: MODERNIZED FORCED AIR DRYING  
(FAD) FOR MULTI-BASE PROPELLANTS

COST: \$908,600

GOAL: INSTALL, DEBUG AND EVALUATE THE  
MODERNIZED FORCED AIR DRYING  
SYSTEM



MODIFIED FORCED AIR  
DRYING SYSTEM FLOW DIAGRAM

### RESULTS

- THE ABILITY OF THE MODERNIZED FAD TO DRY MULTI-BASE PROPELLANTS WAS DEMONSTRATED
- THE AMOUNT OF STEAM REQUIRED WAS REDUCED BY 59 PERCENT
- A 95 PERCENT REMOVAL EFFICIENCY FOR THE SOLVENT ABSORBER WAS ACHIEVED
- A 99 PERCENT REMOVAL EFFICIENCY FOR THE NITROGLYCERIN CAUSTIC SCRUBBER WAS ACHIEVED

## DARCOM MMT ACCOMPLISHMENT

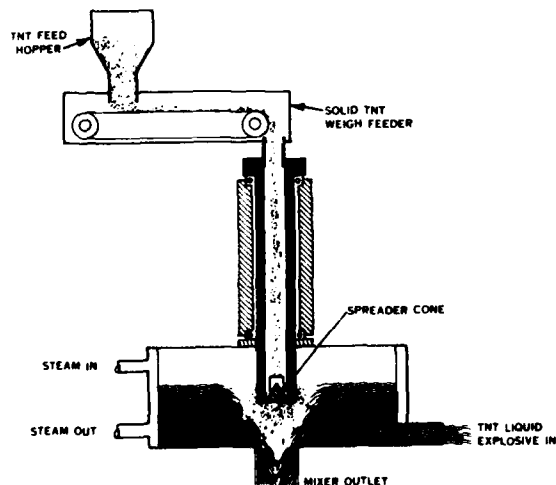
### ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 78,79 4466

TITLE: EVALUATION OF TNT, CYCLOTOL, OCTOL  
WITH ARRADCOM MELT-POUR FACILITY

COST: \$881,500

GOAL: APPLY MELT-POUR TECHNOLOGY TO  
ALTERNATE FILL EXPLOSIVES



TNT LIQUID/SOLIDS MIXER

### RESULTS

- AN AUTOMATED TNT MIXER SYSTEM WAS BUILT WHICH IS COMPATIBLE WITH THE CONTINUOUS MELT-POUR FACILITY.
- THE TNT MIXER SYSTEM IS CAPABLE OF A SOLIDS-TO-LIQUID RATIO TNT SLURRY OF 30%.
- THE TNT MIXER SYSTEM ELIMINATED THE NEED FOR CAST PROBING.
- THE TNT MIXER SYSTEM REDUCED TNT SLURRY PREPARATION TIME.

AD-A133 884

MANUFACTURING METHODS AND TECHNOLOGY PROGRAM  
ACCOMPLISHMENTS (U) ARMY INDUSTRIAL BASE ENGINEERING  
ACTIVITY ROCK ISLAND IL OCT 83

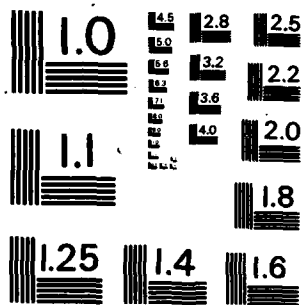
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# DARCOM MMT ACCOMPLISHMENT

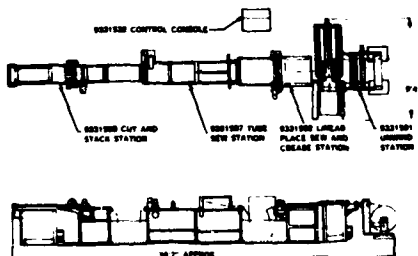
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 78 4472

TITLE: DEVELOPMENT OF EQUIPMENT FOR  
AUTOMATIC/MECHANIZED FABRICATION OF  
CENTER CORE PROPELLANT BAGS

COST: \$208,100

GOAL: IMPROVE MANUFACTURING PROCESS FOR  
CENTER CORE PROPELLANT BAGS



**BODY AND LINER ASSEMBLY STATION**

### RESULTS

- A DETAILED AND THEORETICAL DESIGN ANALYSIS OF THE BODY AND LINER ASSEMBLY SYSTEM WAS CONDUCTED.
- THE NOVATRONICS APPROACH TO AXIALLY ALIGN AND CONCENTRICALLY LOAD BODY AND LINER ASSEMBLIES OVER END ASSEMBLIES WAS DEMONSTRATED.
- WEB HANDLING TECHNIQUES FOR THE ASSEMBLY SYSTEM WERE PROVEN FEASIBLE AND CONVERSION TO AN AUTOMATED OPERATION OFFERS A 98% ROI.
- THE MECHANIZATION OF THE WEB, BODY AND LINER ASSEMBLY PROCESS OFFERS A ROI OF 54% UNDER PEACETIME PRODUCTION REQUIREMENTS.

## **DARCOM MMT ACCOMPLISHMENT**

### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**

**PROJECT NO: 5 78 4498**

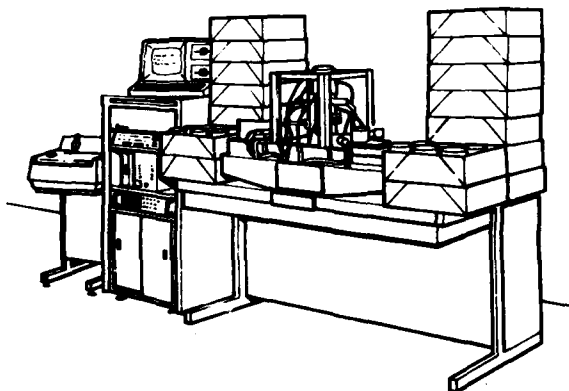
**TITLE: AUTOMATED ASSEMBLY OF SMALL  
MINES**

**COST: \$325,000**

**GOAL: REDUCE MANUFACTURING TIME AND  
DIRECT LABOR COSTS**

#### **RESULTS**

- **ENGINEERING ANALYSIS INDICATED THAT AUTOMATION OF SELECTED OPERATIONS WOULD BE MORE COST EFFECTIVE THAN A TOTALLY AUTOMATED PRODUCTION LINE.**
- **REQUIREMENTS WERE DETERMINED FOR ELECTRONIC LENS TESTER, AUTOMATED SOLDERING MACHINE, AND ASSEMBLY AID FIXTURES. PROTOTYPE EQUIPMENT WILL BE BUILT AND DEMONSTRATED THROUGH FOLLOW-ON MMT PROJECTS.**
- **WHEN IMPLEMENTED, SAFETY WILL BE IMPROVED FOR EXPLOSIVE LOADING AND SAFETY AND ARMING ASSEMBLY SOLDERING.**



**ELECTRICAL TESTER FOR MUNITIONS SYSTEMS**

## **DARCOM MMT ACCOMPLISHMENT**

### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**



**AUTOMATED ELECTRO-OPTICAL  
ARTILLERY METAL PARTS  
INTERNAL CAVITY INSPECTION SYSTEM**

**PROJECT NO: 5 76 6599**

**TITLE: ELECTRO-OPTICAL INSPECTION OF  
ARTILLERY PROJECTILE CAVITIES**

**COST: \$198,000**

**GOAL: IMPROVE ARTILLERY METAL PARTS  
INTERNAL CAVITY INSPECTION**

#### **RESULTS**

- **THIS PROJECT PRODUCED AN AUTOMATED ELECTRO-OPTICAL ARTILLERY METAL PARTS INTERNAL CAVITY INSPECTION SYSTEM.**
- **THE SYSTEM SCANS THE FIBER OPTIC ILLUMINATED ARTILLERY METAL PART CAVITY WITH A TV CAMERA. LIGHT CONTRAST CHANGES ARE DETECTED AND COMPUTER ANALYZED, AND THE PART IS EITHER ACCEPTED OR REJECTED.**
- **ONCE THIS SYSTEM IS IMPLEMENTED, THE INSPECTION RELIABILITY IS ANTICIPATED TO INCREASE FROM 80% TO 95%.**

# DARCOM MMT ACCOMPLISHMENT

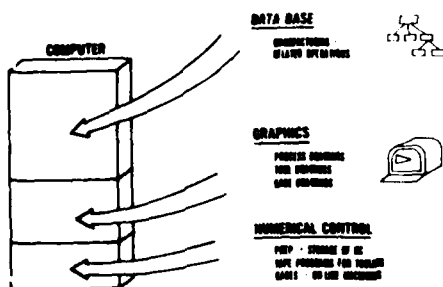
## ARMAMENT RESEARCH & DEVELOPMENT COMMAND

PROJECT NO: 5 76, 78, 79, 80 6736

TITLE: TECHNICAL READINESS ACCELERATION  
THRU COMPUTER INTEGRATED  
MANUFACTURE

COST: \$907,000

GOAL: IMPROVE LEAD TIMES AND REDUCE COST BY  
USE OF MANUFACTURING DATA BASE



MINI-COMPUTER SYSTEM CAPABLE OF HANDLING  
THE TRACIM DATA BASE, GRAPHICS AND  
NUMERICAL CONTROL PART PROGRAMMING

### RESULTS

- AN ARCHITECTURE OF MANUFACTURING FOR 2 CONVENTIONAL AMMUNITION ITEMS WAS ESTABLISHED
- A DATA BASE MANAGEMENT SYSTEM WAS ESTABLISHED AND COMPUTER INPUT REQUIREMENTS FOR MANUFACTURING OPERATIONS WERE DETERMINED. THE CAPABILITY OF THE MODULAR DESIGNED COMPUTER SYSTEM WAS DEMONSTRATED.
- WHEN IMPLEMENTED UNDER ARRCOM CAD/CAM SYSTEMS PROCUREMENT PROGRAMS, READINESS WILL BE ENHANCED THROUGH THE ABILITY TO RAPIDLY RETRIEVE AND USE PRODUCTION INFORMATION.



# DARCOM MMT ACCOMPLISHMENT

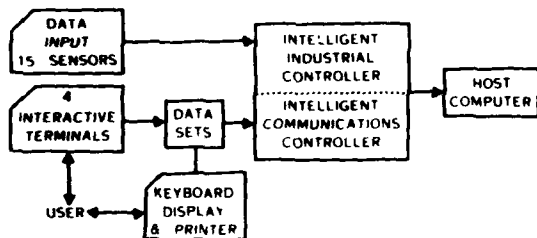
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 79 6736-02

TITLE: DATA ACQUISITION FEASIBILITY STUDY

COST: \$166,000

GOAL: UTILIZE MANUFACTURING CONTROL SYSTEM TO REDUCE COSTS



MANUFACTURING CONTROL SYSTEM  
INFORMATION FLOW

### RESULTS

- PROTOTYPE MANUFACTURING CONTROL SYSTEM UTILIZING DATA ACQUISITION TECHNIQUES WAS EVALUATED.
- DATA WAS ANALYZED FOR DOWNTIME, REJECT TRENDS, DAILY PRODUCTION RATES, AND MACHINE UTILIZATION.
- RECOMMENDATIONS WERE FORMULATED FOR THE IMPLEMENTATION OF A MANUFACTURING CONTROL SYSTEM AND RELATIONAL DATA BASE MANAGEMENT SYSTEM.
- POTENTIAL COST SAVINGS OF 20% REDUCTION IN MANUFACTURING COSTS WERE IDENTIFIED.

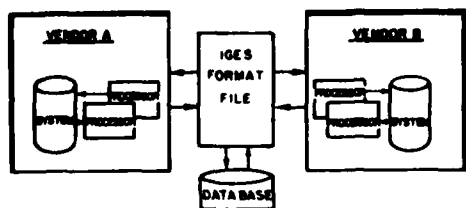
## DARCOM MMT ACCOMPLISHMENT ARMAMENT RESEARCH & DEVELOPMENT COMMAND

PROJECT NO: 5 80 6736-03

TITLE: INITIAL GRAPHICS EXCHANGE SPECIFICATION

COST: \$50,000

GOAL: FACILITATE INFORMATION EXCHANGE  
BETWEEN DISSIMILAR CAD/CAM SYSTEMS



INFORMATION FLOW

### RESULTS

- THE ARMY, NAVY, AIR FORCE AND NASA ALL PROVIDED FUNDING TO SUPPORT IGES.
- DEMONSTRATIONS WITH AS MANY AS 5 VENDOR SYSTEMS ILLUSTRATED THE CAPABILITY OF THE IGES FORMAT TO SUCCESSFULLY EXCHANGE AND MODIFY DATA AMONG SYSTEMS.
- ANSI HAS APPROVED THE STANDARD AND IS PROMOTING ITS ADOPTION INTERNATIONALLY.

