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MANUFACTURING METHODS AND TECHNOLOGY PROGRAM ACCOMPLISHMENTS.(U)
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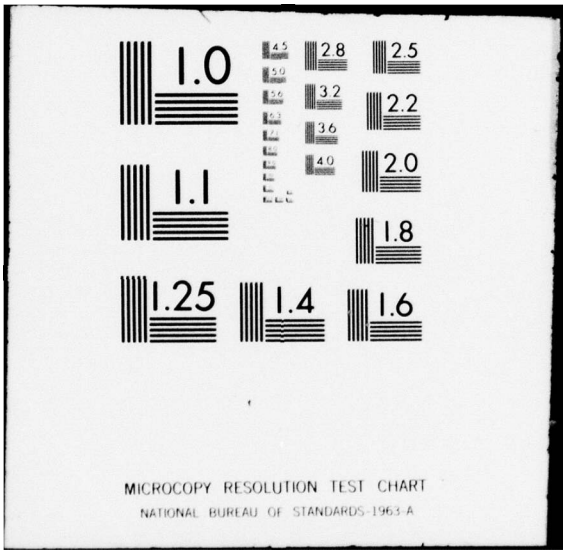
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U S ARMY

MATERIEL DEVELOPMENT AND READINESS COMMAND

PROGRAM ACCOMPLISHMENTS

MANUFACTURING METHODS & TECHNOLOGY

PREPARED BY

MANUFACTURING TECHNOLOGY DIVISION

U S ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY

ROCK ISLAND, ILLINOIS 61299

JUL 78

DEPARTMENT OF THE ARMY
US ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY
ROCK ISLAND, ILLINOIS 61299

DRXIB-MT

SUBJECT: MM&T Program Accomplishments

SEE DISTRIBUTION

1. Reference is made to AR 700-90, C1, Para 3-8e(2), Logistics, Army Industrial Preparedness Program, dated 10 March 1977.

2. This brochure illustrates some of DARCOM's MM&T Program accomplishments. It presents the achievements by Major Subordinate Command with emphasis on illustration on the types of projects pursued. The purpose of the document is to publicize results of the program and thereby promote communication and increase technology transfer.

3. This document will be published annually based on the results of MM&T projects. DARCOM elements are requested to take action to assure that accomplishment information will be available at the conclusion of projects in order to publicize the program.

4. Further information on the projects illustrated in this brochure should be obtained from the MM&T representatives, project officers shown, or from Mr. James W. Carstens, Chief, Manufacturing Technology Division, AV 793-5113.

J R Gallaugher

J. R. GALLAUGHER
Director,
Industrial Base Engineering Activity

INTRODUCTION

The Army Manufacturing Methods and Technology (MMT) Program was begun in 1964. The purpose of the program was to develop new manufacturing processes that could be applied to the production of Army items. Over the years hundreds of these projects have been funded and used to develop new technology. This brochure records the results of some of those projects.

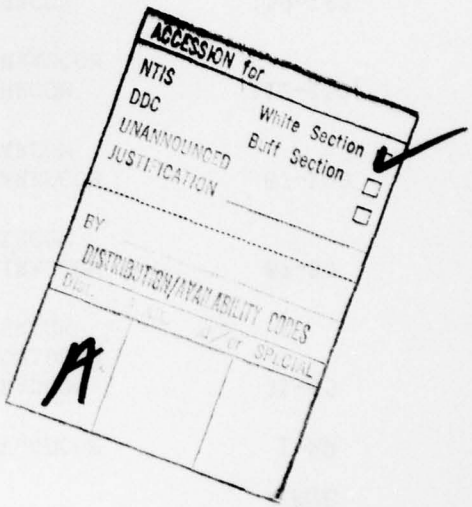
The project results are divided into DARCOM major subordinate commands. Each project is identified by title, funding, and project number. A brief description is given of the results and benefits. A contact point is provided for additional information on technical details.

The purpose of this brochure is two fold: first, to record the results of the MMT Program, and second, to disseminate information on new technology.

TECHNOLOGY TRANSFER

Much literature has been written recently about how to transfer technology from the "laboratory" to actual production. It is often difficult to make this transition. The fact remains, however, that the full benefits of the new technology can only be obtained if the process or technique is actually implemented in production. The Army is trying to place more emphasis on this phase of the program cycle. An important step will be to assure documentation of project results and the potential benefits. This information will then be more widely disseminated throughout the Army in order to spread the knowledge to potential users. This will be accomplished through end of project demonstrations; preparation of technical reports, project summary reports, and technical notes; and, through inclusion of technology information in bulletins and journals. All of these techniques, however, serve only to disseminate the information. Real benefits can only accrue when the new technology is implemented.

Each action officer dealing with MMT projects should be stressing the need for implementation and taking an active role in assuring that implementation is being carried out by the producers of Army materiel.



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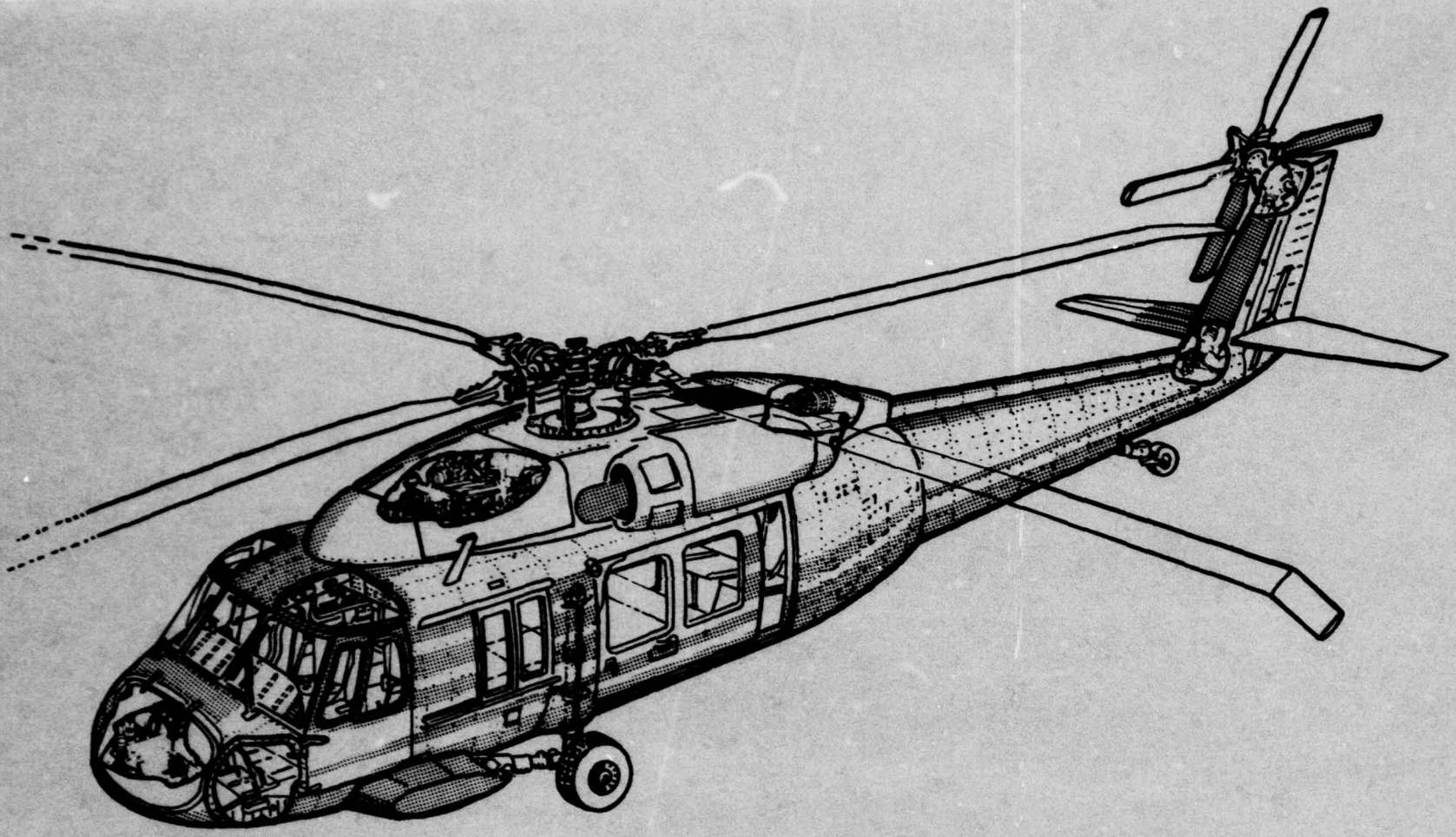

AVIATION R&D COMMAND
(AVRADCOM)

MM&T Representatives:

Mr. Robert Vollmer
US Army Aviation Systems
R&D Command
DRDAV-EXT
12th & Spruce Streets
St. Louis, MO 63166

AV 698-6476
(314) 268-6476

AVRADCOM

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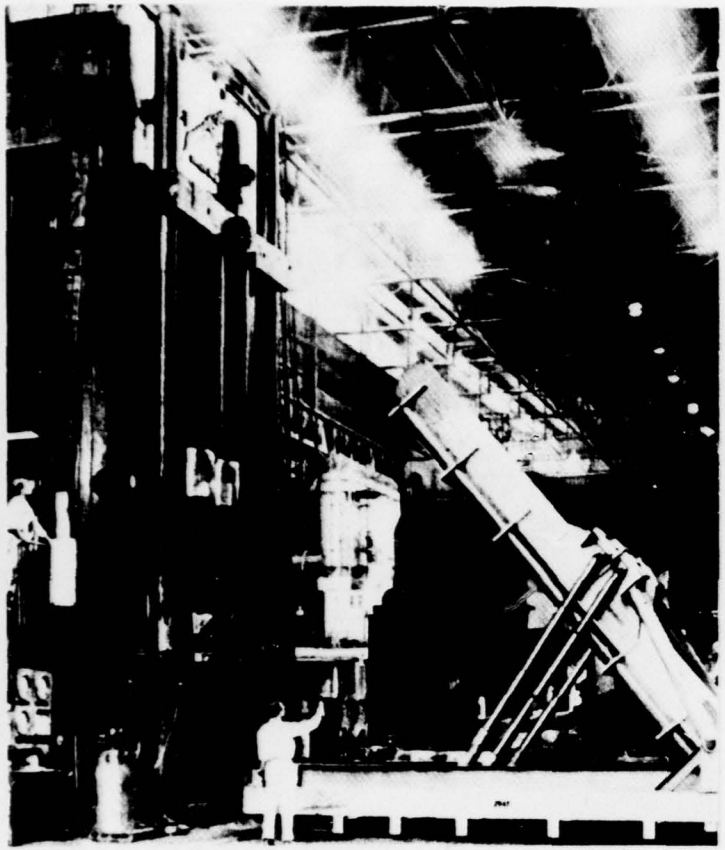
Advanced Titanium Alloys for Main Rotor Shafts	1 73 6039	Dr. Richard Chait Army Materials & Mechanics Research Center DRXMR-LP Watertown, MA 02172	AV 955-3202 (617) 923-3202

Contractor: The Boeing Company
Vertol Division
Philadelphia, PA

Report: An Evaluation of Some High Strength Titanium Alloys Processed in Heavy Sections
AVSCOM Report No. 76-6 DRSAV
AMMRC PTR 75-3

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT
AIRCRAFT



20,000 TON PRESS FOR
BACKWARD EXTRUSION PROCESS

(Photo courtesy of Cameron Iron Works.)

PROJECT NO: 1696039, 1726039, 1736039

TITLE: UTILIZATION OF ADVANCED TITANIUM ALLOYS FOR HELICOPTER APPLICATIONS

COST: $292,000; $385,000; $250,000 (TOTAL: $927,000)

BENEFITS

High strength titanium alloy billets were processed using a modified backward extrusion technique to form *helicopter main rotor shafts.*

Billets were reduced up to 85% to achieve maximum working for improved physical properties.

Direct aging after hot working is possible for metastable beta titanium alloys. Intermediate heat treating is unnecessary.

Process will be used to make main rotor drive shafts for CH-54 and other heavy lift helicopters.