## DARCOM MMT ACCOMPLISHMENT ARMAMENT MATERIAL READINESS COMMAND

PROJECT NO: 6 77.78 7649

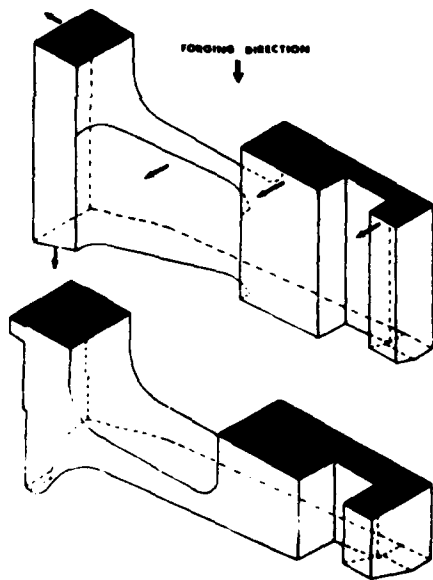
TITLE: COMPUTERIZED POWDER METALLURGY  
FORGING DESIGN

COST: \$202,000

GOAL: REDUCE COSTS FOR DESIGN OF POWDER  
METAL PREFORMS

### RESULTS

- A COMPUTER AIDED PREFORM DESIGN TECHNIQUE HAS BEEN DEVELOPED AND APPLIED TO OBTAIN A PREFORM FOR A WEAPON COMPONENT.
- THE TECHNIQUE WAS SUCCESSFULLY DEMONSTRATED BY FABRICATING COMPONENT PREFORMS AND FORGING DIES AND BY FORGING COMPONENTS AT A PRODUCTION FACILITY.
- THE TEST COMPONENTS SUCCESSFULLY MET THE QUALITY STANDARDS. TRW, BORG-WARNER AND OTHERS HAVE MADE USE OF THE DEVELOPED COMPUTER PROGRAM IN DESIGNING FORGING DIES FOR PM PARTS.



METAL FLOW DIRECTIONS IN THE DESIGNED  
PREFORM DURING FORGING

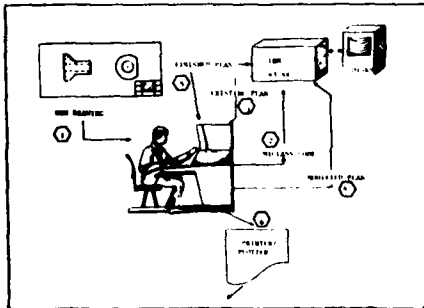
## DARCOM MMT ACCOMPLISHMENT ARMAMENT MATERIAL READINESS COMMAND

PROJECT NO: 6 79 7724

TITLE: GROUP TECHNOLOGY OF WEAPON SYSTEMS

COST: \$83,000

GOAL: REDUCE COSTS THROUGH PART-FAMILY  
MANUFACTURE



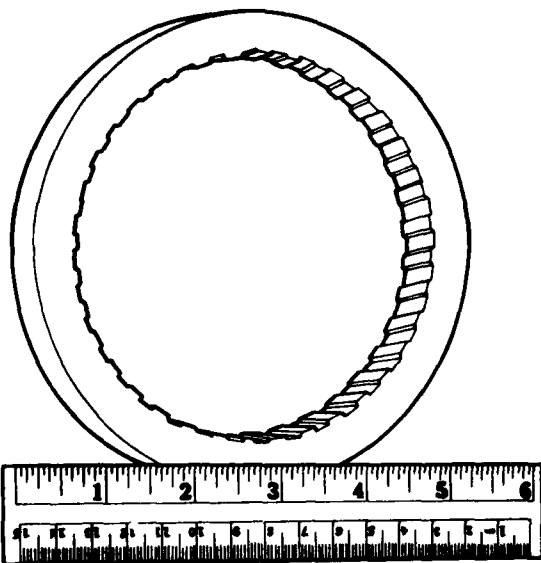
GROUP TECHNOLOGY MANUFACTURING  
PROCESS PLANNING

### RESULTS

- THE FEASIBILITY OF APPLYING A CLASSIFICATION AND CODING/GROUP TECHNOLOGY SYSTEM AT WATERVLIEET ARSENAL WAS DEMONSTRATED. 474 ROTATIONAL PARTS WERE CODED.
- WHEN THE TOTAL EFFORT IS COMPLETED AND IMPLEMENTED, IT IS ESTIMATED THAT
  - SET-UP TIME WILL BE DECREASED 20-35%
  - THROUGH PUT TIME WILL BE REDUCED 15-20%
  - COSTLY VARIATION IN PROCESS PLANS WILL BE ELIMINATED

# DARCOM MMT ACCOMPLISHMENT

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND



CROSS-SECTION OF RIFLING  
CONFIGURATION IN COLD FORGED  
106-MM RECOILLESS RIFLE

PROJECT NO: 6 77,78,79 7726

TITLE: APPLICATION OF COLD AND WARM  
ROTARY FORGING

COST: \$810,000

GOAL: REDUCE MANUFACTURING COST

### RESULTS

- THE CAPABILITY TO COLD FORGE THIN-WALLED RIFLED TUBES, SUCH AS THE 106-MM RECOILLESS RIFLE, WAS ESTABLISHED.
- THE MACHINING COST OF THE COLD FORGED 106-MM RECOILLESS RIFLE CAN BE REDUCED BY 34 PERCENT USING THIS METHOD.
- THE FEASIBILITY OF COLD FORGING THE 105-MM M68 TUBE TO THE PRE-AUTO-FRETTAGED CONFIGURATION WAS DEMONSTRATED.

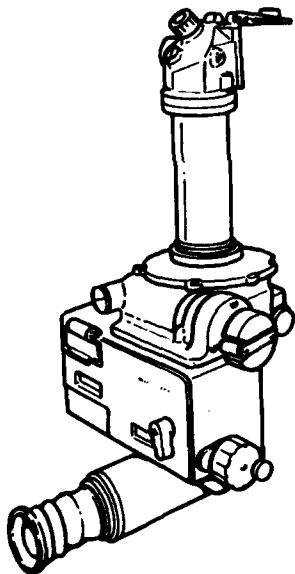
## **DARCOM MMT ACCOMPLISHMENT ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**

**PROJECT NO: 6 78 7808**

**TITLE: LEAK DETECTION TECHNIQUES FOR  
SMALL SEALED FIRE CONTROL  
ASSEMBLIES**

**COST: \$86,000**

**GOAL: IDENTIFY MORE ACCURATE AND LESS  
COSTLY LEAK DETECTION TECHNIQUES**



**VEHICLE FIRE CONTROL**

### **RESULTS**

- **THE PROJECT DEMONSTRATED APPLICABILITY OF MASS SPECTROMETER PROBE TEST, MASS SPECTROMETER VACUUM TEST, AND ACOUSTIC LEAK DETECTION SYSTEMS.**
- **A COMBINATION OF INSPECTION TECHNIQUES RESULTED WHICH ALLOWS FOR FASTER AND MORE SENSITIVE LEAK DETECTION MEASUREMENTS.**
- **ALTERNATIVE METHODS FOR LEAK LOCATION AND SIZE WERE ESTABLISHED.**

## **DARCOM MMT ACCOMPLISHMENT ARMAMENT MATERIEL READINESS COMMAND**

**PROJECT NO: 6 80 7926**

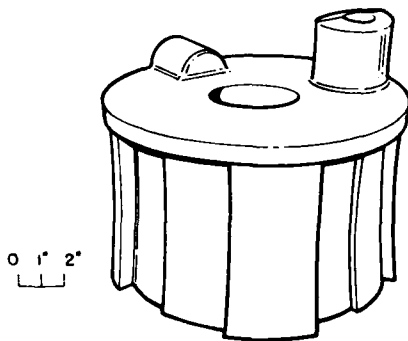
**TITLE: HOT ISOSTATIC PRESSING (HIP) OF  
LARGE ORDNANCE COMPONENTS**

**COST: \$216,000**

**GOAL: REDUCE MANUFACTURING COSTS**

### **RESULTS**

- **THIS EFFORT ACHIEVED BREECH BLOCK PREFORMS IN NEAR-NET SHAPE CONFIGURATIONS BY HIP.**
- **HIP IS CAPABLE OF FULLY DENSIFYING ALLOY STEEL POWDER TO SATISFACTORY LEVELS OF STRENGTH AND TOUGHNESS.**
- **COMPLETION AND IMPLEMENTATION OF THIS EFFORT WILL RESULT IN AN ESTIMATED SAVINGS OF \$432 PER LARGE BREECH BLOCK.**



**MACHINED BREECH BLOCK**

## DARCOM MMT ACCOMPLISHMENT ARMAMENT MATERIAL READINESS COMMAND

PROJECT NO: 6 77.78 7943

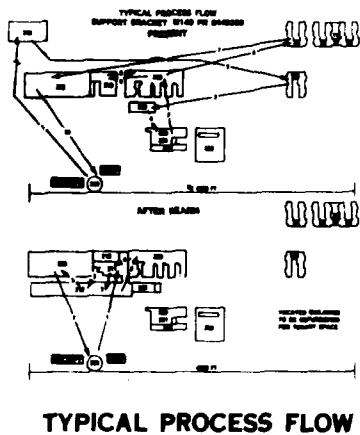
TITLE: ANALYSIS FOR MODERNIZATION OF  
INDUSTRIAL OPERATIONS

COST: \$1,020,000

GOAL: ESTABLISH MODERNIZATION MASTER PLAN

### RESULTS

- A MASTER PLAN FOR TECHNOLOGY UPGRADE AND MODERNIZATION OF ROCK ISLAND ARSENAL WAS DEVELOPED.
- THE PLAN RESULTED IN RECOMMENDATIONS ON PROCESS IMPROVEMENTS, SAFETY AND POLLUTION CONTROLS, MATERIAL HANDLING, ENERGY USE, PLANT REARRANGEMENT AND FACILITY IMPROVEMENTS.
- IMPLEMENTATION OF THE MASTER PLAN IS ESTIMATED TO RESULT IN COST SAVINGS OF \$18 MILLION PER YEAR.





## **DARCOM MMT ACCOMPLISHMENT ARMAMENT MATERIAL READINESS COMMAND**

**PROJECT NO: 6 79 7949**

**TITLE: APPLICATION OF GROUP TECHNOLOGY AT  
ROCK ISLAND ARSENAL**

**COST: \$123,000**

**GOAL: REDUCE MANUFACTURING COSTS AND LEAD  
TIMES**

- Formation of groups of parts (part families) and machine groups
- Quick retrieval of designs, drawings, and production plans
- Design rationalization and reduction of design costs
- Reliable workpiece statistics
- Accurate estimation of machine tool requirements, rationalized machine loading, and optimized capital expenditure
- Rationalization of tooling setup and reduction of setup time and overall production time
- Rationalization and improvement of tool design and reduction of tool design and fabrication times and costs
- Rationalization of production planning procedures and scheduling
- Accurate cost accounting and cost estimation
- Better utilization of machine tools, workholding devices, and manpower
- Improvement in numerical control (NC) programming and effective uses of NC machines.

### **GROUP TECHNOLOGY BENEFITS**

### **RESULTS**

- **A CLASSIFICATION AND CODING/GROUP TECHNOLOGY SYSTEM WAS INSTALLED AND DE-BUGGED. 76% OF THE MAJOR PARTS AT RIA WERE CODED.**
- **INTER-DEPARTMENT PART MOVEMENT HAS BEEN REDUCED 20%.**
- **ONCE FULLY IMPLEMENTED, ADDITIONAL PRODUCTIVITY GAINS WILL RESULT FROM:**
  - **STANDARD PROCESS PLANS.**
  - **REDUCED SET-UP.**
  - **DECREASED MATERIAL HANDLING.**
  - **IMPROVED SCHEDULING.**

## DARCOM MMT ACCOMPLISHMENT

### ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

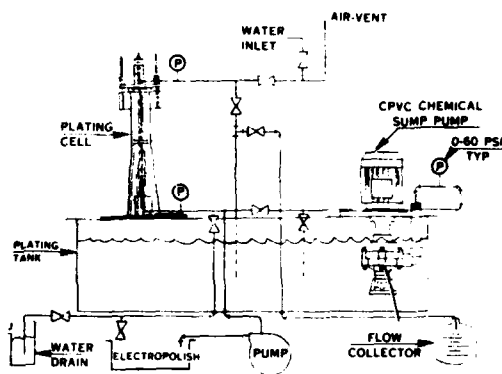


DIAGRAM OF THE  
ELECTROLYTE FLOW SYSTEM

PROJECT NO: 6 81 8001

TITLE: RAPID FLOW PLATING OF SMALL  
CALIBER GUN TUBES

COST: \$132,000

GOAL: REDUCE MANUFACTURING COST

### RESULTS

- SMOOTH, ADHERENT CHROMIUM WAS ELECTROPLATED INSIDE THE BORE OF 50-CALIBER GUN TUBES
- A DEPOSITION RATE 15 TIMES FASTER THAN CONVENTIONAL PLATING WAS DEMONSTRATED
- CHROMIUM WAS DEPOSITED UNIFORMLY AT A RATE EXCEEDING 0.015 INCH PER HOUR PER GUN TUBE

# DARCOM MMT ACCOMPLISHMENT

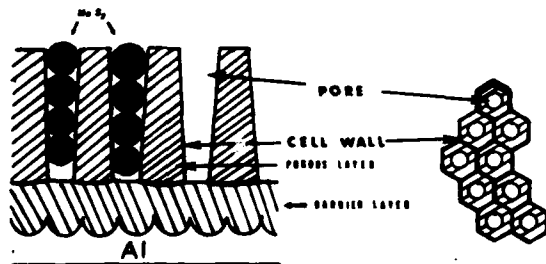
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 6 79,80 8004

TITLE: CO-DEPOSITION OF SOLID LUBRICANTS  
DURING ANODIZING

COST: \$241,000

GOAL: REDUCE COSTS BY SALVAGING WORN  
COMPONENTS AND EXTENDING THE  
SERVICE LIFE



DEPICTION OF CO-DEPOSITION

### RESULTS

- ANODIZED COATING WITH  $\text{MoS}_2$ , REDUCES GALLING, SEIZING, AND WEAR; AND IMPROVES CORROSION RESISTANCE.
- SERVICE LIFE IS EXTENDED RESULTING IN COST SAVINGS.
- MIL-A-8626, TYPE III WAS REVISED WITH NEW SPECIFICATIONS.

# DARCOM MMT ACCOMPLISHMENT

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 6 79 8005

TITLE: ESTABLISHMENT OF THE MECHANICAL  
PLATING PROCESS

COST: \$150,000

GOAL: REDUCE MANUFACTURING COSTS

### RESULTS

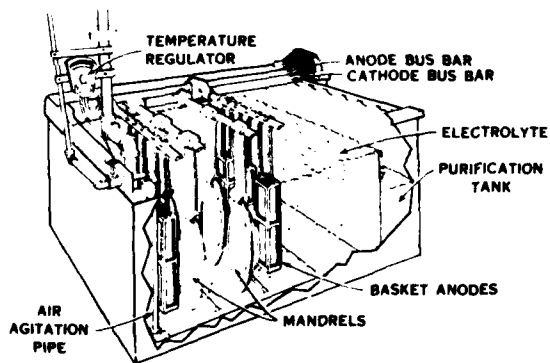
- THE MECHANICAL PLATING PROCESS WAS ESTABLISHED AS AN ALTERNATIVE TO THE ELECTROPLATING PROCESS.
- THE MECHANICAL PLATING PROCESS DOES NOT PRESENT HYDROGEN EMBRITTLEMENT AND POLLUTION PROBLEMS THAT ARE ASSOCIATED WITH ELECTROPLATING.
- THE PROJECT VERIFIED THAT MECHANICAL PLATING COSTS ARE 25 PERCENT LOWER THAN ELECTROPLATING COSTS.
- MIL SPEC C-81562A WILL BE CHANGED BY THE NAVAL AIR ENGINEERING CENTER, LAKEHURST, NJ.



CROSS-SECTION OF BARREL TUMBLING  
FASTENERS

## **DARCOM MMT ACCOMPLISHMENT**

### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**



**TANK INTERIOR FOR  
ELECTROPLATING SOLUTION**

**PROJECT NO: 6 78,79 8017**

**TITLE: POLLUTION ABATEMENT PROGRAM**

**COST: \$143,000**

**GOAL: ELIMINATE CYANIDE-BASED PLATING  
AND DERUSTING BATHS**

### **RESULTS**

- **NON-CYANIDE BASED CHEMICALS TO REPLACE CYANIDE BASED ELECTROPLATING SOLUTIONS WERE EVALUATED**
- **CADMIUM AND COPPER CYANIDE BASED BATHS WERE ELIMINATED**
- **THE CYANIDE CONTENT OF THE PLATING FACILITY WASTE STREAMS WAS REDUCED**

# DARCOM MMT ACCOMPLISHMENT

## ARMAMENT MATERIEL READINESS COMMAND

PROJECT NO: 6 78 8048

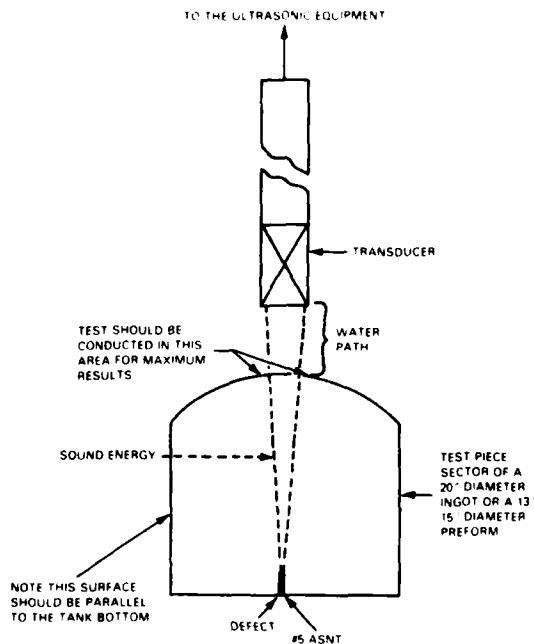
TITLE: IMPROVED INSPECTION TECHNIQUES  
FOR INGOTS AND PREFORMS FOR  
ROTARY FORGING

COST: \$154,000

GOAL: IMPROVE ROTARY FORGE PREFORMS  
INSPECTION

### RESULTS

- THIS PROJECT PRODUCED AN AUTOMATIC ULTRASONIC ROTARY FORGE PREFORMS INSPECTION SYSTEM.
- THE SYSTEM UTILIZES AN ULTRASONIC PULSE-ECHO TECHNIQUE. THE ENERGY TRANSFER IS ACCOMPLISHED BY A COUPLANT-COLUMN DISPENSER/CHAMBER WHICH USES WATER AS THE SONIC TRANSFER MEDIUM.
- ONCE THIS SYSTEM IS IMPLEMENTED, A 20-25 PERCENT REDUCTION IN INSPECTION TIME WITH A CORRESPONDING SAVINGS IS ANTICIPATED.



**AUTOMATIC ULTRASONIC  
ROTARY FORGE PREFORMS  
INSPECTION SYSTEM CONCEPT**

## DARCOM MMT ACCOMPLISHMENT

### ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 6 78 8049

TITLE: MANUFACTURING PROCESSES ENERGY CONSERVATION PROGRAM

COST: \$104,000

GOAL: REDUCE ENERGY CONSUMPTION AT WATERVLIT ARSENAL

Austenitizing 53%	Tempering 47%
Flue - 58% (30%)	Flue - 84% (40%)
Rolls - 18% (10%)	
Work - 18% (8%)	
Radiation - 10% (5%)	Work - 11% (5%)
	Radiation - 5% (2%)

COMPOSITE ENERGY USE DISTRIBUTION

### RESULTS

- AN ENERGY ANALYSIS OF THE ROTARY FORGE FACILITIES USED IN THE MANUFACTURE OF GUN BARRELS WAS CONDUCTED.
- THE ANALYSIS IDENTIFIED POTENTIAL ENERGY RECOVERY SOURCES FOR THE FURNACES AND THE HEAT TREAT LINE.
- POTENTIAL BENEFIT OF A 50% REDUCTION IN FUEL CONSUMPTION FOR THE HEAT TREAT OPERATION IS ESTIMATED.

## **DARCOM MMT ACCOMPLISHMENT ARMAMENT MATERIAL READINESS COMMAND**

**PROJECT NO: 6 79 8104**

**TITLE: IMPROVED BREECH BLOCK MANUFACTURING**

**COST: \$40,000**

**GOAL: REDUCE BREECH BLOCK MANUFACTURING  
COSTS**



**PRESENT METHOD OF HANDLING  
BREECH RINGS**

### **RESULTS**

- **A STUDY WAS COMPLETED WHICH RECOMMENDED FLEXIBLE MANUFACTURING SYSTEM TECHNOLOGY BE USED TO REPLACE THE CURRENT INEFFICIENT METHOD OF HANDLING AND MACHINING BREECH BLOCKS.**
- **A PRESOLICITATION CONFERENCE WAS HELD AND THE PURCHASE OF THE FMS, ESTABLISHED AT \$12-15 MILLION, IS UNDER NEGOTIATION.**
- **A PAYBACK OF 8 YEARS ON THE FMS IS ESTIMATED.**



# DARCOM MMT ACCOMPLISHMENT

## ARMAMENT MATERIEL READINESS COMMAND

PROJECT NO: 6 81 8120

TITLE: ADAPTIVE CONTROL TECHNOLOGY  
(CAM)

COST: \$80,000

GOAL: EVALUATE A CYLINDRICAL GRINDING  
CONTROL PROCESS

CONVENTIONAL VERSUS  
COLD GRINDING PARAMETERS

Parameters	Grinding Method	
	CNC Conventional	Cold Grinding
Wheel RPM	Fixed	Changing
Wheel Wear Rate	Uncontrolled	Controlled
Wheel Surface Velocity	Uncontrolled	Controlled
Feedrate	Variable	Changing
Work RPM	Variable	Changing
Work Surface Velocity	Uncontrolled	Controlled
Metal Removal Rate	Uncontrolled	Controlled
Power Used	Uncontrolled	Controlled
Grinding Heat	Uncontrolled	Controlled
Grinding Time	Uncontrolled	Controlled
Truing Roll RPM	Fixed	Changing
Truing Feed Rate	Variable	Changing
Relative Wheel Truing Velocity	Uncontrolled	Controlled

Legend: FIXED (generally characteristic of machine)  
VARIABLE (but fixed during grinding)  
UNCONTROLLED (during grinding)  
CONTROLLED (continuously during grinding)  
CHANGING (continuously during grinding  
controlled indirectly)

## RESULTS

- A COLD GRINDING PROCESS KNOWN AS ENERGY ADAPTIVE GRINDING WAS EVALUATED.
- THIS PROCESS REDUCES THE GRINDING "ART" TO MORE OF A SCIENCE BY BRINGING THE IMPORTANT GRINDING PARAMETERS UNDER CONTROL.
- METAL REMOVAL RATE REDUCTION FROM 10-40 H.P./IN<sup>3</sup> TO 3 H.P./IN<sup>3</sup> WAS DEMONSTRATED. UPON IMPLEMENTATION AN ESTIMATED 3 HOURS PER TUBE CAN BE SAVED IN PROCESSING. ENERGY CONSUMPTION WILL ALSO BE REDUCED.

# DARCOM MMT ACCOMPLISHMENT

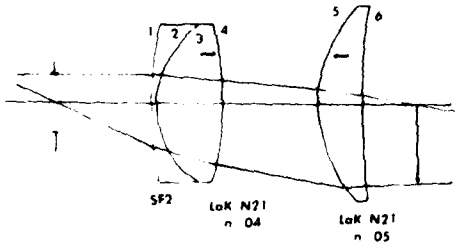
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 6 80 8209

TITLE: PILOT PRODUCTION OF GRADIENT INDEX OPTICS

COST: \$213,000

GOAL: DEVELOP LOW COST EYEPIECE USING GRADIENT INDEX LENSES



GRADIENT INDEX LENS EYEPIECE DESIGN

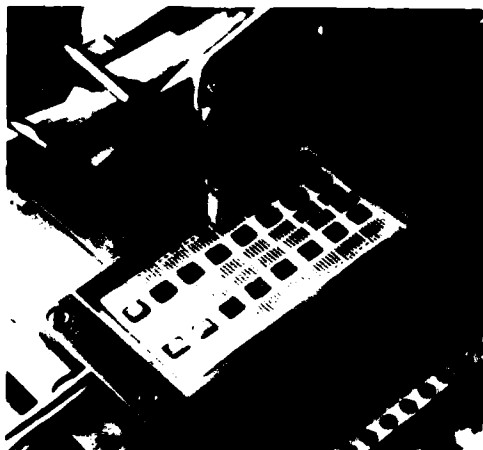
### RESULTS

- THE EYEPIECE FOR THE M1 TANK GUNNERS SIGHT HAS BEEN REDESIGNED USING 3 GRADIENT INDEX LENSES TO REPLACE THE CURRENT 6 LENS DESIGN. THE RAY TRACE ANALYSIS HAS BEEN COMPLETED AND VERIFIED.
- EQUIPMENT FOR PURCHASE HAS BEEN SELECTED. MMT 6 81 8209 WILL CONTINUE THE EFFORT BY PROCESSING THE GLASS AND FABRICATING THE LENSES.
- THE END BENEFITS UPON IMPLEMENTATION WILL BE A LOWER EYEPIECE COST, RUGGEDIZATION, SMALLER VOLUME AND LIGHTER WEIGHT.