Advanced Titanium Alloys
for Main Rotor Shafts

1 73 6039

Dr. Richard Chait
Army Materials & Mechanics
Research Center
DRXMR-LP
Watertown, MA 02172

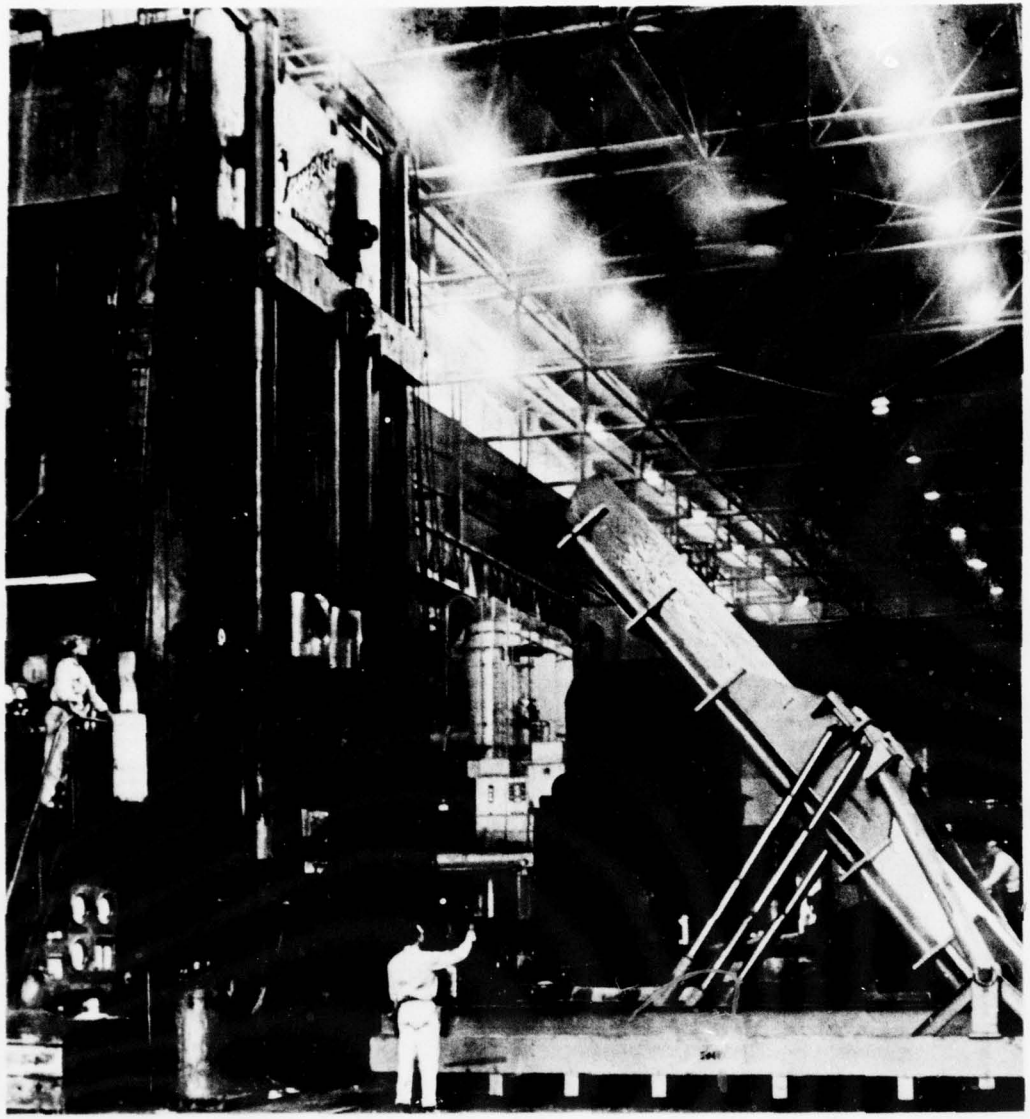
AV 955-3202
(617) 923-3202

Contractor: The Boeing Company
Vertol Division
Philadelphia, PA

Report: An Evaluation of Some High Strength Titanium Alloys Processed in Heavy Sections
AVSCOM Report No. 76-6 DRSAV
AMMRC PTR 75-3

SPECIFICS

- Reduction of approximately 85% during hot working
- Improved properties result from greater amount of hot working
- For metastable beta Ti alloys, it is possible to direct age after hot working eliminating the intermediate solutionize heat treatment
- Dependency on machining reduced, therefore less metal lost
- Less time required to achieve required reduction, therefore improve production schedules possible with less energy consumed for furnaces, forging presses, etc.



20,000 TON PRESS FOR BACKWARD EXTRUSION PROCESS

(Photo courtesy of Cameron Iron Works.)

Process Proprietary Plastic Material for Lightweight Armor	171 6042	Mr. Edward R. Barron US Army Natick R&D Command Chief, Helmet and Body Armor Group, Clothing and Personal Life Support Equipment Laboratory Natick, MA 01760	AV 955-2349

TAILORED FOR PROTECTION—Captain Don Galliers holds the sleeveless vest that gives law enforcement officers the critical edge when faced with an armed suspect. The vest is made of seven layers of DuPont Kevlar material; it weighs a little more than one pound and can stop the penetration of a low velocity 38-caliber bullet. The sports coat the captain is wearing is also one of the latest developments in body armor. Lined with the Kevlar material, it can protect the wearer from the bullets of small caliber handguns. A flap or bib attached to the coat's liner can be drawn over the chest area for added protection. The coat weighs a little more than three pounds and is one of four designs being tested at Natick.

USAMC PRIOR YEAR MM&T ACCOMPLISHMENT

PROJECT NO: 1716042

PROCESS PROPRIETARY
PLASTIC MATERIAL FOR
LIGHTWEIGHT ARMOR

COST: $380,000

BENEFITS

Provides ballistic protection for helicopter pilot & copilot. In civilian use provides ballistic protection for police vehicles.

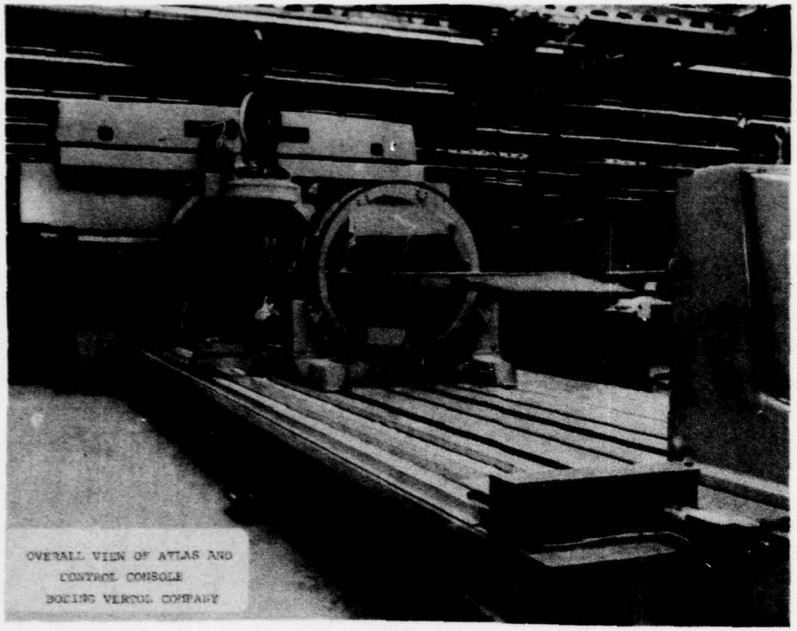
Automated Tape Layup System - ATLAS	1 71 6050	Mr. Richard E. Tierce US Army Aviation Systems Command DRSAV-EXT P.O. Box 209 St. Louis, MO 63166	AV 698-6476 (314) 268-6476

Contractor: The Boeing Company
Vertol Division
P.O. Box 16858
Philadelphia, PA 19142

Goldsworthy Engineering, Inc.
2917 Lomita Blvd.
Torrence, CA 90505

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

MAIN ROTOR SYSTEM



ATLAS AND CONTROL CONSOLE LAYING UP A CH-47 MAIN ROTOR BLADE.

PROJECT NO: 171 6050

TITLE: AUTOMATED TAPE LAYUP SYSTEM (ATLAS)

COST: $2,278,300

BENEFITS

Goldsworthy Engineering developed a computer controlled tape layup machine and supervised its installation and qualification at Boeing Vertol.

The Six-Axis machine demonstrated production of composite components at Boeing.

The machine provides a technical base for developing new layup techniques.

Demonstrated laminate repeatability previously unattainable.

Machine layup of a Ch-47 Fairing Skin was done in 2.7 hours; hand layup requires 7 hours.

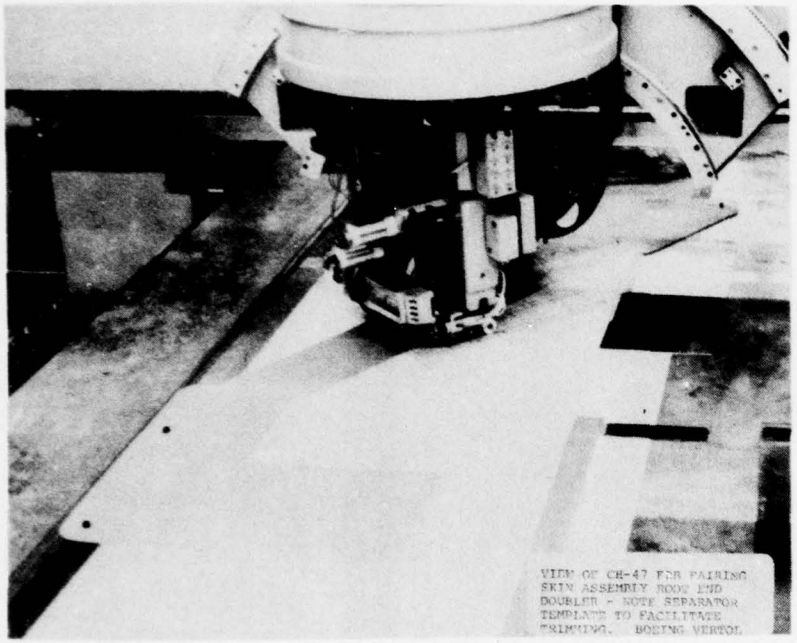
Automated Tape Layup System - ATLAS	171 6050	Mr. Richard E. Tierce U.S. Army Aviation Systems Command DRSAV-EXT P.O. Box 209 St. Louis, MO 63166	AV 698-6476 (314) 268-6476

Contractor: The Boeing Company
Vertol Division
P.O. Box 16858
Philadalphia, PA 19142

Goldsworthy Engineering, Inc.
2917 Lomita Blvd.
Torrence, CA 90505

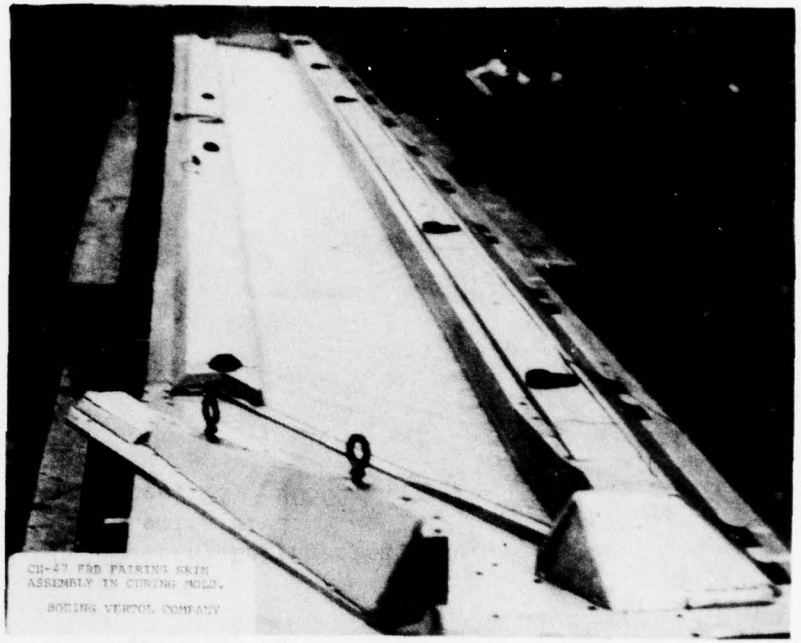
DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

MAIN ROTOR SYSTEM



ROOT END DOUBLER FOR CH-47 FAIRING SKIN

Metal template facilitates trimming.