**SECTION III**

**IMPLEMENTED EFFORTS**

## **DARCOM MMT IMPLEMENTATION ELECTRONICS RESEARCH & DEVELOPMENT COMMAND**



**INTEGRATED CIRCUIT FABRICATION**

**EFFORT NO: H 5094**

**TITLE: 8K BIT BORAM**

**COST: \$80,000**

**GOAL: ESTABLISH PRODUCTION TECHNIQUES FOR  
8K BIT BORAM**

### **BENEFITS**

- **WESTINGHOUSE PRODUCTION ENGINEERED THE 8K BIT MEMORY FOR MILITARY APPLICATIONS.**
- **THE 8K NON-VOLATILE BORAM DEVICE IS NOW IN PRODUCTION AT WESTINGHOUSE FOR SEVERAL MILITARY SYSTEMS SUCH AS MIFASS.**
- **INTERNAL MARKETING BY WESTINGHOUSE AND DEVELOPMENT OF SECOND SOURCE EFFORTS IS UNDERWAY.**
- **IT IS ESTIMATED THAT AT MOB RATES, \$13 MILLION WILL BE SAVED OVER 5 YEARS.**

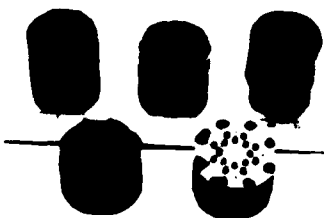
## **DARCOM MMT IMPLEMENTATION ELECTRONICS RESEARCH & DEVELOPMENT COMMAND**

**EFFORT NO: 2 9751**

**TITLE: FABRICATION OF YAG LASER RODS**

**COST: \$142.000**

**GOAL: REDUCE LASER ROD PROCESSING TIME AND  
COST**



**ND: YAG LASER ROD POLISHING BLOCKS**

### **BENEFITS**

- **BATCH PROCESSING METHODS FOR GRINDING AND POLISHING ND: YAG LASER RODS WERE ESTABLISHED.**
- **ECONOMICAL MASS PRODUCTION OF 150 RODS/MONTH WAS ESTABLISHED THROUGH THE DESIGN AND USE OF A 16 ROD POLISHING BLOCK.**
- **THESE BATCH PROCESSING METHODS ARE BEING USED FOR FABRICATING LASER RODS USED IN THE LASER RANGE FINDER. AT FYDP RATES, SAVINGS ARE ESTIMATED AT \$2.7 MILLION.**

## DARCOM MMT IMPLEMENTATION COMMUNICATIONS & ELECTRONICS COMMAND

EFFORT NO: 2 9778

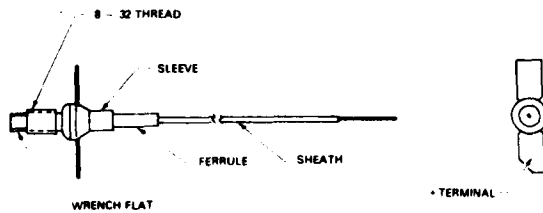
TITLE: PRODUCTION OF LONG LIFE EMITTERS  
FOR FIBER OPTICS

COST: \$466,000

GOAL: OPTIMIZE PRODUCTION PROCESSES FOR  
INJECTION LASER DIODES AND LIGHT  
EMITTING DIODES

### BENEFITS

- HIGH YIELD PRODUCTION PROCESSES HAVE BEEN DEVELOPED FOR GaAlAs INJECTION LASERS AND LIGHT EMITTING DIODES (LED) WHICH OPERATE AT .82 MICRONS.
- SELF-ALIGNING DIFFUSION MASKS, PREFERENTIAL ETCHING AND MIL PACKAGING WERE DEVELOPED. THE LED'S ARE BEING USED IN THE AN/TYC-39 AUTOMATIC MESSAGE SWITCH CENTRAL STORE AND FORWARD MODULE.
- THE LED UNIT COST WAS REDUCED \$500 AND A \$325K COST SAVINGS WAS REALIZED IN FY81-82 PRODUCTION.



FIBER COUPLED LED

# DARCOM MMT IMPLEMENTATION

## ELECTRONICS RESEARCH & DEVELOPMENT COMMAND

EFFORT NO: 2 9834

TITLE: SERIES TRANSDUCER DELAY LINES

COST: \$271,000

GOAL: TO ESTABLISH A PRODUCTION  
CAPABILITY

### BENEFITS

- LOW COST PRODUCTION TECHNIQUES WERE DETERMINED FOR FABRICATING MICROWAVE INTEGRATED CIRCUIT DELAY LINES AT A RATE OF 500 PER MONTH.
- PRODUCTION MAN-HOURS PER DELAY LINE WERE REDUCED FROM 10 TO 2.5. A METAL MASK DELINEATION PROCESS WAS INTRODUCED TO ELIMINATE WET PHOTO-PROCESSING. HAND TUNING WAS ELIMINATED.
- EFFORT RESULTED IN THE ESTABLISHMENT AND USE OF A COMPETITIVE SECOND SOURCE FOR DELAY LINES.

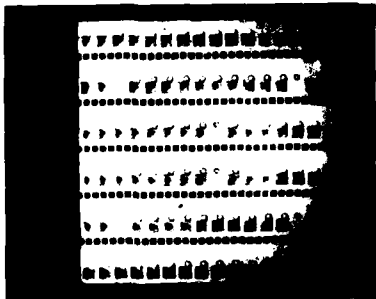


FIGURE 1 - TYPICAL METAL MASK  
PROCESSED WAFER



FIGURE 2 - MACHINED KOVAR PACKAGE  
CONTAINING DELAY LINE CHIP

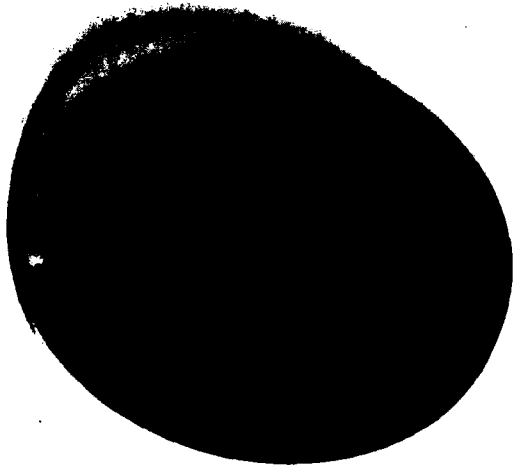
## **DARCOM MMT IMPLEMENTATION ELECTRONICS RESEARCH & DEVELOPMENT COMMAND**

**EFFORT NO: H 9841**

**TITLE: ZINC SELENIDE WINDOWS AND OPTICAL  
ELEMENTS**

**COST: \$156,000**

**GOAL: REDUCE PRODUCTION COST OF ZINC  
SELENIDE WINDOWS BY AUTOMATION**



**ZINC SELENIDE INFRARED WINDOW**

### **BENEFITS**

- **AUTOMATED LARGE BATCH PRODUCTION TECHNIQUES WERE DEVELOPED TO PRODUCE INFRARED WINDOWS BY CHEMICAL VAPOR DEPOSITION.**
- **THE PRODUCTION RATE OF THE EQUIPMENT CAN REACH 800/MONTH WITH A YIELD OF 98%.**
- **DUE TO THIS PROJECT, UNIT COSTS WENT FROM \$600 TO \$275. TO DATE, A TOTAL SAVINGS OF \$546,000 HAS BEEN REALIZED. WITH ON-GOING PROCUREMENTS, SAVINGS OVER \$2 MILLION ARE ESTIMATED.**



**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**



**EFFORT NO: M 6350-1646 (ARRADCOM/CSL)**

**TITLE: DEVELOPMENT OF RELIABLE METHOD FOR  
EVALUATION OF AGENT PERMEATION**

**COST: \$54,000**

**GOAL: AUTOMATE AGENT PERMEATION EVALUATION**

**BENEFITS**

- **AN AUTOMATED EVALUATION PROCEDURE TO QUANTITATIVELY DETERMINE THE CHEMICAL AGENT PENETRATION RESISTANCE OF BUTYL COATED CLOTH WAS DEVELOPED.**
- **THE MANUAL METHOD WHICH UTILIZED CONGO RED PAPER AND FRUIT FLIES WAS REPLACED.**
- **THIS PROCEDURE IMPROVED THE PRODUCT QUALITY AND RELIABILITY. THE FYDP COST SAVING IS ESTIMATED TO BE \$270,000.**

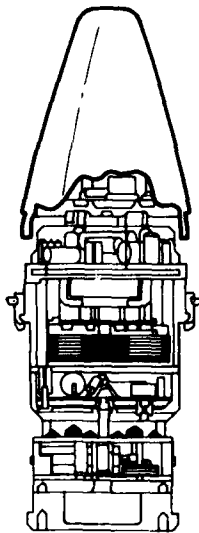
**DARCOM MMT IMPLEMENTATION**  
**MATERIALS AND MECHANICS RESEARCH CENTER**  
**MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M6350-1802 (ERADCOM/HDL)**

**TITLE: RANDOM TRANSPORTATION VIBRATION  
(RTV) FUZE MECHANISM TESTING**

**COST: \$155,000**

**GOAL: IMPROVE RTV FUZE MECHANISM TEST  
METHODS**



**M732 FUZE**

**BENEFITS**

- **THIS EFFORT PRODUCED AN IMPROVED RTV FUZE MECHANISM TEST SYSTEM THAT REPLACED THE SINUSOIDAL METHOD.**
- **THE SYSTEM USES A COMPUTER TO TRANSMIT SIMULATED RANDOM VIBRATION WAVE FORMS TO A FUZE VIBRATION TABLE.**
- **WITH THIS IMPROVED RTV TEST SYSTEM, THE FYDP SAVINGS FOR THE M732 FUZE ARE ANTICIPATED TO BE \$250,000. WITH MINOR MODIFICATIONS, THIS SYSTEM MAY BE USED TO TEST SIMILAR FUZES.**

# **DARCOM MMT IMPLEMENTATION**

## **MATERIALS AND MECHANICS RESEARCH CENTER**

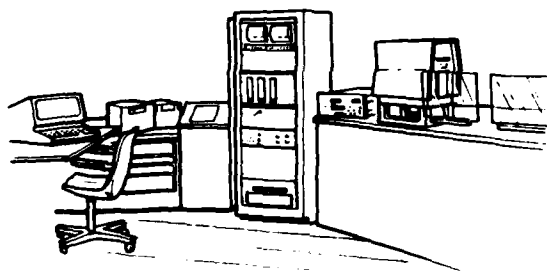
### **MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M 6350-2032**

**TITLE: INFRARED TEST FOR PRINTED CIRCUIT  
BOARDS (PCB)**

**COST: \$165,000**

**GOAL: IMPROVE PCB TESTING**

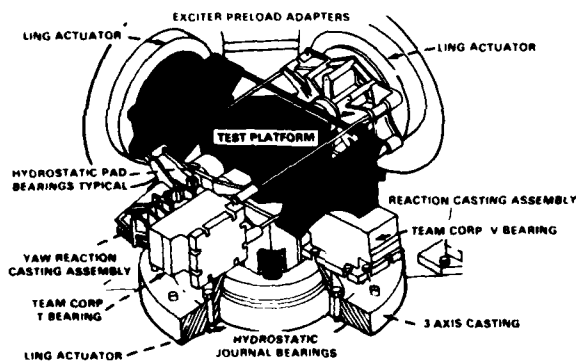


**INFRARED SYSTEM FOR TESTING  
PRINTED WIRING BOARDS**

#### **BENEFITS**

- **THIS EFFORT RESULTED IN COMPUTER METHODOLOGY AND RAPID SCAN TEST EQUIPMENT WHICH CAN ISOLATE PCB FLAWS THAT WERE PREVIOUSLY UNDETECTABLE.**
- **THE SYSTEM WAS INSTALLED AT HUGHES AIRCRAFT AND HAS SAVED \$120,000 BY MAKING UNNECESSARY A PROPOSED REDESIGN OF AMRAAM ELECTRONICS.**
- **SAVINGS OF \$10,000 PER DAY ARE ANTICIPATED WHEN A MODIFICATION OF THIS EQUIPMENT IS INSTALLED FOR AIR FORCE DEPOT INSPECTION.**

**DARCOM MMT IMPLEMENTATION**  
**MATERIALS & MECHANICS RESEARCH CENTER**  
**MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**



**3-D VIBRATION TEST SYSTEM**

**EFFORT NO: M 6350-2225**

**TITLE: 3-D SHOCK/VIBRATION TEST FOR FUZES**

**COST: \$70,000**

**GOAL: IMPROVE VIBRATION TEST SYSTEM**

**BENEFITS**

- **A PRELIMINARY TDP FOR THE 3-D VIBRATION PROTOTYPE WAS ESTABLISHED. TDP FINALIZATION WILL OCCUR UNDER 5 79,80,81 3961.**
- **IN CONTRAST TO CONVENTIONAL SINGLE INPUT, UNIDIRECTIONAL TESTING, THIS SYSTEM PERMITS 3 SIMULTANEOUS INPUTS.**
- **WITH THE NEW TEST SYSTEM, FYDP SAVINGS ON THE PATRIOT, MLRS, AND M724/M732 WEAPONS FUZES ARE EXPECTED TO BE \$1,800,000.**