CH-47 FAIRING SKIN IN CURING MOLD

DEMONSTRATION COMPONENTS FOR CH-47 FRB ROTOR BLADE.
Work was done at Boeing Vertol on Goldsworthy Tape Layup System

171 6050

Automated Tape Layup System - ATLAS	171 6050	Mr. Richard E. Tierce U.S. Army Aviation Systems Command DRSAV-EXT P.O. Box 209 St. Louis, MO 63166	AV 698-6476 (314) 268-6476
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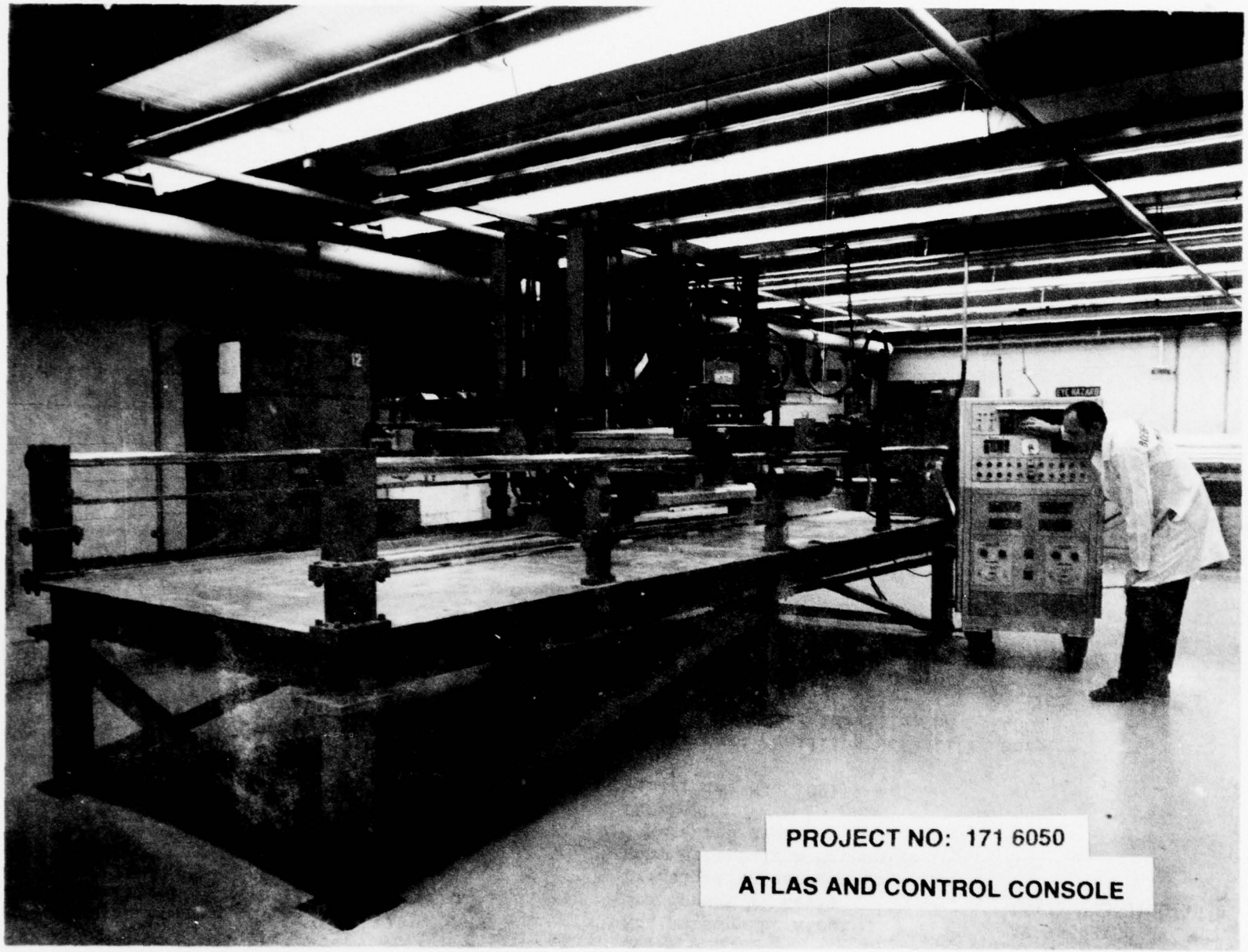
		Goldsworthy Engineering, Inc. 2917 Lomita Blvd. Torrence, CA 90505	



PROJECT NO: 171 6050

ATLAS AND CONTROL CONSOLE

XP ARMOR FABRICATION

XP Plastic Armor Applications	170, 71 6073	Mr. Anthony L. Alesi Mr. Robert W. Lewis Principal Investigators Army Materials & Mechanics Research Center DRXMR-RD Watertown, MA 02172	AV 955-3100 (617) 923-3100/3530

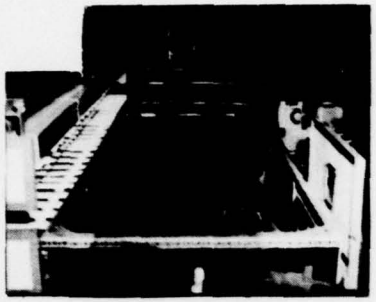
Contractor: Phillips Scientific Corp.
Bartlesville, OK 74004

Contract: DAAG46-72-C-0104

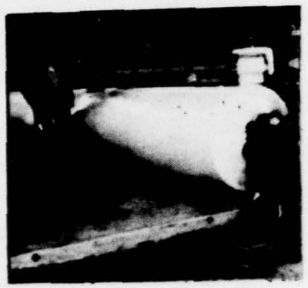
DARCOM MM&T ACCOMPLISHMENT

AIRCRAFT

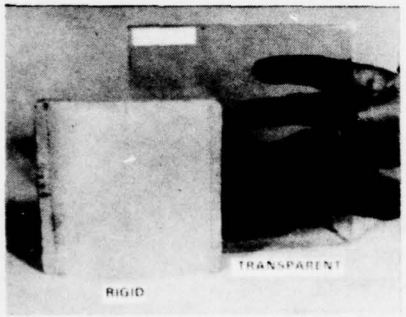
BLOWN FILM LINE



INDUCED ORIENTATION



FILM WINDER



FINAL PRODUCT

PROJECT NO: 1706073; 1716073

TITLE: PROCESSING OF XP PROPRIETARY PLASTIC MATERIALS FOR LIGHT-WEIGHT ARMOR APPLICATIONS.

COST: $320,000; $380,000

BENEFITS

Provided hot-stretching and laminating/molding technology for producing XP armor in film pad and rigid forms.

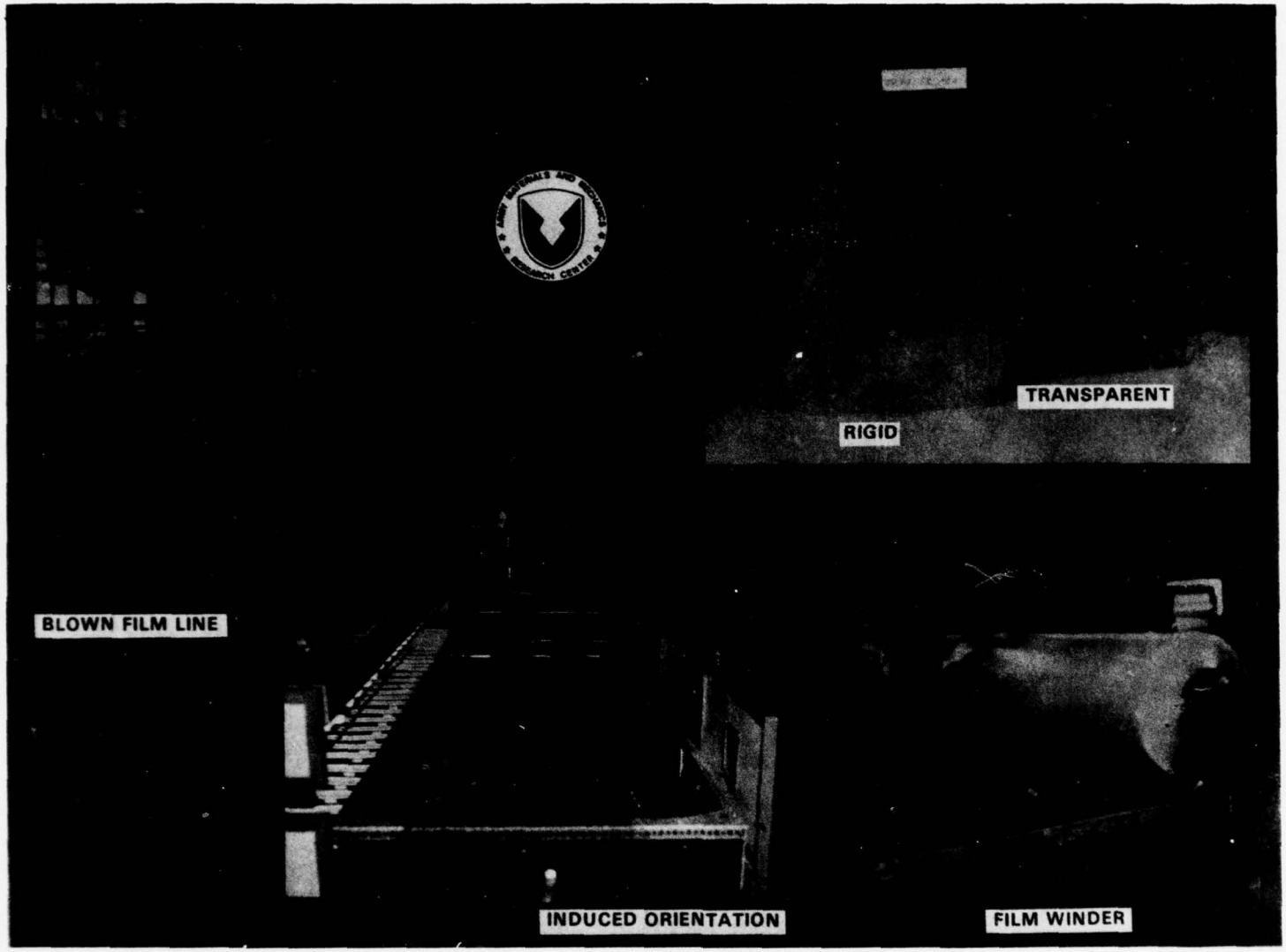
Demonstrated feasibility of molding compound curvature shapes.

Will reduce aircraft loss and mission cancellation, and will thus provide overall cost reduction.

The new armor material has been made available in large production volumes for use on aircraft windshields, vision blocks, and radar antenna shields.

XP ARMOR FABRICATION

XP Plastic Armor Applications	171 6073	Mr. Anthony L. Alesi Mr. Robert W. Lewis Principal Investigators Army Materials & Mechanics Research Center DRXMR-RD Watertown, MA 02172 Contractor: Phillips Scientific Corp. Bartlesville, OK 74004 Contract: DAAG46-72-C-0104	AV 955-3100 (617) 923-3100/3530



XP ARMOR FABRICATION

Glass-Plastic Transparent Armor	1 72 8032	Mr. G. R. Parsons, Principal Investigator Army Materials & Mechanics Research Center DRXMR-RD Watertown, MA 02172	AV 955-3514 (617) 923-3514

Contractor: Goodyear Aerospace Corp.
Litchfield Park, Arizona

Contract: DAAG46-73-C-0075

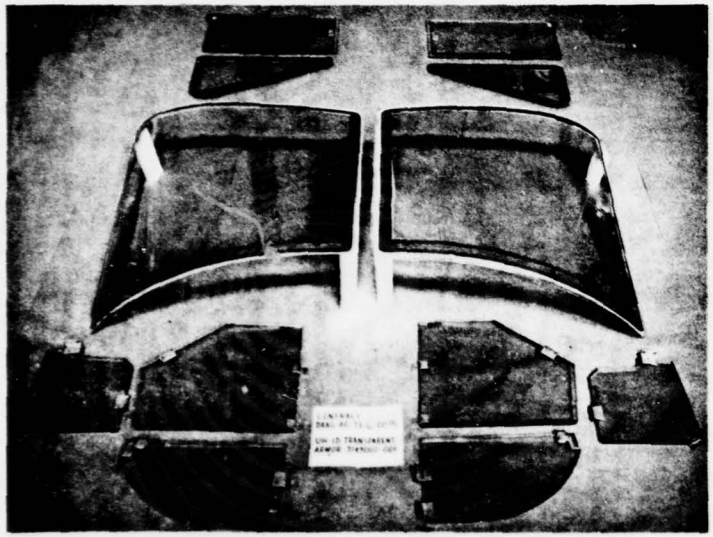
DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

AIRCRAFT

PROJECT NO: 1728032

TITLE: GLASS-PLASTIC TRANSPARENT ARMOR

COST: $315,000



FABRICATED PARTS

BENEFITS

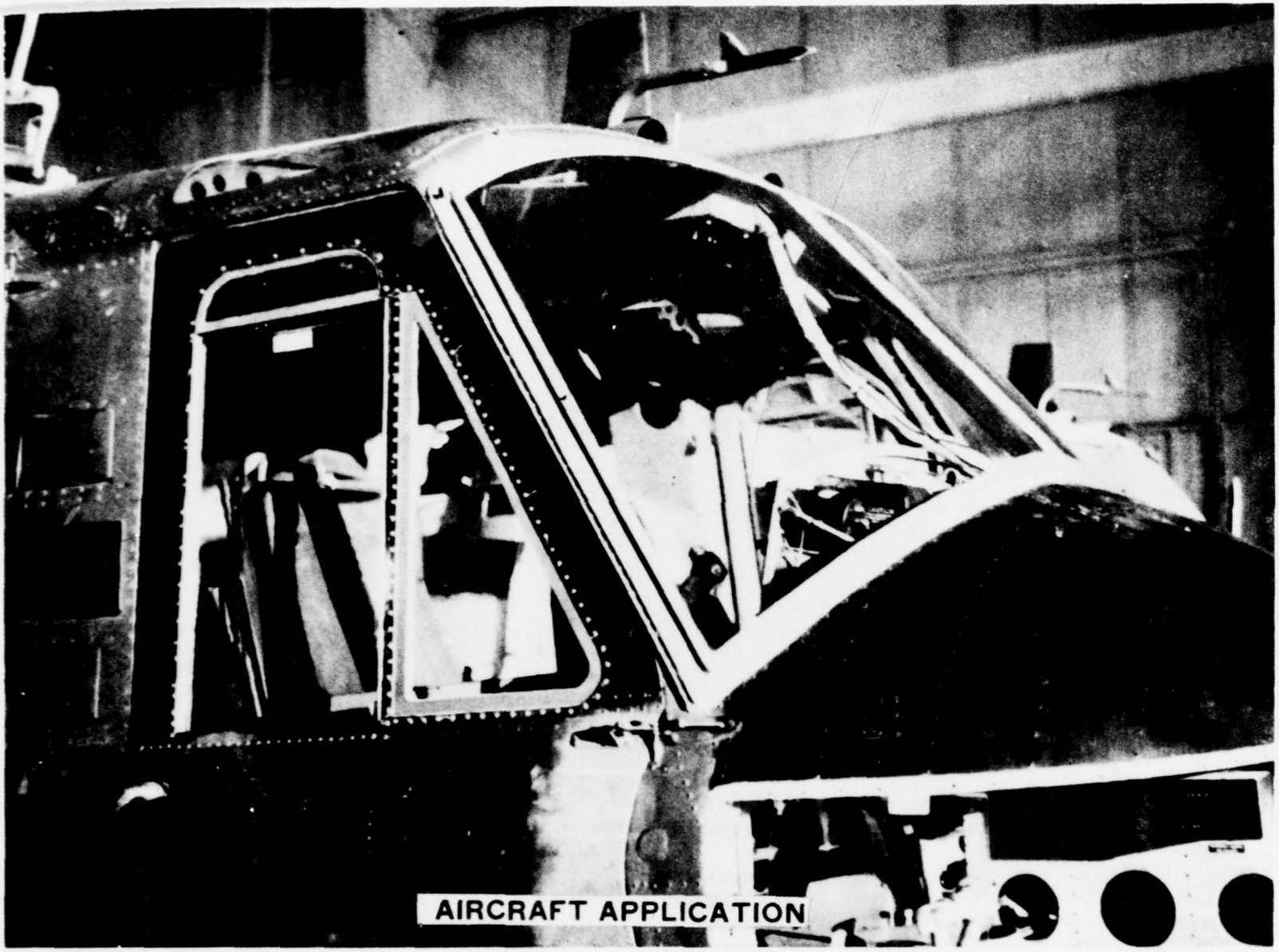
Developed MT for flat and contoured sections of glass-plastic transparent armor.

Improves survivability by protecting the flight crew and vital helicopter components.

Eliminates backside spalling upon ballistic impact.

Will be implemented in the AAH program currently under way.

Glass-Plastic Transparent Armor	172 8032	Mr. G. R. Parsons, Principal Investigator Army Materials and Mechanics Research Center ATTN: DRXMR-RD Watertown, MA 02172 Contractor: Goodyear Aerospace Corporation Contract: DAAG46-73-C-0075	AV 955-3514



AIRCRAFT APPLICATION

Gradient Furnace Processing of Ceramic Armor and Structural Ceramics	173 8042	Mr. A. Joseph DeLai Army Materials & Mechanics Research Center DRXMR-RD Watertown, MA 02172 Contractor: Arthur D. Little, Inc. Cambridge, MA 02140 Contract: DAAG46-73-C-0175	AV 955-3603 (617) 923-3603

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

CERAMIC ARMOR

20" ZONE GRADIENT FURNACE FACILITY

PROJECT NO: 173 8042

TITLE: GRADIENT FURNACE PROCESSING OF CERAMIC ARMOR AND STRUCTURAL CERAMICS

COST: $135,000

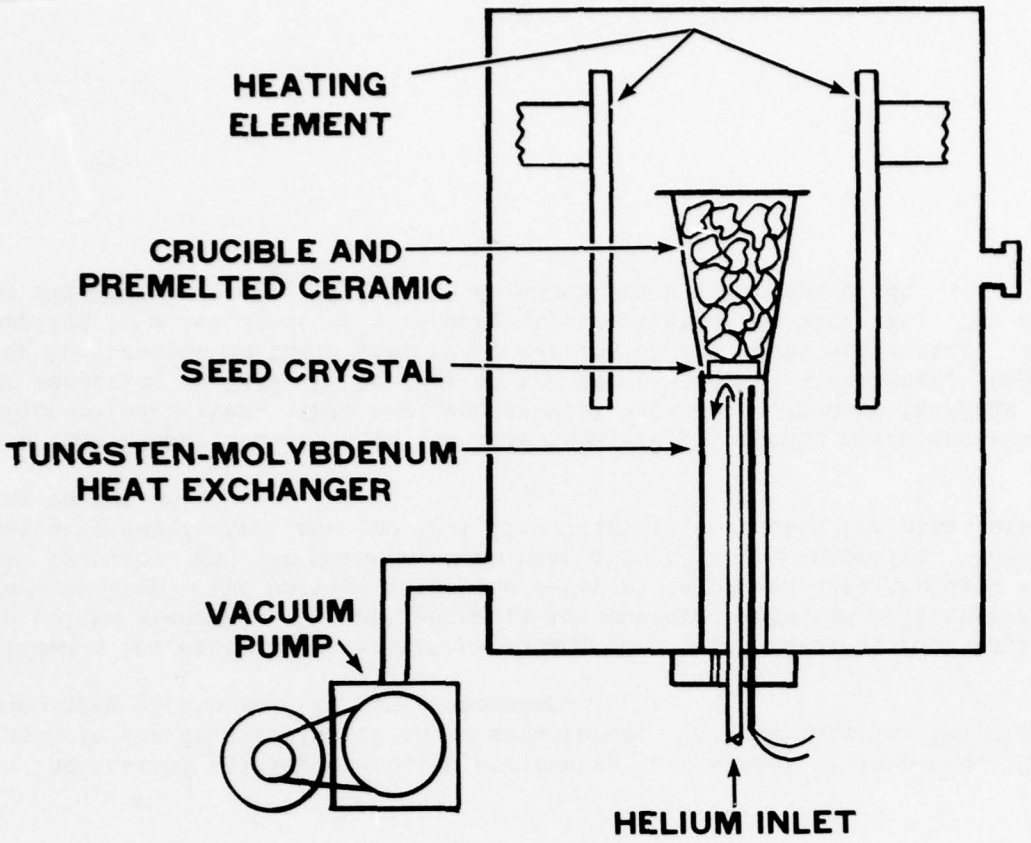
BENEFITS

AMMRC used a 20 inch zone gradient vacuum furnace to grow single crystal sapphire for transparent armor and laser windows.

A.D. Little developed an inexpensive method for machining and polishing the sapphire blocks into armor tiles, reducing machining cost from 42¢ per sq. inch to 15¢.

AMMRC built a helium recirculator and cooler and cut gas consumption 80%.

Gradient Furnace Processing of Ceramic Armor and Structural Ceramics	173 8042	Mr. A. Joseph DeLai Army Materials & Mechanics Research Center DRXMR-RD Watertown, MA 02172	AV 955-3603 (617) 923-3603
		Contractor: Arthur D. Little, Inc. Cambridge, MA 02140	
		Contract: DAAG46-73-C-0175	



PROJECT NO: 1728042; 1738042

Composite Structures from Low Cost Molds

174 8131

Mr. Bernard M. Halpin, Jr.
Army Materials & Mechanics Research Center
DRXMR-RD
Watertown, MA 02172

AV 955-3100
(617) 923-3100

Contractor: Hughes Aircraft Co.
Centinela & Teale Streets
Culver City, CA 90230

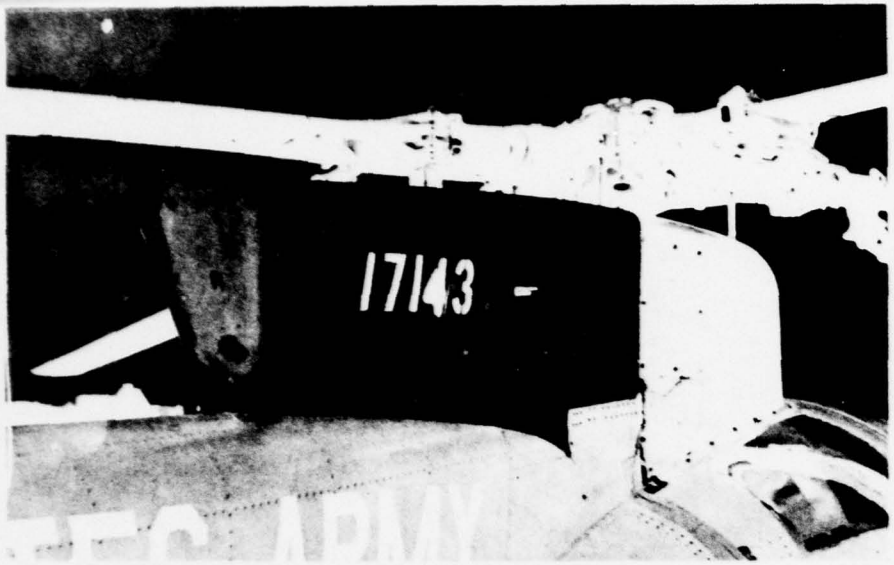
Contract: DAAG46-74-C-0100

Report: AMMRC CTR

A major factor in the cost of molding composite structures is the tooling involved. Currently, matching metal molds are used in the fabrication of these structures. The raw material for these molds is expensive, and machining of the mold is time consuming.

This project utilized a low cost die material consisting of a hard nickel surface backed up by a reinforced concrete-like material. Copper tubing is incorporated into the mold near the surface for uniform heating and cooling. The uncured composite material is placed into the die, a vacuum bag holds the material in place, and the mold is steam heated to cure the composite. Nine OH-6A engine inlet aft fairings were fabricated, and the last five fairings were used for structural evaluation and flight testing on the OH-6A.

Benefits include a significant reduction in the time required to produce molds and also in the time required to manufacture each item. This new process will be used to produce fairings on the Advanced Attack Helicopter resulting in $220,000 savings on the first production contract. Hughes Helicopter is currently using the process on their commercial version of the OH-6A helicopter. In general, the process can be applied to a multitude of secondary structure items on aircraft. The basic concept will be scaled up via MM&T project 1 77 7121 to do an entire UTTAS rotor blade.