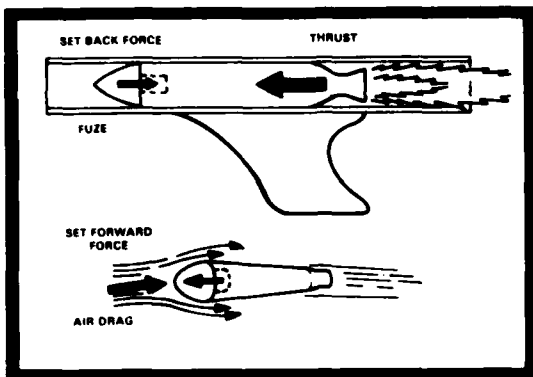
**DARCOM MMT IMPLEMENTATION**  
**MATERIALS AND MECHANICS RESEARCH CENTER**  
**MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M 6350-2227**

**TITLE: SETBACK-DRAG TESTER FOR S&A  
DEVICES**

**COST: \$86,000**

**GOAL: REDUCE NEED FOR LIVE FIRING FUZE  
TESTS**



**SETBACK AND DRAG FORCES**

**BENEFITS**

- **THIS EFFORT PRODUCED A SIMULATION TESTING CAPABILITY FOR FUZE SAFETY AND ARMING DEVICES.**
- **THIS TEST CAPABILITY, WHICH DID NOT PREVIOUSLY EXIST, ENHANCES FUZE/MISSILE RELIABILITY AND SAFETY.**
- **THE TEST EQUIPMENT HAS BEEN INSTALLED AT BULOVA AND HAS RESULTED IN A FYDP SAVINGS OF \$2,000,000 ON THE VIPER. SIMILAR SYSTEMS WILL BE USED FOR TANK FUZES.**

**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**



**TRACK PIN AND BUSHING**

**EFFORT NO: M 6350-2233 (TACOM)**

**TITLE: TRACK BUSHING TEST MACHINE**

**COST: \$125,000**

**GOAL: IMPROVE TRACK BUSHING TESTING**

**BENEFITS**

- **THIS EFFORT PRODUCED TRACK BUSHING TESTING MACHINE WHICH REPLACED 1940 VINTAGE EQUIPMENT.**
- **TWO TRACK BUSHING TEST MACHINES ARE BEING USED AT TACOM FOR QUALIFICATION TESTING. IMPLEMENTATION PLANS ARE BEING FORMULATED FOR PRODUCTION TESTING.**
- **THIS EQUIPMENT HAS REDUCED THE QUALIFICATION TESTING TIME 87%. THE ANTICIPATED FYDP SAVINGS IS \$175,000.**

**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M 6350-2403 (TECOM)**

**TITLE: IMPROVED STANDARDIZED WEAPON  
CHAMBER PRESSURE**

**COST: \$100,000**

**GOAL: IMPROVE WEAPON CHAMBER PRESSURE  
MEASUREMENT**

**BENEFITS**

- **THIS EFFORT PRODUCED A STANDARDIZED WEAPON CHAMBER MEASUREMENT METHOD.**
- **THIS IMPROVED METHOD IS MORE ACCURATE, RELIABLE AND INSURES BOTH THE SAFETY AND COMBAT EFFECTIVENESS OF LARGE CALIBER WEAPONS.**
- **THE DATA RELIABILITY OF THE PREVIOUS METHOD OFTEN WAS CHALLENGED WHICH NECESSITATED RETESTING AT \$10,000 TO \$300,000 PER TEST. THE ELIMINATION OF RETESTING WILL HAVE A FYDP SAVINGS OF \$1,500,000 TO \$2,500,000.**



**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M 6350-2426 (ERADCOM/NVL)**

**TITLE: CRYOGENIC COOLER HELIUM LEAK RATE  
TEST SET**

**COST: \$120,000**

**GOAL: ESTABLISH CRYOGENIC COOLER HELIUM  
LEAK TEST CAPABILITY**

**BENEFITS**

- **THIS EFFORT PRODUCED A HELIUM LEAK TEST SET AND PROCEDURES FOR EVALUATING CRYOGENIC COOLER LEAK RATES.**
- **THE TEST SET WILL DETECT POROUS CASTINGS, LEAKY SEALS AND HELIUM CONTAINMENTS.**
- **THE RESULTS OF THIS EFFORT ARE BEING USED FOR THE HD-1033/UA CRYOGENIC COOLER PRODUCTION TESTING. THE ANTICIPATED FYDP SAVINGS IS \$3,150,000.**





# DARCOM MMT IMPLEMENTATION

## MATERIALS AND MECHANICS RESEARCH CENTER

### MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM

EFFORT NO: M 6350-2430 (MICOM)

TITLE: ACCEPTANCE TESTER FOR COMMON  
MODULE SCANNER PERFORMANCE

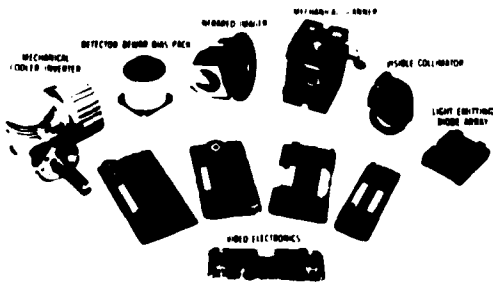
COST: \$100,000

GOAL: IMPROVE COMMON MODULE ACCEPTANCE  
TESTING

#### BENEFITS

- THE EFFORT PRODUCED A PRODUCTION PROTOTYPE SCAN MIRROR INTERFERENCE PATTERN ANALYZER (SMIPA) TEST SYSTEM FOR COMMON MODULE ACCEPTANCE TESTING.
- THE SMIPA TEST SYSTEM HAS THE CAPABILITY TO MEASURE DELETERIOUS FLAWS SUCH AS WARPAGE. THIS SYSTEM REPLACES COSTLY OPTICAL BENCH TESTING.
- ONE COMMON MODULE CONTRACTOR IS COMMITTED TO IMPLEMENT SMIPA TEST SYSTEM. THE ANTICIPATED FYDP SAVING IS \$750,000 PER CONTRACTOR.

THE ARMY'S COMMON MODULES



COMMON MODULES

**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M 6350-2431 (NLABS)**

**TITLE: COMPUTERIZED COLOR-MATCHING  
SYSTEM**

**COST: \$606,000**

**GOAL: IMPROVE MILITARY FABRIC INSPECTION  
METHOD**



**COMPUTERIZED COLOR-MATCHING SYSTEM**

**BENEFITS**

- **THIS EFFORT PRODUCED A COMPUTERIZED COLOR-MATCHING SYSTEM THAT WILL REPLACE THE CURRENT VISUAL METHOD USED TO DETERMINE ACCEPTABILITY OF MILITARY FABRIC COLORS AND SHADES.**
- **THIS SYSTEM UTILIZES A SPECTROPHOTOMETRIC TECHNIQUE TO PERFORM THE COLOR EVALUATIONS. THE SYSTEM IS A STAND-ALONE UNIT WITH A MINI/MICRO PROCESSOR.**
- **WITH THIS IMPROVED METHOD, THE FYDP SAVINGS ARE ANTICIPATED TO BE \$2,500,000.**

**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M 6350-2434 (ERADCOM/NVL)**

**TITLE: RAPID NDT FOR DETERMINING LASER  
DOPANT DENSITY AND DISTRIBUTION.**

**COST: \$90,000**

**GOAL: PRODUCE A LASER ROD INSPECTION  
TECHNIQUE**

**BENEFITS**

- **A METHOD WAS PRODUCED FOR DETERMINING NEODYMIUM DOPANT DENSITY AND DISTRIBUTION IN LASER RODS.**
- **THIS NEW METHOD ALLOWS LASER ROD TO BE EVALUATED PRIOR TO ASSEMBLING THE HAND HELD LASER RANGE FINDER AN/GVS-5.**
- **SINCE THE RESULTS OF THIS EFFORT WERE IMPLEMENTED, APPROXIMATELY \$200,000 SAVINGS HAS BEEN REALIZED. THE FYDP SAVINGS IS ANTICIPATED TO BE \$390,000.**



**LASER RANGE FINDER**

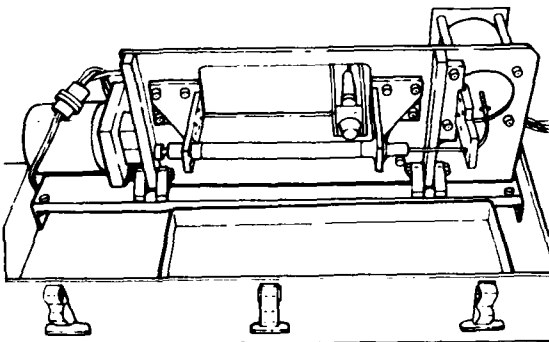
**DARCOM MMT IMPLEMENTATION  
MATERIALS & MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M 6350-2437**

**TITLE: ACOUSTIC MEASUREMENTS FOR ELECTROMAGNETIC COMPONENTS**

**COST: \$120,000**

**GOAL: IMPROVE RELIABILITY OF PHASE SHIFTERS**



**PATRIOT TOROID ULTRASONIC THICKNESS GAGING SYSTEM**

**BENEFITS**

- **AUTOMATED THICKNESS TESTING METHODS WERE DEVELOPED FOR TOROIDS USED IN PATRIOT RADAR PHASE SHIFTERS.**
- **THE IMPROVED RELIABILITY PREVENTS COSTLY ASSEMBLY OF BAD TOROIDS INTO THE PHASE SHIFTERS.**
- **THE SYSTEM WAS INSTALLED AT A CONTRACTOR'S PLANT FOR INCOMING INSPECTION. FYDP SAVINGS OF \$605,000 ARE ANTICIPATED.**

# DARCOM MMT IMPLEMENTATION

## MATERIALS AND MECHANICS RESEARCH CENTER MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM

EFFORT NO: M 6350-2440 (MICOM)

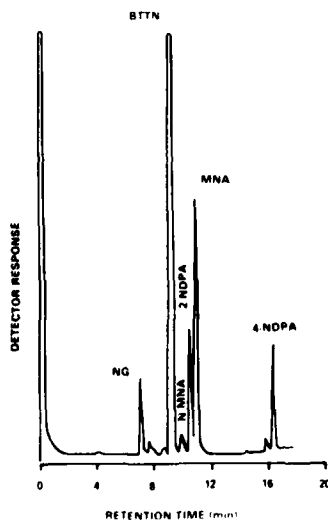
TITLE: GAS CHROMATOGRAPHY OF  
NITROCELLULOSE-BASE PROPELLANTS

COST: \$165,000

GOAL: IMPROVE NITROCELLULOSE-BASE PROPELLANTS EVALUATION

### BENEFITS

- A GAS CHROMATOGRAPHIC PRODUCTION TEST WAS PRODUCED BY THIS EFFORT.
- THIS TECHNIQUE HAS TRI-SERVICE GENERIC APPLICABILITY FOR ALL MISSILES WITH NITROCELLULOSE-BASE PROPELLANTS.
- THIS TECHNIQUE, WHICH REPLACES SOME 30 CONVENTIONAL METHODS, IS BEING USED FOR THE CHAPARRAL AND HELLFIRE MISSILE SYSTEMS. MIL-STD-286B IS BEING REVISED TO INCORPORATE THIS TECHNIQUE. THE ANTICIPATED FYDP COST SAVINGS IS \$1,500,000.