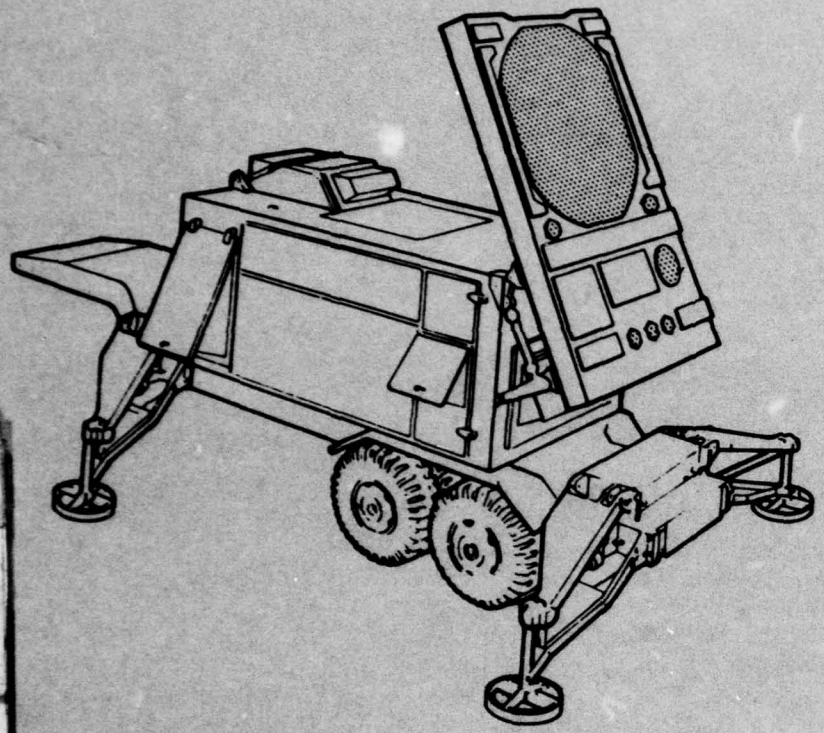
KEVLAR-49 FAIRING ON OH-6A

PROJ. NO: 1748131

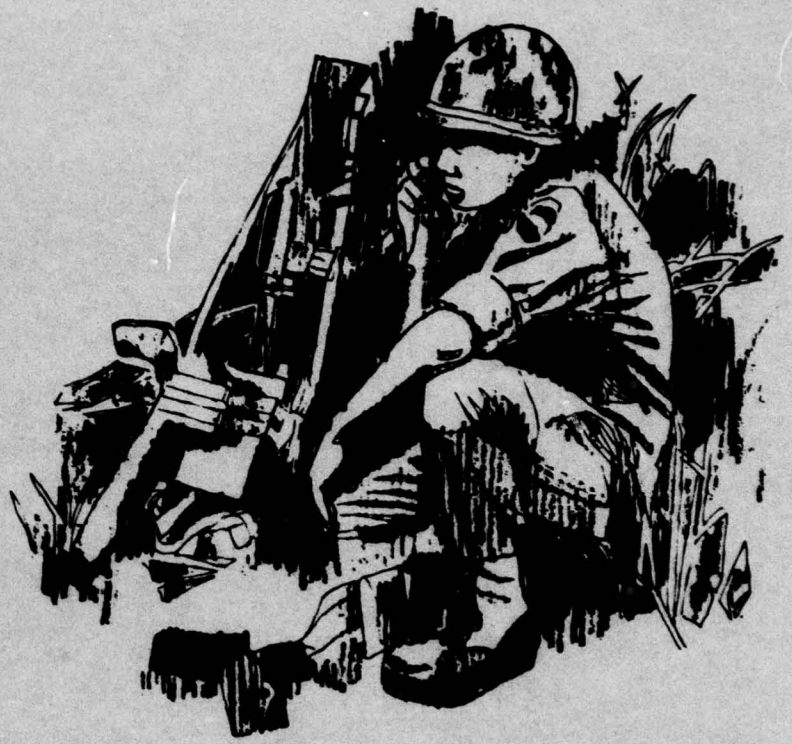
TITLE: MOLDING OF COMPOSITE STRUCTURES USING LOW COST MOLDS.

COST: $85,000

KEVLAR-49 FAIRINGS FABRICATED WITH HOT LAYUP TOOLS



ELECTRONICS R&D COMMAND
(ERADCOM)



COMMUNICATIONS R&D COMMAND
(CORADCOM)

ELECTRONICS

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Mr. Joseph Key, MMT Coordinator
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Mr. Mortin Eichel, MMT Coordinator
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Ft. Monmouth, NJ 07703
AV 992-4950
(201) 532-4950

E R A D C O M

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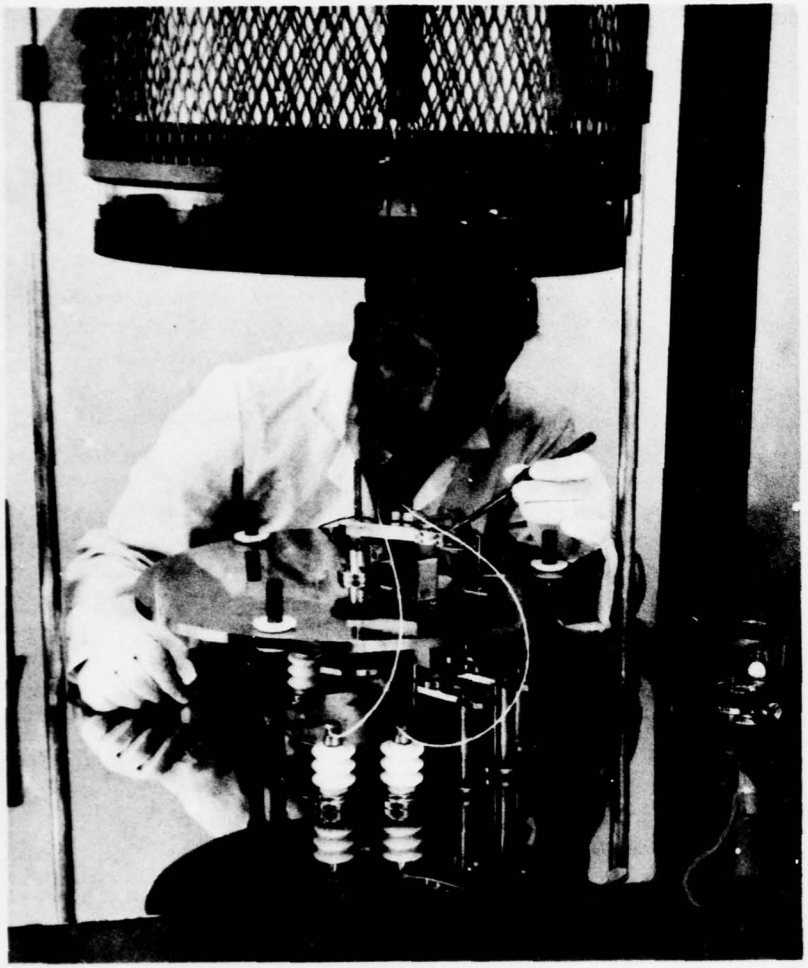
Solid State Microwave Acoustic Delay Line	271 9311	Elio Mariani U.S. Army Electronics Research and Development Command Technical Support Activity DELET-MM Ft. Monmouth, NJ 07703 Contractor: Teledyne MEC 3165 Porter Drive Palo Alto, CA 94304 Contract: DAAB05-71-C-2621	AV 995-2647 (201) 535-2593

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

DELAY LINES



Vacuum deposition station used in fabrication of thin-film metal electrodes for transducers.

VACUUM-DEPOSITION STATION

PROJECT NO: 271 9311

TITLE: SOLID STATE MICROWAVE ACOUSTIC DELAY LINE

COST: $381,000

BENEFITS

Teledyne MEC developed production line methods for making bulk wave delay lines.

They automated the vacuum deposition equipment controls for depositing thin film transducers on the alumina substrates.

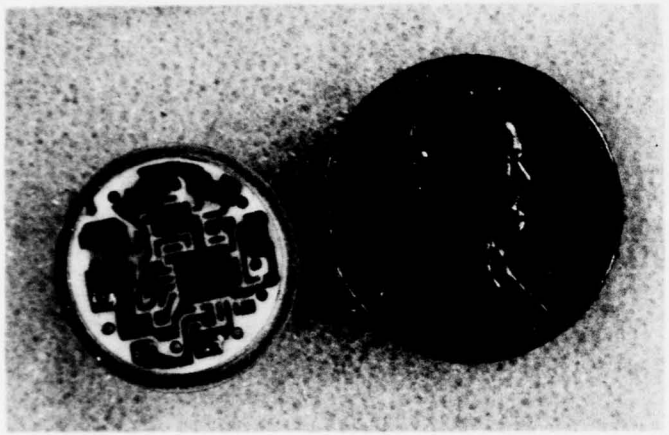
Delay lines are used in electronic fuzes such as XM750.

Price dropped from $1,575 to $200 when the firm went into production.

Precision Oscillator for Fuzes	271 9334	Mr. Gregory Melonowski Army Electronics Research and Development Command Electronic Technical Devices Labs DRSEL-TL-NM Ft. Monmouth, NJ 07703 Contractor: Sprague Electric Co. Worchester, MA Contract: DAAB05-71-C-2642	AV 995 2325 (201) 535 2325

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

FUZE CIRCUITS



THIN FILM OSCILLATOR CIRCUIT
FOR M587 FUZE

PROJECT NO: 271 9334

TITLE: PRECISION OSCILLATOR FOR FUZES

COST: $150,400

BENEFITS

Sprague Electric Co. assembled thin film sputtering equipment for laying down resistor-capacitor networks.

The firm also assembled equipment for component mounting, wire-bonding and integrated circuit into the unit, and soldering leads.

Units are used in the M587 artillery fuze, M517 nuclear projective fuze, and the 152mm behive round fuze.

Circuits withstood 25,000 G's shock.

EQUATE - Automatic Examination of Electronic Components and Systems	271 9353	Mr. John Agrios U.S. Army Electronics Research and Development Command Technical Support Activity DELET-MI Ft. Monmouth, NJ 07703 Contractor: RCA Aerospace Division Burlington, MA 01803 Contract: DAAB05-71-C-2641	AV 995-4934 (201) 535-2593

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

ELECTRONIC TESTING

PROJECT NO: 2719353

TITLE: AUTOMATIC EXAMINATION OF ELECTRONIC COMPONENTS AND SYSTEMS (EQUATE)

COST: $1,200,000

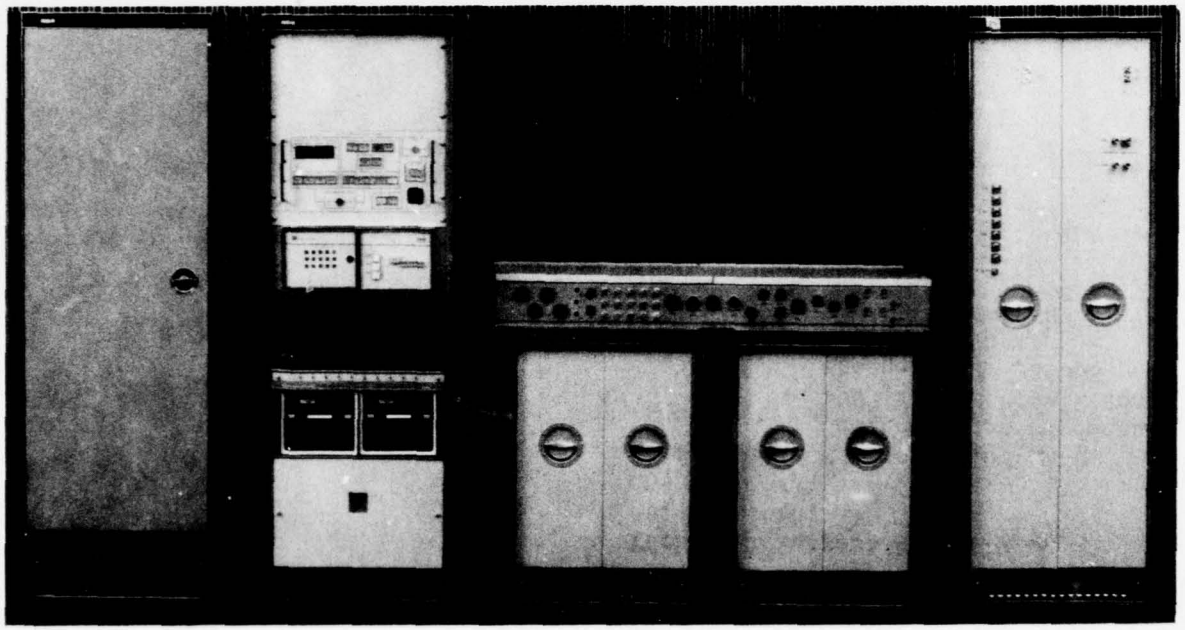
Tests a radio in 10 minutes where it formerly took 24 hours

BENEFITS

RCA developed a computerized tester for checking all types of electronic systems.

Equate systems are in use at:

- **Tobyhanna Army Depot**
- **Naval Avionics Facility**
- **Army Security Agency**
- **Boeing Aircraft Co.**
- **Army Aviation R&D Command**



EQUATE SYSTEM

PHOTO COURTESY RCA

High Power Fast Switching Silicon Controlled Rectifier	2 72 9358	Mr. Gelnovatch US Army Electronics Research & Development Command Technical Support Activity Ft. Monmouth, NJ 07703	AV 995-4883 (201) 535-4883

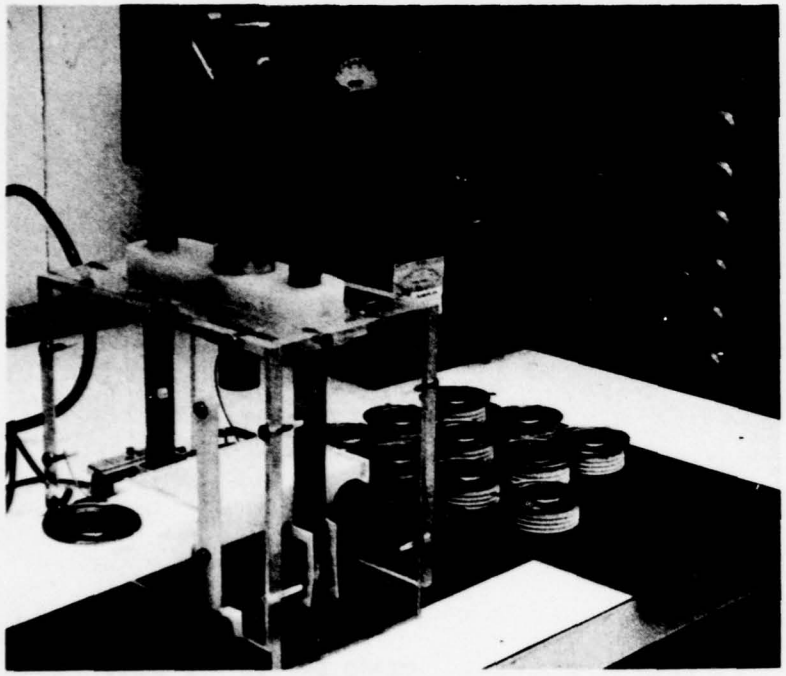
Contractor: Motorola, Inc.
Semiconductor Products Division
5005 East McDowell Road
Phoenix, AZ 85008

Contract: DAAB05-72-C-5868

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

POWER SWITCHES

SCR



TEST FIXTURE LOADER

PROJECT NO: 272 9358

TITLE: MM&T FOR HIGH POWER, FAST SWITCHING SILICON CONTROLLED RECTIFIER (SCR)

COST: $220,000

BENEFITS

Developed methods for producing power devices for switching 300 amps at 400 cycles per second.

Established diffusion temperatures, etching process, and glass passivation for high current units.

Motorola will retain a capability for volume production of these and related SCRs to meet military requirements.

Used in power inverters. Reduced unit price from $300 to $200.

MM&T for Closed Cycle Cryogenic Cooler	2 74 9423	Mr. Sheldon Kramer US Army Night Vision and Electro-Optics Laboratory DELNV-SEP Ft. Belvoir, VA 22060	AV 354-6041 (703) 664-6041

Contractor: Kinergetics Incorporated
6029 Reseda Boulevard
Tarzana, CA 91356

Contract: DAAB05-74-C-2523

Report No: 3136-7F

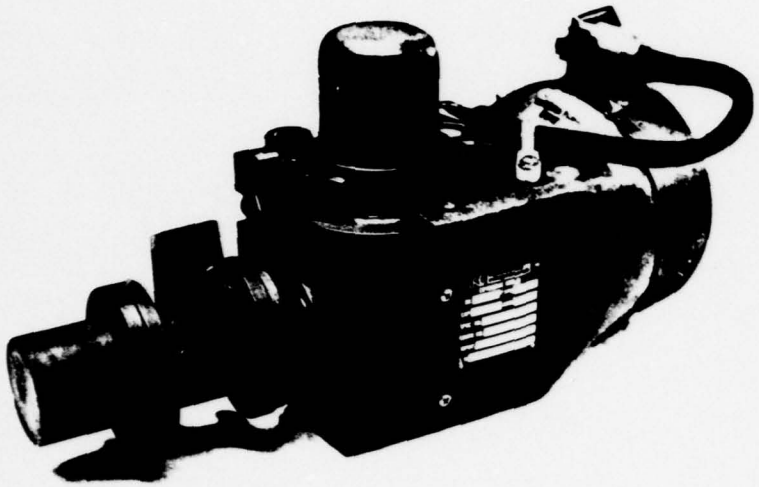
DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

NIGHT VISION

PROJECT NO: 2749423

TITLE: MM&T FOR CLOSED CYCLE CRYOGENIC COOLERS

COST:



CRYOGENIC REFRIGERATOR

BENEFITS

KINERGETICS, INC. PRODUCTION ENGINEERED SMALL REFRIGERATORS FOR CREW-SERVED NIGHT VISION EQUIPMENT.

PRODUCTION COST WAS REDUCED 50%. COST PER UNIT MAY BE $2,500 EACH IN QUANTITIES OF 1,000.

REFRIGERATION EFFICIENCY WAS DOUBLED AND IS NEAR THAT OF LABORATORY PRODUCED UNITS.

COST COULD BE REDUCED FURTHER WITH ADDITIONAL TOOLING, AND LIFE EXTENDED WITH MATERIALS IMPROVEMENTS.

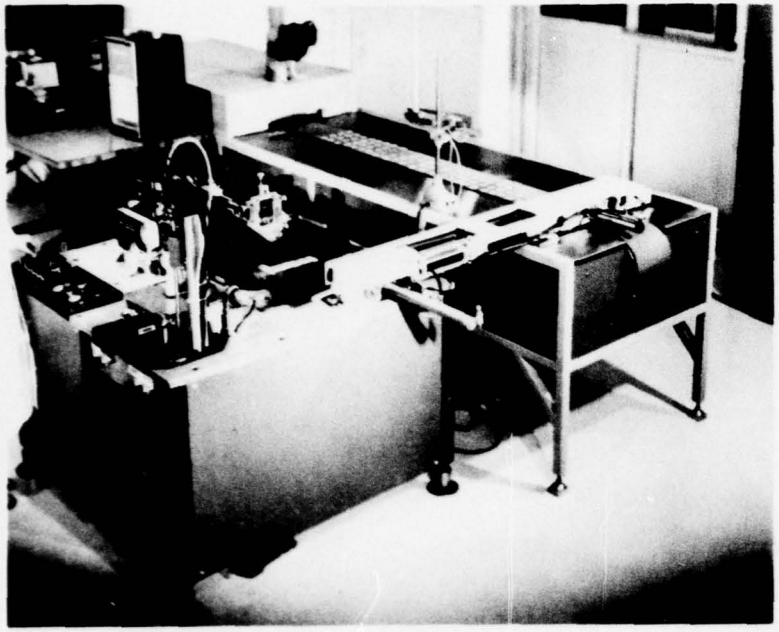
Automatic Assembly of Hybrid Circuits for Proximity Fuzes	2 74 9575	Mr. Julius Hoke Harry Diamond Labs DELHD-PP 2800 Powder Mill Road Adelphi, MD 20783	AV 290-1551

Contractor: RCA Aerospace Division
Box 588
Burlington, MA 01803

Contract: DAAB05-73-C-2039

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

HYBRID CIRCUITS



AUTOMATIC SCREEN PRINTING OF HYBRID SUBSTRATES

PROJECT NO: 2739575 2749575

TITLE: AUTOMATIC ASSEMBLY OF HYBRID CIRCUITS FOR PROXIMITY FUZES

COST: $322,000 AND $100,000

BENEFITS

RCA, Burlington, built a production line for automatic assembly of hybrid circuits for electronic fuzes.

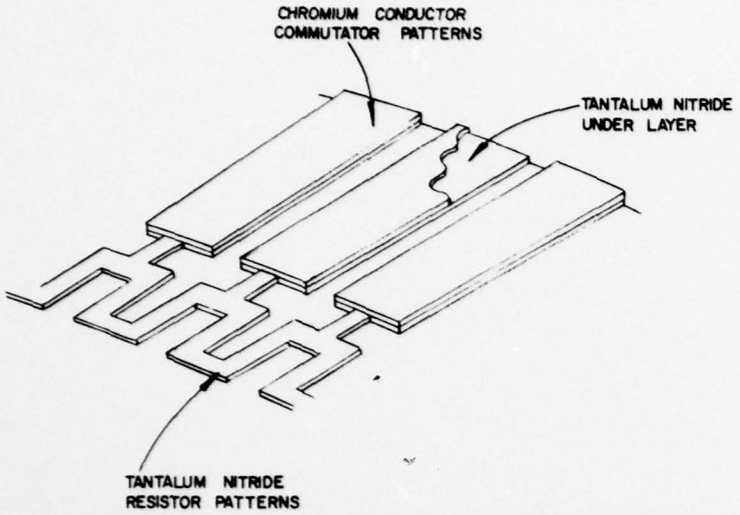
RCA expects to produce at the rate of 100,000 units per month.

Number of production workers was cut from 280 to 22 when producing 600 circuits per hour.

Thick Film Ratiometer	273 9605	Mr. Lester Kitchman Harry Diamond Laboratories DELHD 2800 Powder Mill Road Adelphi, MD 20783	AV 290 3190 (201) 535 3190
		Contractor: TRW, Inc. 401 North Broad Street Philadelphia, PA 19108	
		Contract: DAAB05-73-C-2077	

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

ELECTRONIC FUZE COMPONENTS



COMMUTATOR AND RESISTOR PATTERNS

IN-PROCESS LINEARITY TEST STATION

PROJECT NO: 273 9605

TITLE: MM&T FOR THICK FILM RATIOMETER

COST: $161,663

BENEFITS

TRW employed sputtering and photo-etching processes to form chromium conductors and tantalum nitride resistors on six-unit ceramic blanks.

A laser was used to scribe the ceramic to separate discs from the six-unit blanks.

Ratiometers are employed in electronic time fuzes for illuminating rounds and high burst shells.

Will save approximately $200,000 on first year's buy.

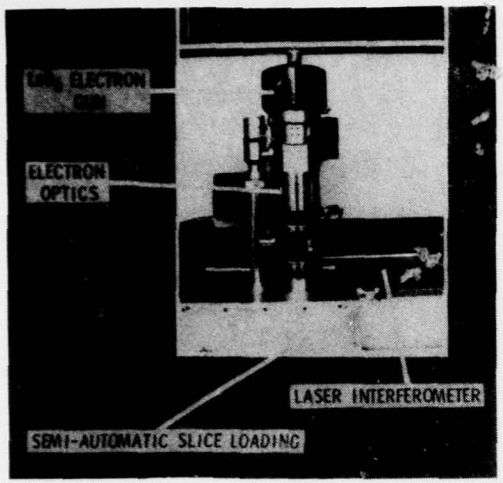
Thick Film Ratiometer	273 9605	Mr. Lester Kitchman Harry Diamond Laboratories DELHD 2800 Powder Mill Road Adelphi, MD 20783	AV 290 3190 (201) 535 3190
		Contractor: TRW, Inc. 401 North Broad Street Philadelphia, PA 19108	
		Contract: DAAB05-73-C-2077	


U.S. ARMY MATERIEL DEVELOPMENT
AND READINESS COMMAND
MANUFACTURING METHODS AND TECHNOLOGY
PRODUCTION OF THIN-FILM RATIOMETER
Harry Diamond Laboratories
Adelphi, Maryland
LOCATION OF RATIOMETER IN M732 ARTILLERY PROXIMITY FUZE
Push TO start

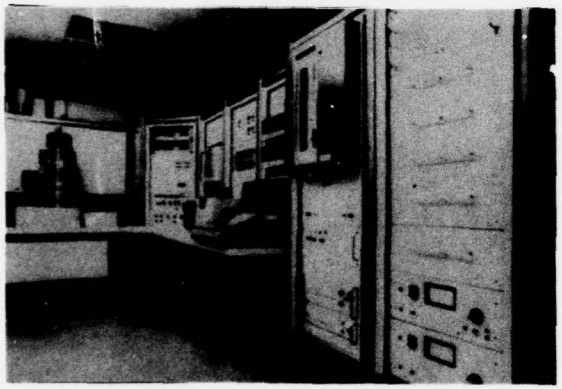
Integrated Circuit Fabrication using Electron Beam Technology	276 9631	Mr. Bill Glendinning Army Electronics Research and Development Command DELET-ID Ft. Monmouth, NJ 07703 Contractor: Texas Instruments, Inc. Dallas, TX Contract: DAAB07-76-C-8105	AV 995 4396 (201) 535-4396

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

ELECTRON BEAM WAFER PRINTER



ELECTRON BEAM MACHINE III



OVERALL SYSTEM

PROJECT NO: 2769631

TITLE: INTEGRATED CIRCUIT FABRICATION USING ELECTRON BEAM TECHNOLOGY

COST: $783,000

BENEFITS

Texas instruments, Inc., used their computer controlled Electron Beam Exposure Machine to draw circuit patterns in E-Beam resist directly on the wafer.