Gas chromatogram of a minimum signature propellant extract on an OV 225 glass column

Component	Symbol
Nitroglycerine	NG
1,2,4-Butanetriol trinitrate	BTN
N-Nitroso-N-methyl-p-nitroaniline	M-MNA
2-Nitrodiphenylamine	2-NDPA
N-methyl-p-nitroaniline	MNA
4-Nitrodiphenylamine	4-NDPA

### GAS CHROMATOGRAM

**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M 6350-2447 (ARRADCOM/CSL)**

**TITLE: AEROSOL TEST APPARATUS FOR BIOLOGICAL  
DETECTION AND WARNING SYSTEM**

**COST: \$455,000**

**GOAL: IMPROVE BIOLOGICAL DETECTION AND WARN-  
ING SYSTEM EVALUATION**



**BENEFITS**

- **A PORTABLE PROTOTYPE AEROSOL TESTER FOR EVALUATING BIOLOGICAL DETECTION AND WARNING SYSTEMS WAS PRODUCED.**
- **ALSO, A STANDARDIZED REPRODUCIBLE BIOLOGICAL AEROSOL CHALLENGE AGENT TEST WAS ESTABLISHED FOR EVALUATING BIO-ALARMS**
- **THIS EQUIPMENT HAS REDUCED THE TESTING TIME BY 83%. THE ANTICIPATED FYDP SAVING IS \$720,000.**

**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**



**EFFORT NO: M 6350-2455 (ARRCOM/WATERVLIET)**

**TITLE: DETERMINATION OF QUENCH CRACKS AFTER  
HEAT TREATMENT**

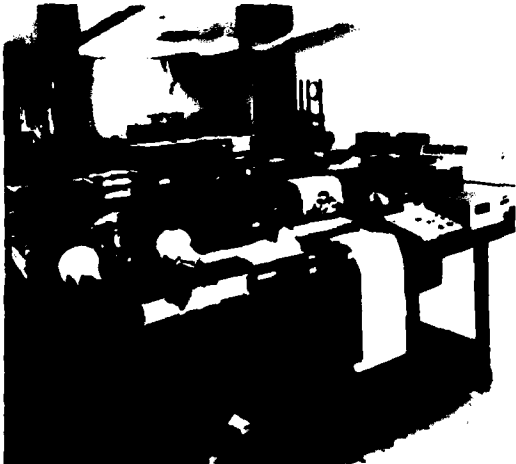
**COST: \$125,000**

**GOAL: DEVELOP QUENCH CRACK INSPECTION  
TECHNIQUE**

**BENEFITS**

- **THIS EFFORT PRODUCED AN ULTRASONIC TESTING TECHNIQUE FOR DETECTING GUN TUBE QUENCH CRACKS AFTER HEAT TREATMENT.**
- **THIS NEW METHOD HAS ALLOWED WATERVLIET TO DETECT CRACKS IMMEDIATELY AFTER QUENCHING WHICH HAS ELIMINATED UNNECESSARY TEMPERING AND MACHINING OF GUN TUBE FORGING.**
- **THE FYDP SAVINGS FOR THE 105MM AND 155MM GUN TUBES IS ANTICIPATED TO BE \$843,000.**

**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**



**EFFORT NO: M 6350-2610 (ARRADCOM/CSL)**

**TITLE: IMPROVED METHOD FOR DETERMINATION OF  
PURITY OF DYES**

**COST: \$14,000**

**GOAL: IMPROVE DYE PURITY DETERMINATION  
METHOD**

**BENEFITS**

- **AN IMPROVED METHOD FOR DETERMINING  
PURITY OF SIGNAL SMOKE DYES WAS PRODUCED.**
- **THIS NEW AUTOMATED METHOD IS USED TO PRO-  
VIDE ANALYTICAL DYE PURITY REFERENCE  
STANDARDS. THIS METHOD HAS REDUCED  
HUMAN CONTACT WITH HAZARDOUS DYES AND  
HAS IMPROVED ACCURACY.**
- **THE ANTICIPATED FYDP COST SAVING IS \$115,000.**



**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

**EFFORT NO: M 6350-2621 (ERADCOM/NVL)**

**TITLE: THERMOELECTRIC MATERIALS EVALUATION**

**COST: \$95.000**

**GOAL: IMPROVE THERMOELECTRIC MATERIALS  
EVALUATION**

**BENEFITS**

- **THIS EFFORT DEVELOPED A COMPUTERIZED THERMOELECTRIC MATERIALS MEASUREMENT SYSTEM.**
- **THE SYSTEM HAS CAPABILITY TO EVALUATE AC/DC RESISTIVITY, THERMAL CONDUCTIVITY AND SEEBECK COEFFICIENT OF THERMOELECTRIC COOLER MATERIAL.**
- **THE RESULTS OF THIS EFFORT ARE BEING USED TO EVALUATE THERMOELECTRIC MATERIALS FOR PREPRODUCTION PROTOTYPE THERMAL WEAPON SIGHTS. ONCE PRODUCTION COMMENCES, A FYDP SAVINGS OF \$1.725.000 IS ANTICIPATED.**

**DARCOM MMT IMPLEMENTATION  
MATERIALS AND MECHANICS RESEARCH CENTER  
MATERIALS TESTING TECHNOLOGY (MTT) PROGRAM**

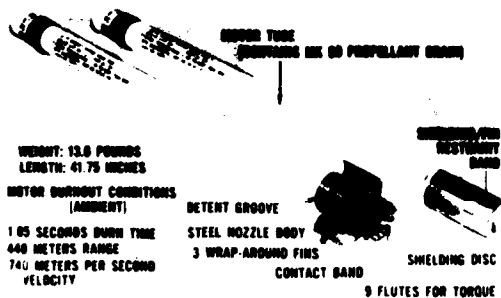
**EFFORT NO: M 6350-2825 (MICOM)**

**TITLE: MISSILE PROPELLANT BALLISTIC MODIFIERS  
IMPROVED TEST METHOD**

**COST: \$70,000**

**GOAL: IMPROVE PROPELLANT BALLISTIC MODIFIER  
TEST METHOD**

**MK 66 MOD 1 2.75 INCH  
ROCKET MOTOR**



**BENEFITS**

- IMPROVED GC, UV, AA, DTA, TGA, AND X-RAY DIFFRACTION METHODS WERE DEVELOPED FOR TESTING PROPELLANT BALLISTIC MODIFIERS.
- THESE METHODS WILL DETERMINE THE RATIO OF ACIDS IN A PARTICULAR BALLISTIC MODIFIER.
- BALLISTIC MODIFIER SPECIFICATIONS ARE BEING PREPARED INCORPORATING THESE TEST METHODS FOR THE 2.75 INCH ROCKET AND DRAGON BALLISTIC MODIFIERS. THE FYDP SAVINGS ARE ESTIMATED TO BE \$3,315,000.

# DARCOM MMT IMPLEMENTATION

## MISSILE COMMAND

EFFORT NO: R 3116

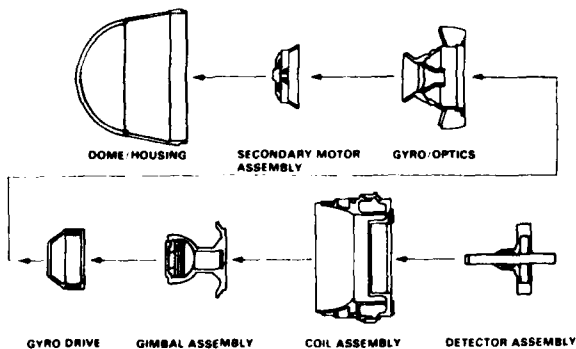
TITLE: ROSETTE AIR DEFENSE SEEKER OPTICS  
AND DETECTORS

COST: \$1,154,000

GOAL: IMPROVE PRODUCTION METHODS FOR  
AIR DEFENSE SEEKER

### BENEFITS

- IMPROVED PRODUCTION METHODS FOR THE STINGER-POST MISSILE SEEKER HAVE BEEN ESTABLISHED. IMPLEMENTATION OF 9 OF THE METHODS IS TAKING PLACE THROUGH THE TDP FOR THE MISSILE.
- COST REDUCTION, LEAD TIME REDUCTION, AND IMPROVED MATERIEL WILL RESULT FROM THIS EFFORT.
- AN ESTIMATED MOBILIZATION SAVINGS OF \$9.5 MILLION WILL ACCRUE FROM THIS IMPLEMENTATION.



STINGER-POST SEEKER HEAD

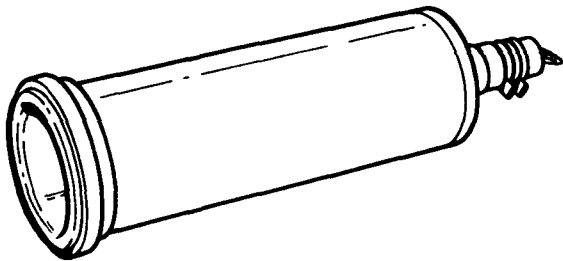
## **DARCOM MMT IMPLEMENTATION MISSILE COMMAND**

**EFFORT NO: R 3140**

**TITLE: IMPROVED MANUFACTURING PRO-  
CESSES FOR SILICON VIDICONS**

**COST: \$624,000**

**GOAL: DEVELOP MANUFACTURING PROCESSES  
FOR SILICON VIDICONS**



**SILICON VIDICON CAMERA TUBE**

### **BENEFITS**

- **MANUFACTURING TECHNIQUES TO PRODUCE A RUGGEDIZED, HIGH PERFORMANCE SILICON TARGET VIDICON WERE DEVELOPED.**
- **THE YIELD WAS INCREASED TO 52 PERCENT AT THE END OF THE 40 TUBE PRODUCTION RUN. THE DARK CURRENT AND SUSCEPTIBILITY TO "BLOOMING" HAVE BEEN REDUCED.**
- **THE TUBE COST WAS REDUCED FROM \$5000 TO \$625 IN QUANTITIES OF 2,500. TUBES WERE USED ON RUGGEDIZED INSTRUMENTATION FOR M1 TANK TESTING.**

# DARCOM MMT IMPLEMENTATION

## MISSILE COMMAND

EFFORT NO: R 3167

TITLE: CRACK FREE PLATED-THROUGH-HOLES  
(PTH) IN PRINTED CIRCUIT BOARDS

COST: \$223,000

GOAL: ELIMINATE PLATED-THROUGH-HOLE  
CRACKING IN CIRCUIT BOARDS

### BENEFITS

- PROCESSES, CONTROLS AND EQUIPMENT NEEDED TO INSURE CRACK FREE PTH'S WERE DETERMINED.
- THE OPTIMUM COMBINATION INCLUDED A POLYIMIDE-GLASS BOARD PLATED IN EITHER A SEL-REX ACID SULFATE OR AN M&T PYRO-PHOSPHATE COPPER PLATING BATH.
- HUGHES HAS IMPLEMENTED THE TECHNOLOGY IN BOARD PRODUCTION. BELL, LOCKHEED, AND MOTOROLA ARE ALSO USING THE TECHNOLOGY.
- ONE FIRM HAS ESTIMATED A \$36K/YR SAVINGS ON BATH OPERATIONS. OTHER SAVINGS WILL RESULT FROM THE OTHER IMPLEMENTATIONS.

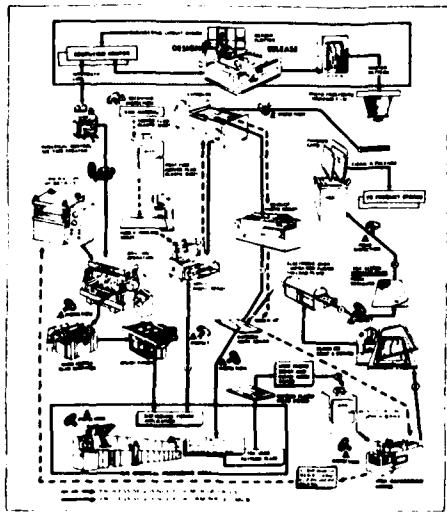


FIGURE 1 - MULTILAYER BOARD FABRICATION

## DARCOM MMT IMPLEMENTATION MISSILE COMMAND

EFFORT NO: R 3183

TITLE: INERTIAL QUARTZ FLEXURE  
ACCELEROMETER

COST: \$345,000

GOAL: INCREASE YIELDS AND REDUCE  
MANUFACTURING COSTS

### BENEFITS

- A NEW TOOLING AND VACUUM DEPOSITION SYSTEM COMBINATION WAS DEVELOPED WHICH INCREASED CAPACITIES FOR METALIZING PROOF MASS QUARTZ SURFACES.
- CHROME/GOLD DEPOSITION PROCESS WAS IMPROVED BY ENHANCED QUARTZ CLEANING.
- ACCELEROMETER IS USED IN ASSAULT BREAKER T-22 PROGRAM AND HAS APPLICATION FOR THE LANCE, SIG-D, NAVY HARPOON MISSILE AND BOEING 767 AIRCRAFT.
- ESTIMATED FYDP SAVINGS RESULTING FROM THIS WORK TOTAL \$40 MILLION.

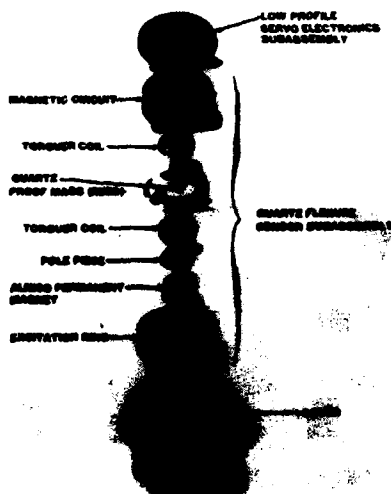


FIGURE 1 - SUNDSTRAND QA 2000 QUARTZ  
FLEXURE ACCELEROMETER

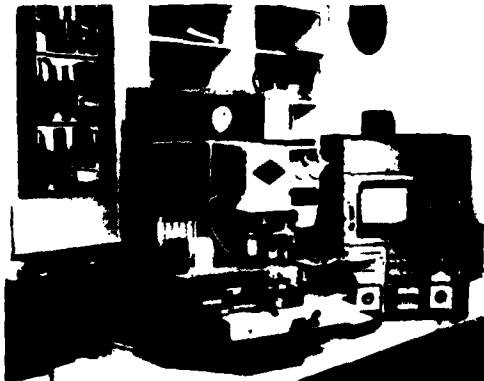
## **DARCOM MMT IMPLEMENTATION MISSILE COMMAND**

**EFFORT NO: 3 3227**

**TITLE: HYBRID CHIP HANDLING VIA TAPE CARRIER  
LEAD FRAME**

**COST: \$573,000**

**GOAL: DECREASE PRODUCTION COSTS FOR HAND-  
LING HYBRID CHIPS**



**OUTER LEAD BONDER**

### **BENEFITS**

- **HONEYWELL AVIONICS ESTABLISHED METHODS FOR BONDING SEMICONDUCTOR CHIPS TO TAPE CARRIERS, FOR TESTING CHIP CARRIERS, AND FOR BONDING CHIPS TO HYBRID CIRCUIT SUBSTRATES.**
- **EQUIPMENT DEVELOPED IN THE PROGRAM INCLUDED**
  - **CONTINUOUS TAPE PLATER**
  - **INNER AND OUTER LEAD BONDERS**
  - **LEAD FRAME CUTTING MACHINE**
  - **AUTOMATIC TEST HANDLER**
- **HONEYWELL HAS INCORPORATED THIS TECHNOLOGY INTO THEIR PRODUCTION. YIELDS WERE ESTIMATED TO IMPROVE 40%.**

## **DARCOM MMT IMPLEMENTATION**

### **MISSILE COMMAND**

**EFFORT NO: R 3272**

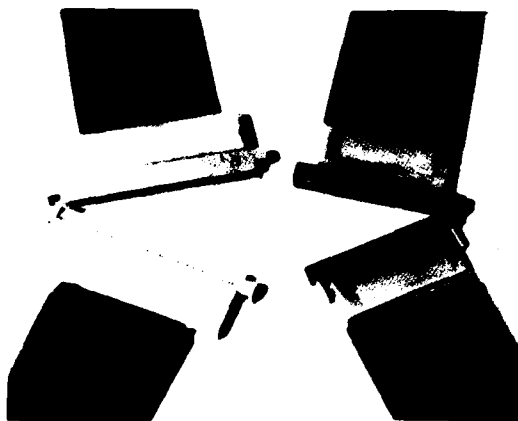
**TITLE: FLEXIBLE PRINTED CIRCUITS WITH  
INTEGRAL MOLDED CONNECTORS  
(FLEXICON)**

**COST: \$217,000**

**GOAL: REDUCE MANUFACTURING COSTS**

#### **BENEFITS**

- **HIGH SPEED LASER ABLATION, LASER WELDING, AND LIQUID INJECTION MOLDING WERE ESTABLISHED FOR TERMINATING FLEXIBLE PRINTED WIRING TO CONNECTORS.**
- **FLEXIBLE PRINTED WIRING SAVES 80% OF THE WEIGHT, 20% OF THE VOLUME AND 30% TO 50% OF THE COST OF INTERCONNECTION IN MILITARY ASSEMBLIES.**
- **TECHNIQUES WERE IMPLEMENTED IN AN/ALQ-131(V) AND E3A-AWACS RADAR. F16 RADAR AND AQUILA ARE TWO OTHER APPLICATIONS.**
- **TOTAL SAVINGS PROJECTED OVER 10 YEARS IS ESTIMATED AT \$5.9 MILLION.**



**FIGURE 1 - MOLDED FLEXICON ASSEMBLIES  
FOR TWO CONNECTOR FAMILIES**



# DARCOM MMT IMPLEMENTATION

## MISSILE COMMAND

EFFORT NO: R 3372

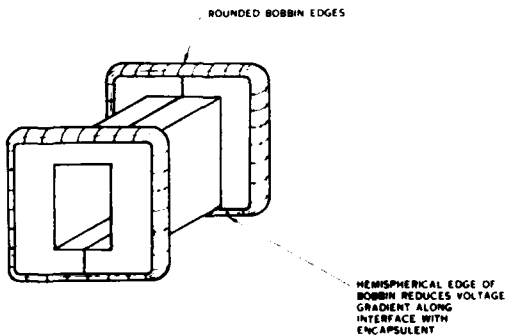
TITLE: MANUFACTURING METHODS FOR  
MAGNETIC COMPONENTS

COST: \$1,200,000

GOAL: REDUCED COST AND INCREASED  
RELIABILITY

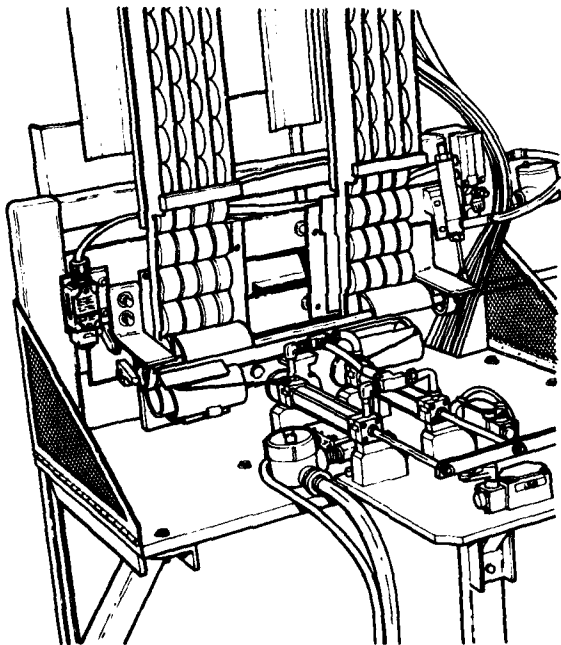
### BENEFITS

- MAGNETIC COMPONENT MANUFACTURING PROCESSES WERE INVESTIGATED FOR IMPROVEMENTS. THE MOST SIGNIFICANT CHANGES WERE:
  - REPLACING THE MYLAR TACKING TAPE WITH A QUICK SETTING ADHESIVE.
  - IMPROVING THE BANDING DESIGN TO REPLACE THE CLIP AND SOLDERING OPERATIONS.
  - IMPROVING THE BOBBIN DESIGN TO REDUCE VOLTAGE GRADIENTS.
- THESE TECHNIQUES ARE BEING IMPLEMENTED AT HUGHES AIRCRAFT WITH OTHER COMPANIES SHOWING AN INTEREST. SAVINGS ARE ESTIMATED AT \$2 MILLION/YEAR.



## **DARCOM MMT IMPLEMENTATION**

### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**



**SLUG PLACEMENT MACHINE**

**EFFORT NO: 5 1316**

**TITLE: ADVANCED TECHNOLOGY FOR  
PROCESSING SMOKE GRENADES**

**COST: \$500,000**

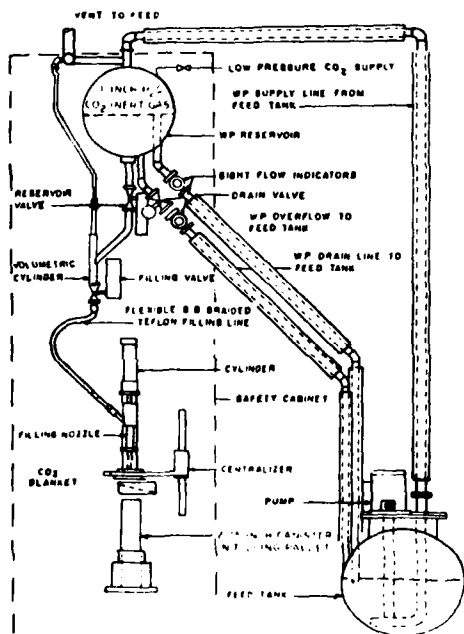
**GOAL: REDUCE COST AND HEALTH HAZARDS**

#### **BENEFITS**

- **A SIMPLIFIED PRODUCTION SYSTEM THAT REDUCES THE NUMBER OF OPERATORS FROM 45 TO 18 WAS DEVELOPED.**
- **THE NEED FOR REAMING PRESSED GRENADES WAS ELIMINATED.**
- **THE NEW PROCESS IS SAFE, EFFICIENT AND ENVIRONMENTALLY ACCEPTABLE.**
- **IMPLEMENTATION OF THIS EFFORT AT PINE BLUFF ARSENAL WILL RESULT IN AN ESTIMATED 10 YEAR SAVINGS OF \$4.2 MILLION.**

# DARCOM MMT IMPLEMENTATION

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND



**WP VOLUMETRIC  
FILLING SYSTEM**

**PROJECT NO: 5 1320**

**TITLE: PILOT STATIONS FOR FILLING AND  
CLOSING WHITE PHOSPHORUS (WP)  
MUNITIONS**

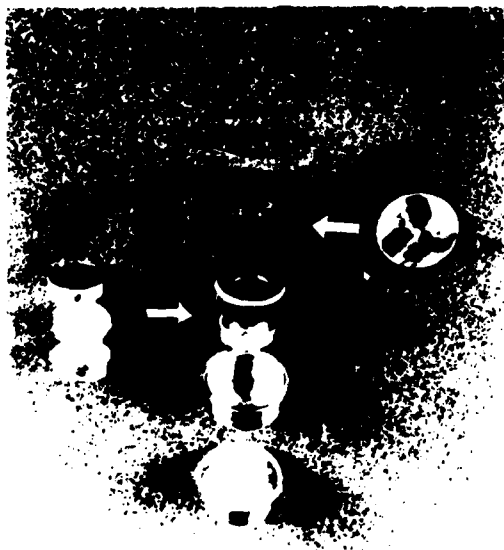
**COST: \$749,000**

**GOAL: ESTABLISH AN INITIAL PRODUCTION  
CAPABILITY FOR WP MUNITIONS**

### BENEFITS

- **EQUIPMENT WAS ASSEMBLED FOR THE FILLING, CLOSING, LOADING, AND PACKING OF THE M259 2.75 INCH WP ROCKET.**
- **THE EXISTING WP DRY FILL LINE AT PINE BLUFF ARSENAL (PBA) WAS MODIFIED AND NEW EQUIPMENT INSTALLED.**
- **APPROXIMATELY 30,000 ROCKETS WERE SUCCESSFULLY PRODUCED AT PBA.**

## **DARCOM MMT IMPLEMENTATION ARMAMENT RESEARCH & DEVELOPMENT COMMAND**



**COPPER AMPULE**

**EFFORT NO: 5 3104**

**TITLE: COPPER AMPULES FOR FUZE POWER  
SUPPLIES**

**COST: \$350,000**

**GOAL: IMPROVE MANUFACTURING TECHNIQUES  
FOR COPPER AMPULES**

### **BENEFITS**

- **PRODUCTION PROCESSES WERE ESTABLISHED AND EQUIPMENT WAS DEVELOPED FOR FABRICATING COPPER AMPULES. TIG WELDING WAS ESTABLISHED FOR THE THIN COPPER PARTS.**
- **THIS SUCCESSFUL MMT WORK RESULTED IN AN IPF WITH UNION CARBIDE WHERE ASSEMBLY EQUIPMENT FOR COPPER AMPULES WAS FABRICATED.**
- **TO DATE, THIS EQUIPMENT HAS BEEN USED TO PRODUCE OVER 3 MILLION AMPULES.**

## **DARCOM MMT IMPLEMENTATION**

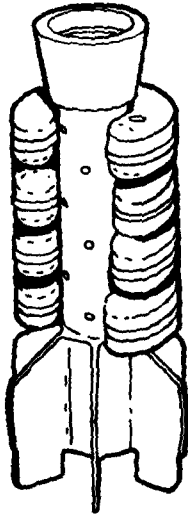
### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**

**EFFORT NO: 5 4041**

**TITLE: AUTOMATED EQUIPMENT FOR MORTAR COMPONENTS**

**COST: \$2,845,000**

**GOAL: REDUCE COSTS TO LOAD, ASSEMBLE AND INSPECT MORTAR PROPELLING CHARGES**



**PROPELLING CHARGES**

#### **BENEFITS**

- **A NON-SYNCHRONOUS PRODUCTION SYSTEM FOR LOADING, ASSEMBLING AND INSPECTING 61MM AND 81MM PROPELLING CHARGES WAS DEVELOPED.**
- **RAPID START-UP, EASE OF TOOL CHANGE AND FLEXIBILITY OF TOOLING WERE DESIGN GOALS.**
- **A PRODUCTION RATE OF 108 INCREMENTS PER MINUTE CAN NOW BE ACHIEVED.**
- **IMPLEMENTATION OF THIS SYSTEM AT MILAN AAP IS EXPECTED TO RESULT IN A TEN YEAR SAVINGS OF \$5.2 MILLION.**

## DARCOM MMT IMPLEMENTATION ARMAMENT RESEARCH & DEVELOPMENT COMMAND

EFFORT NO: 5 4147

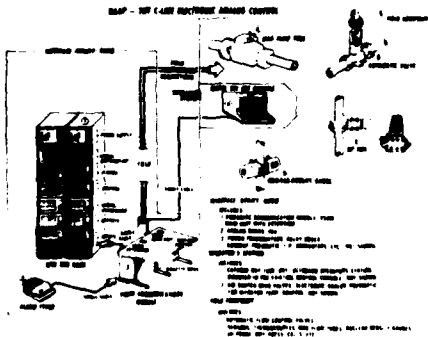
TITLE: COMPUTER CONTROL APPLICATION TO  
CONTINUOUS TNT MANUFACTURE

COST: \$2,120,000

GOAL: IMPROVE SAFETY AND EFFICIENCY OF  
CONTINUOUS TNT PROCESS

### BENEFITS

- A PROTOTYPE COMPUTER CONTROLLED SYSTEM INSTALLED AT VOLUNTEER AAP DEMONSTRATED THE DESIREABILITY OF AUTOMATED CONTROL AND OPERATION OF TNT LINES.
- PRODUCTION RATES WERE INCREASED 16% WITH FEWER OPERATORS.
- AN ELECTRONIC ANALOG CONTROL SYSTEM WAS SUBSEQUENTLY INSTALLED ON A TNT LINE AT RADFORD AAP. MOBILIZATION SAVINGS FROM THIS MMT ARE ESTIMATED AT \$2.5 MILLION PER YEAR.