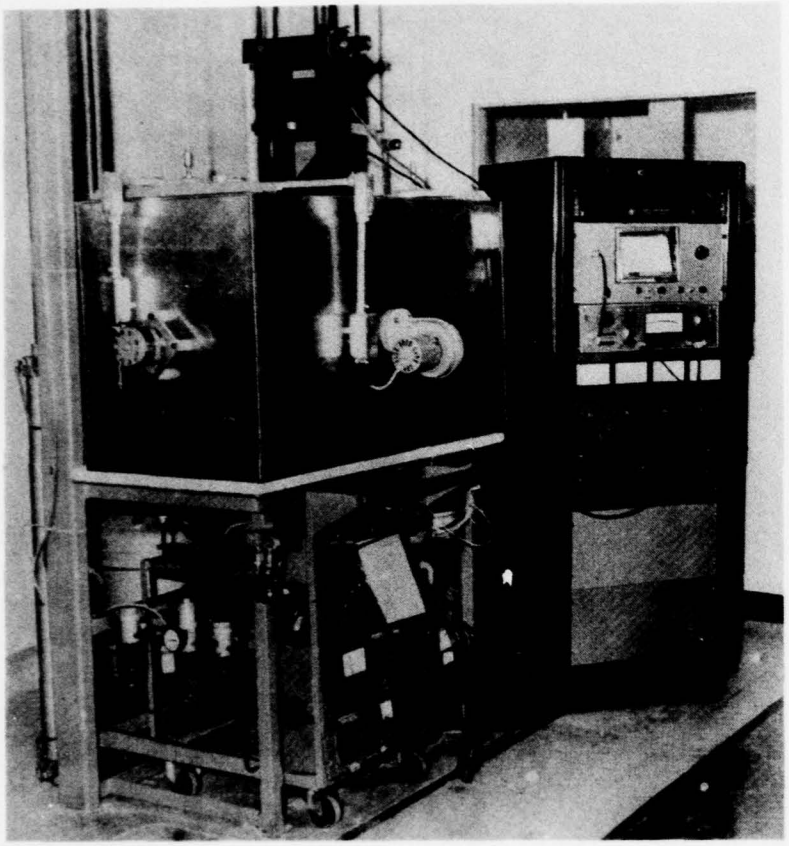
Using a series of exposure steps, TI exposed all the layers of resist for a complex 256 bit random access memory.

Writing on the wafer eliminates the need for masks and masking problems such as pinholes and registration.

Automation of Production Methods for Multi-Alkali Photocathode Processing	274 9639 A	Mr. Joe Saunders US Army Electronics Research and Development Command Technical Support Activity DELSD-D-PC Ft. Monmouth, NJ 07703	AV 995-2046 (201) 535-2046
		Contractor: ITT, Electro-optical Products Division Roanoke, VA 24019	(703) 563-0371
		Contract: DAAB05-74-C-2521	

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

NIGHT VISION



PHOTOCATHODE PROCESSING STATION

PROJECT NO: 274 9639 PART A

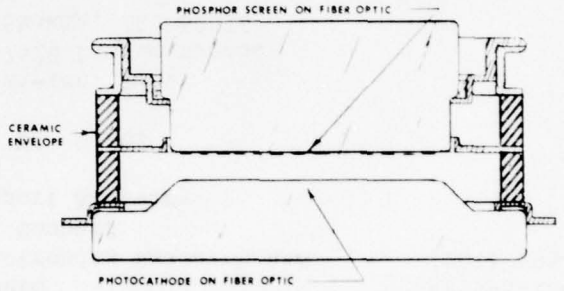
TITLE: AUTOMATION OF PRODUCTION METHODS FOR MULTI-ALKALI PHOTOCATHODE PROCESSING

COST: $713,500 $365,000 CONTRACT TO ITT

BENEFITS

ITT Electro Optics Products Division developed a computer controlled external process for applying multi-alkali to photocathodes.

All photocathodes in the batch met Army specifications. Life and performance were also improved substantially.

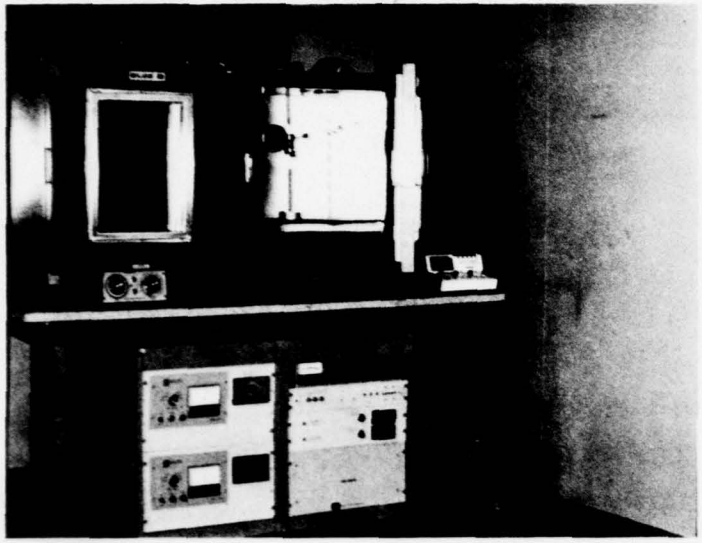


TEST DIODE CROSS-SECTION VIEW, 18 MM WAFER TUBE

Automation of Production Methods for Multi-Alkali Photocathode Processing	274 9639B	Mr. Joe Saunders U.S. Army Electronics Research and Development Command Technical Support Activity DELSD-D-PC Ft. Monmouth, NJ 07703 Contractor: Ni-Tec. Inc. 7426 Linder Avenue Skokie, IL 60076 Contract: DAAB05-74-C-2520	AV 995-2046 (201) 535-2046

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

NIGHT VISION



PHOTOCATHODE PROCESSING STATION

PROJECT NO: 274 9639 PART B

TITLE: AUTOMATION OF PRODUCTION METHODS FOR MULTI-ALKALI PHOTOCATHODE PROCESSING

COST: $713,500 $248,500 CONTRACT TO NI-TEC

BENEFITS

NI-TEC developed a computer-controlled processing station for internal application of sodium, potassium and caesium to photocathodes for night vision equipment.

NI-TEC wrote a computer program that resulted in improved photocathode yield, sensitivity and uniformity.

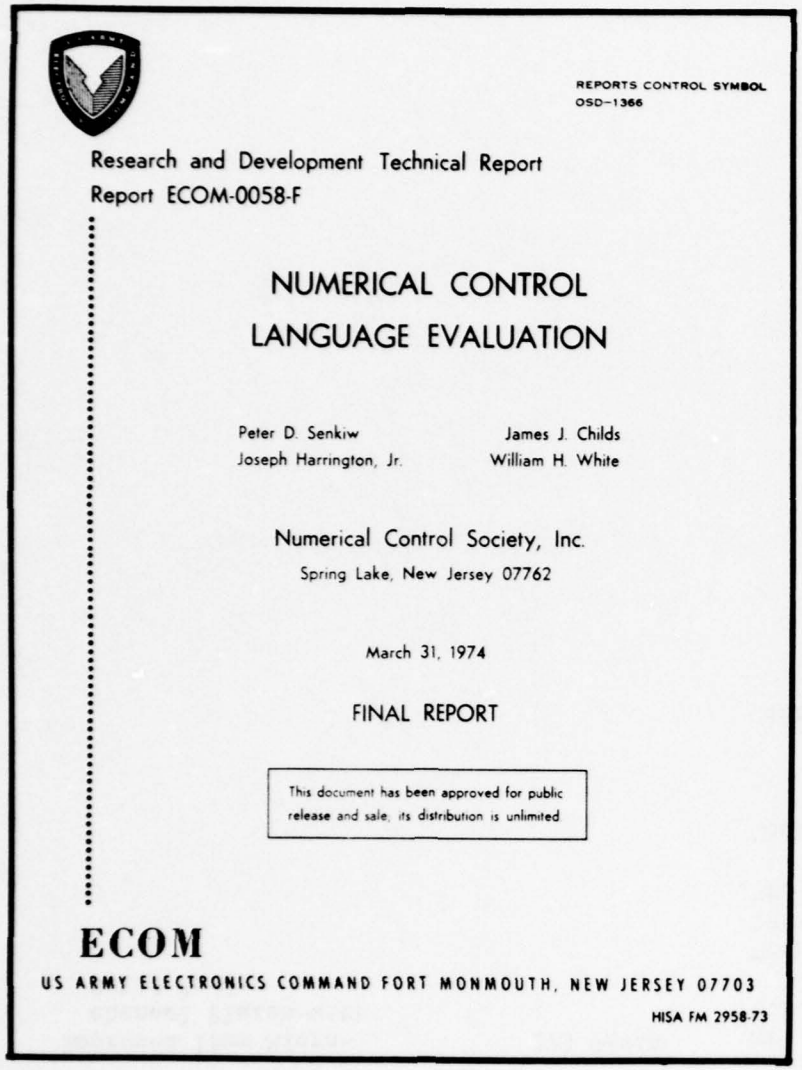
Numerical Control Language Study	272 9679	Mr. David Ruppe US Army Communications Research and Development Command DRDCO-TCS-CT	AV 995-4778 (201) 544-4778

The contractor examined APT, ADAPT, UNIAPT, NUFORM, SPLIT, ACTION and COMPACT-II for milling and drilling of representative parts.

The report was distributed widely and summarized in various technical magazine such as the October 28, 1974 issue of Iron Age.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

NUMERICAL CONTROL



REPORTS CONTROL SYMBOL
OSD-1366

Research and Development Technical Report
Report ECOM-0058-F

NUMERICAL CONTROL
LANGUAGE EVALUATION

Peter D. Senkiw — James J. Childs
Joseph Harrington, Jr. — William H. White

Numerical Control Society, Inc.
Spring Lake, New Jersey 07762

March 31, 1974

FINAL REPORT

This document has been approved for public release and sale; its distribution is unlimited

ECOM
US ARMY ELECTRONICS COMMAND FORT MONMOUTH, NEW JERSEY 07703

HISA FM 2958-73

PROJECT NO: 272 9679

TITLE: NUMERICAL CONTROL LANGUAGE STUDY

COST: $225,000

BENEFITS

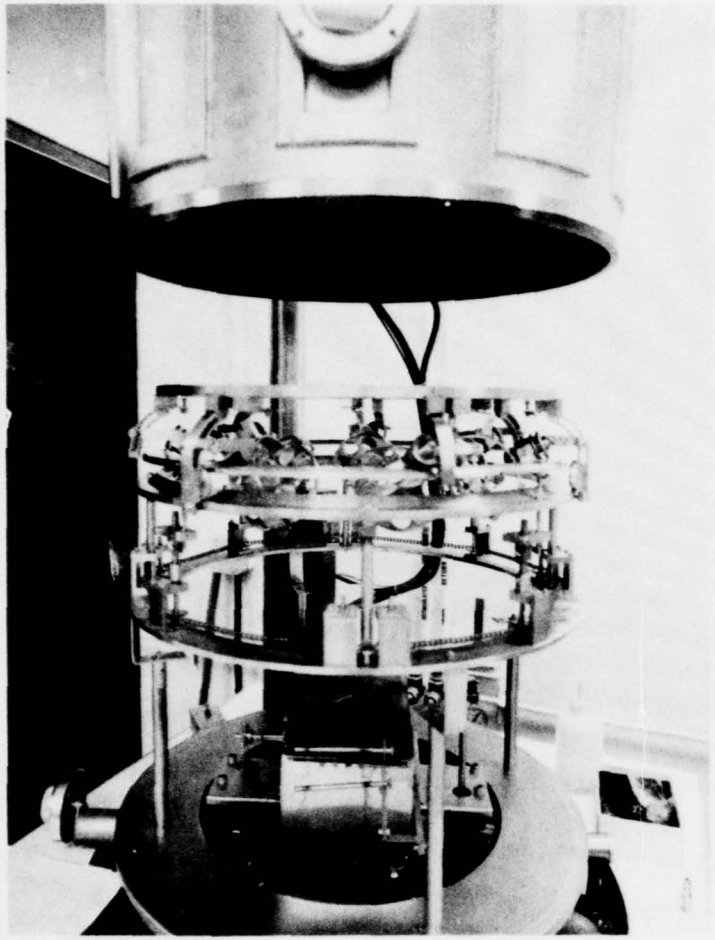
This report, which objectively compared seven major NC programming languages, will allow the language purchase to evaluate and obtain that language which best suits his requirements.

The prime contractor, the Numerical Control Society, sold over 1000 copies of this report to private industry.Can be obtained from NC Society, RCS# OSD-1366.

Improved 18mm Micro-channel Plates with Solid Border	273 9694A	Mr. Joe Saunders U.S. Army Electronics Research and Development Command Technical Support Activity DELSD-D-PC Ft. Monmouth, NJ 07703 Contractor: Varian Associates 611 Hansen Way Palo Alto, CA 94304 Contract: DAAB05-73-C-2079	AV 995-2046 (201) 535-2046

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

NIGHT VISION COMPONENTS



COATING SYSTEM IN USE AT VARIAN

PROJECT NO: 273 9694 A

TITLE: MM&T FOR IMPROVED 18MM MICRO-CHANNEL PLATES WITH SOLID BORDER.

COST: $393,000

BENEFITS

Varian Associates automated equipment for chemical processing, electrode evaporation, and electrical testing of microchannel plates.

A carousel system permits evaporation of a metal nichrome coating onto the border of a batch of wafer-like microchannel plates, 56 at a time.

Varian also developed a computerized test station for automatically checking microchannel plates under power.