TNT ANALOG ELECTRONIC COMPONENTS AND  
AUTOMATIC EQUIPMENT

## DARCOM MMT IMPLEMENTATION

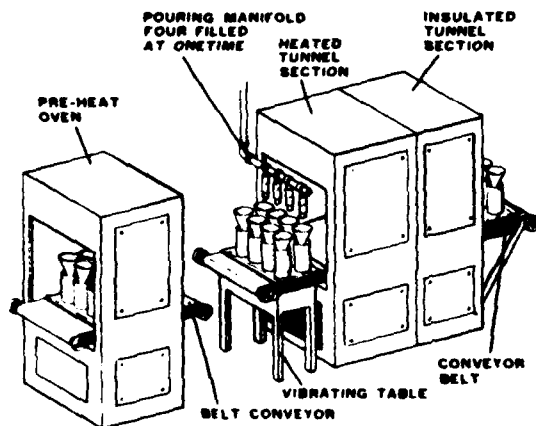
### ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 5 4163

TITLE: CONTROLLED PRODUCTION LOADING  
SYSTEM FOR 105MM HEAT-T M456A1

COST: \$491,000

GOAL: MINIMIZE DEFECTS AND REDUCE  
REJECTS IN CAST LOADING



**SCHEMATIC OF MILAN  
AAP PRODUCTION LINE**

### BENIFITS

- A PROTOTYPE LINE FOR LOADING 105MM HEAT-T M456 A1/A2 AT MILAN AAP WAS INSTALLED AND PROVEN OUT IN 1980.
- A REDUCTION OF NONWET CAVITIES IN THE C-SEGMENT OF THE PROJECTILE WAS OBTAINED.
- A 95% ACCEPTANCE LEVEL FOR PROJECTILES WAS ACHIEVED.
- SAVINGS OF \$5M/YR BASED ON A 100K ROUNDS/YR PRODUCTION RATE HAVE BEEN VALIDATED.

# DARCOM MMT IMPLEMENTATION

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

EFFORT NO: 5 4215

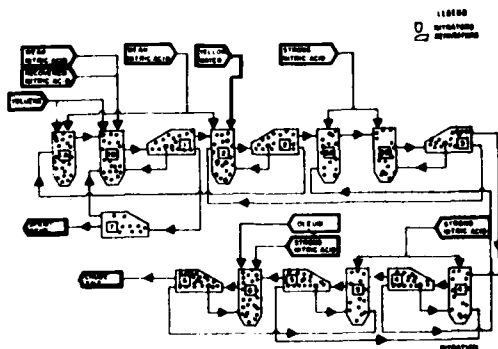
TITLE: AUTOMATING THE CONTINUOUS TNT  
PRODUCTION FACILITY PROCESS  
CONTROLS

COST: \$607,000

GOAL: IMPROVE PROCESS CONTROL

### BENEFITS

- A NUCLEAR DENSITY GAUGE WAS SELECTED TO MEASURE AND CONTROL MASS FLOW RATES.
- MAGNETIC FLOWMETERS WERE CONFIRMED TO BE BEST FOR MEASURING STREAM FLOW RATES.
- SAFETY WAS IMPROVED BY REDUCING PERSONNEL EXPOSURE TO HAZARDOUS OPERATIONS.
- THE IMPROVED PROCESS CONTROL REDUCED SAMPLING AND TESTING TIMES.
- THE PROJECT RESULTS HAVE BEEN IMPLEMENTED IN FACILITY PROJECT 5 75 5901.

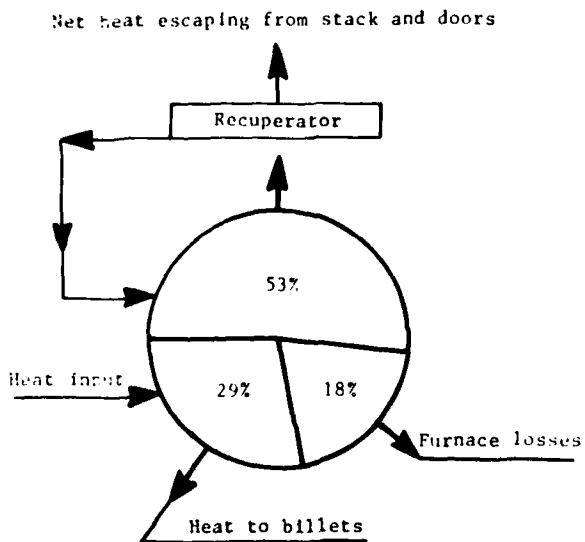


TNT NITRATION FLOW SCHEME



# DARCOM MMT IMPLEMENTATION

## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND



HEAT BALANCE FOR ROTARY HEARTH FURNACE

PROJECT NO: 5 4281-B02

TITLE: REDUCED FORGING TEMPERATURE

COST: \$163,000

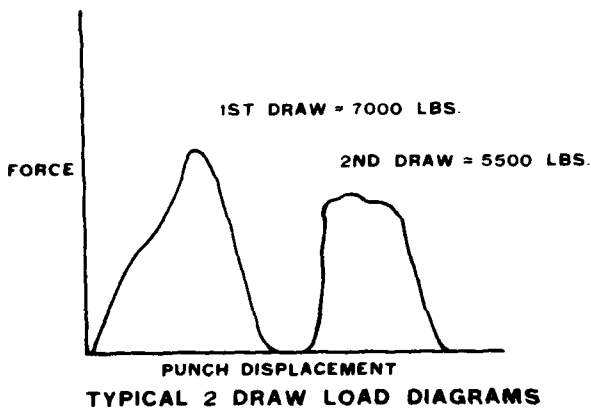
GOAL: ENERGY CONSERVATION

### BENEFITS

- ELECTRICITY CONSUMPTION FOR THE FURNACE WAS DECREASED BY 30%.
- NATURAL GAS CONSUMPTION FOR THE FURNACE WAS DECREASED BY 26%.
- BASED ON A PRODUCTION RATE OF 50,000 PROJECTILES PER MONTH, A SAVINGS OF OVER \$100,000 PER YEAR IS PROJECTED AT SCRANTON AAP.

## **DARCOM MMT IMPLEMENTATION**

### **ARMAMENT RESEARCH AND DEVELOPMENT COMMAND**



**EFFORT NO: 5 77 6200**

**TITLE: SMALL CALIBER AMMUNITION  
PROCESS IMPROVEMENT PROGRAM**

**COST: \$1,259,000**

**GOAL: REDUCE COST AND IMPROVE QUALITY**

#### **BENEFITS**

- **A MODERN MULTI-TOOLED PRESS FOR PRODUCING 5.56MM CARTRIDGE CUPS WAS DESIGNED, TESTED, AND A TECH DATA PACKAGE WRITTEN.**
- **THE PRESS OPERATES AT A RATE OF 1300 CUPS PER MINUTE AND PRODUCES A HIGH QUALITY CUP.**
- **THREE MACHINES WERE PURCHASED (FACILITIES PROJECT 5 79 3002) AND ONE EACH WAS INSTALLED AT ANACONDA, OLIN. AND REVERE.**

# DARCOM MMT IMPLEMENTATION

## ARMAMENT RESEARCH & DEVELOPMENT COMMAND

EFFORT NO: 5 6682

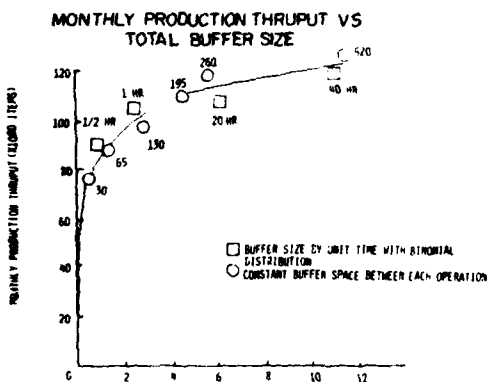
TITLE: SIMULATION OF AMMUNITION PRODUCTION  
LINES

COST: \$170,000

GOAL: DEVELOP COMPUTER MODELS TO OPTIMIZE  
EQUIPMENT DESIGN

### BENEFITS

- SOFTWARE WAS DEVELOPED UTILIZING THE BINOMIAL DISTRIBUTION TO SIMULATE STORAGE BUFFERS FOR IN-PROCESS INVENTORY OF MATERIAL HANDLING SYSTEMS.
- A ONE-TIME SAVINGS OF \$400,000 WAS REALIZED IN THE EQUIPMENT DESIGN FOR LOUISIANA AND MISSISSIPPI ARMY AMMUNITION PLANTS.
- ADDITIONAL SAVINGS WILL LIKELY ACCRUE IN EQUIPMENT DESIGN FOR FACILITIES SUPPORTING THE 120MM PROJECTILE.



## DARCOM MMT IMPLEMENTATION

### ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

PROJECT NO: 6 7727

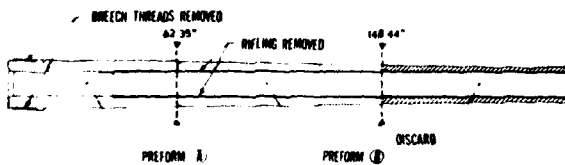
TITLE: RECYCLING OF SCRAP GUN TUBES BY  
ROTARY FORGING

COST: \$461,000

GOAL: MATERIAL COST AVOIDANCE

#### BENEFITS

- A COMPUTER PROGRAM WAS DEVELOPED WHICH GENERATES OPTIMUM END PRODUCT MIXES AND PREFORM DIMENSIONS.
- CRITICAL MATERIALS, E.G., ALLOY GUN STEEL, AND ENERGY ARE CONSERVED.
- THIS NEW RECYCLING TECHNIQUE PROVIDES MATERIAL COST SAVINGS OF \$1267 PER 105 MM M68, AND \$2367 PER 155 MM M185. ESTIMATED ANNUAL SAVINGS BASED ON THE FYDP ARE \$716,000; OR \$9,986,000 BASED ON THE MOB RATE.



RECYCLING 8" M2A2 TO PRODUCE  
PREFORMS FOR TWO 105MM M68'S

# DARCOM MMT IMPLEMENTATION

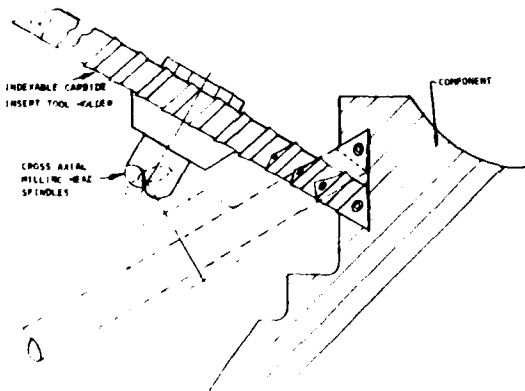
## ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

EFFORT NO: 6 8043

TITLE: IMPROVED MACHINING FOR DOVETAILS

COST: \$88,000

GOAL: MINIMIZE MACHINING ERRORS WHILE  
REDUCING COSTS



PROPOSED METHOD OF MACHINING DOVETAILS

### BENEFITS

- A CNC CONTROLLED, CROSS AXIAL MILLING MACHINE SPECIFICATION WAS DEVELOPED TO ALLOW SIMULTANEOUS MACHINING OF BOTH SIDES OF THE DOVETAIL
- THIS DESIGN REPLACES NO LESS THAN FIVE INGERSOLL MILLING MACHINES PREVIOUSLY USED
- THE TIME STANDARD WAS REDUCED FROM 33.41 HOURS TO APPROXIMATELY 5 HOURS PER PIECE

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