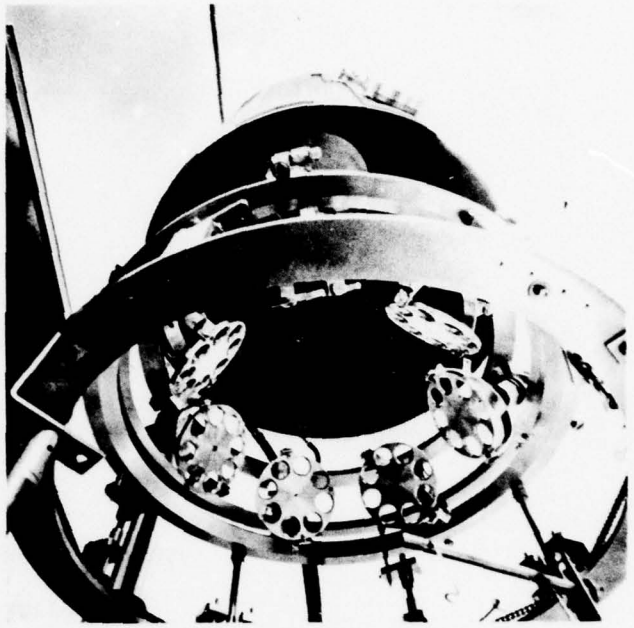
MCPS are used in PVS-5 night vision goggles.

Improved 18mm Microchannel Plates with Solid Border	273 9694B	Mr. Joe Saunders U.S. Army Electronics Research and Development Command Technical Support Activity DELSD-D-PC Ft. Monmouth, NJ 07703 Contractor: Varian Associates 611 Hansen Way Palo Alto, CA 94304 Contract: DAAB05-73-C-2079	AV 995-2046 (201) 535-2046

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROJECT NO: 273 9694 B **MM&T FOR IMPROVED 18MM MICROCHANNEL PLATES WITH SOLID BORDER.**

VARIAN 3135 VACUUM COATING SYSTEM



FLIP-OVER MECHANISM USED INSIDE VACUUM CHAMBER

Equipment was developed at Varian Associates and is used to produce MCPS for night vision goggles.

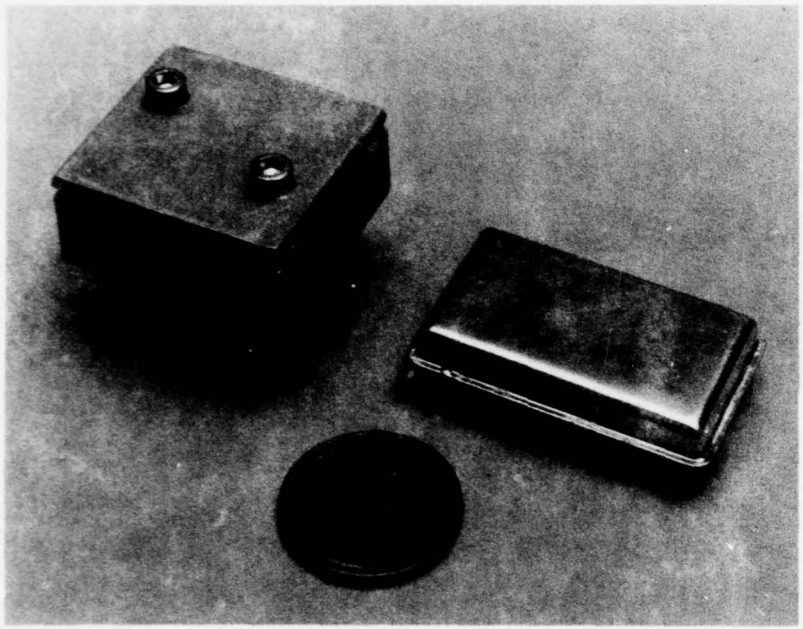
Complex Geometry Photo-lithographic Techniques	275 9739	Mr. Elio Mariani US Army Electronic Research and Development Command Electronic Technical Devices Labs DRSEL-TL-NM Ft. Monmouth, NJ 07703	AV 544 2647 (201) 535 2647

Contractor: Hughes Aircraft Co.
Fullerton, CA

Contract: DAAB07-75-C-0044

The "lift-off" photolithographic method using extremely thin flexible glass masks has been used successfully in the lab for the filter types of this project. This technique was adapted to a production environment.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT
SURFACE WAVE ACOUSTIC DEVICES



MACHINED PACKAGE
FOR TEST -- $107

SEMICONDUCTOR FLAT PACK
WITH SAW DEVICE -- $10

PROJECT NO: 2759739

TITLE: MM&T COMPLEX GEOMETRY PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE (SAW) DEVICES

COST: $250,000

BENEFITS

HUGHES ELECTRONIC DEVICES CO APPLIED ADVANCED PHOTOLITHOGRAPHIC PROCESSES TO BUILD SURFACE WAVE ACOUSTIC DEVICES.

ALSO BUILT BAND PASS FILTERS, PHASE CODED FILTERS, AND PULSE COMPRESSION FILTERS.

USED IN REMBASS, REMOTELY MONITORED BATTLE AREA SENSOR SYSTEM, AND MICRONAVIGATIONAL POSITION LOCATION SYSTEM.

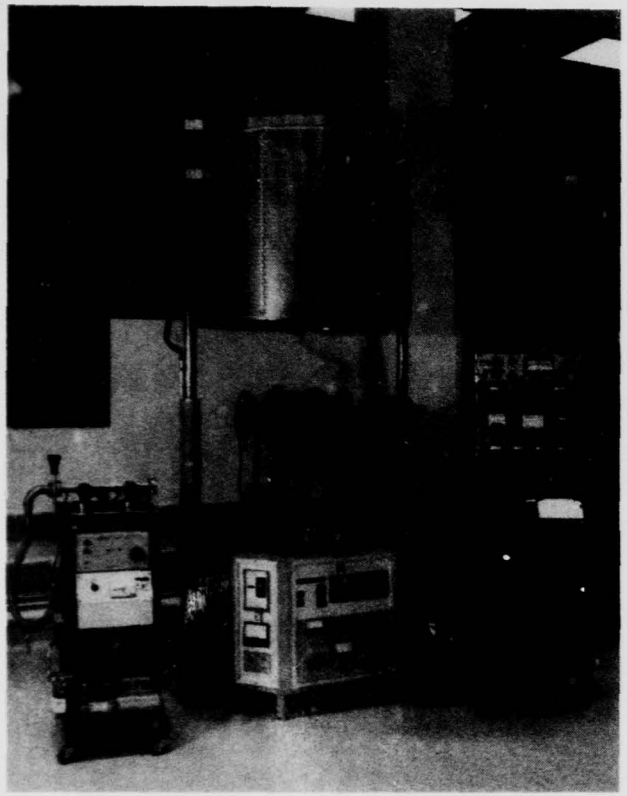
Fabrication of 18mm Wafer Image Tube by Batch Processing	274 9750	Mr. Joe Saunders U.S. Army Electronics Research and Development Command Technical Support Activity DELSD-D-PC Ft. Monmouth, NJ 07703	AV 995-2046 (201) 535-2046

Contractor: Litton Industries, Electron Tube Division
960 Industrial Road
San Carlos, CA 94070

Contract: DAAB07-74-C-0370

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

NIGHT VISION



5-PORT COMPUTER-CONTROLLED WAFER IMAGE TUBE PROCESSOR VAPOR DEPOSITS ANTIMONY, POTASSIUM, SODIUM AND CESIUM.

Photo courtesy Litton Electron Tube Div.

PROJECT NO: 274 9750

TITLE: FABRICATION OF 18MM WAFER IMAGE TUBE BY BATCH PROCESSING TECHNIQUES

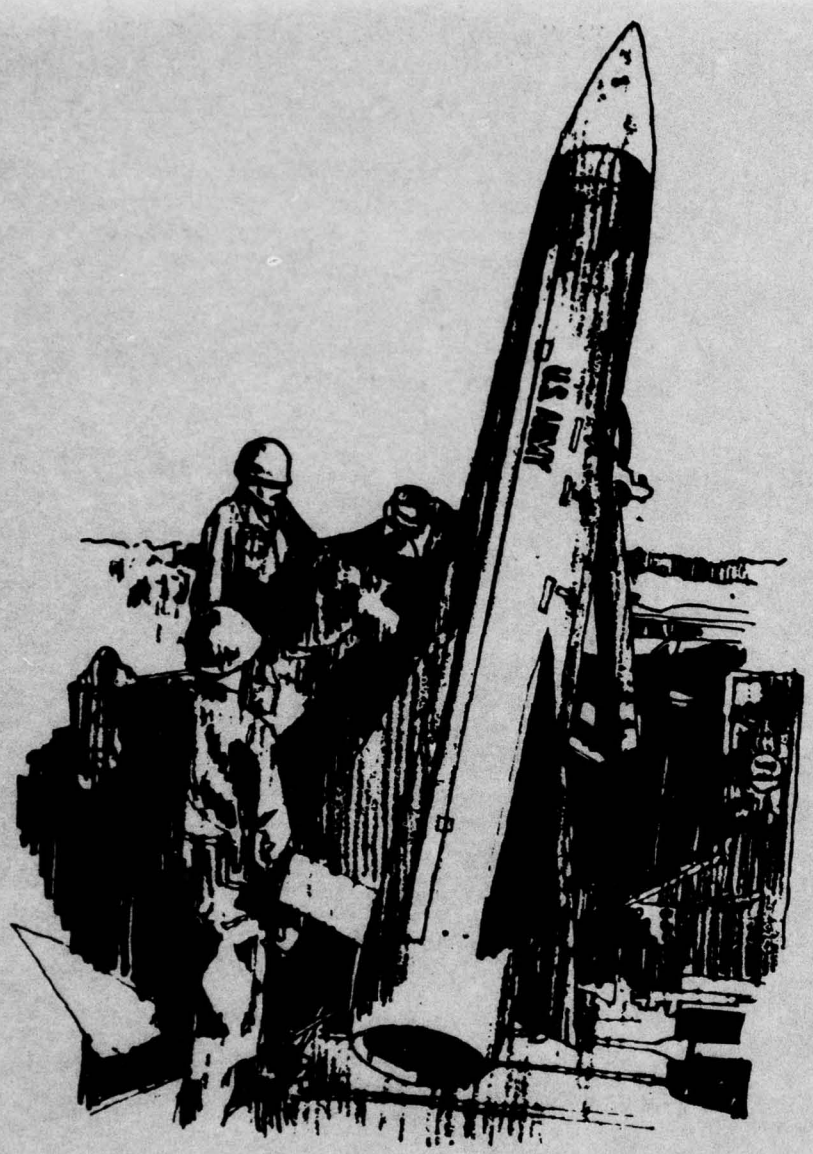
COST: $771,500

BENEFITS

Litton electron tube div. demonstrated the effectiveness of batch processing over single tube processing.

Litton developed a computer-controlled 5-port processor with MMET funds and then built 15 similar machines for its volume production of 18mm wafer image tubes for night vision goggles.

Improved cathode sensitivity and uniformity. Improved yield from 35% to 60%, and reduced cost accordingly. Established double tube sealing techniques for longer tube life.



MIRADCOM

MM&T Representatives	Mr. Willie Patterson US Army Missile Research and Development Command DRDMI-EAT Redstone Arsenal, AL 35809	AV 746-3461 (205) 876-3461
	Mr. Richard Kotler US Army Missile Research and Development Command DRDMI-EAT Redstone Arsenal, AL 35809	AV 746-2065 (205) 876-2065
	Mr. Victor Ruwe US Army Missile Research and Development Command DRDMI-EAA Redstone Arsenal, AL 35809	AV 746-3685 (205) 876 3685
	Mr. Douglas J. Saunders US Army Missile Research and Development Command DRDMI-EAT Redstone Arsenal, AL 35809	AV 746-3321 (205) 876-3321

MISSILE SUPPORT

Army relies completely on American industry for its missile production requirements. There is no civilian market for missile components so Army is forced to support the industry and encourage it to maintain and upgrade its production capability. Typical of their efforts are the following:

MIRADCOM

INDEX

Production of Plastic Molded Quadrant Missile Airframe	370 3012	Mr. Edward Vershot U.S. Army Missile Research and Development Command DRDMI-EAT Restone Arsenal, AL 35809	AV 746-7472 (205) 876-7472

A rocket airframe designed to demonstrate the structural integrity of molded plastic construction is checked out by an Army Missile Research and Development Command flight test engineer. The airframe was made for glass reinforced polyester resin and supplied under contract by Hughes Aircraft Co.

The test vehicle was later successfully fired about two miles at the Redstone Arsenal range. Rocket is 56 inches long and 6.5 inches in diameter and was powered by a modified Falcon missile solid-propellant motor.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

MISSILE AIRFRAME

PROJECT NO: 3703012

TITLE: MM&T FOR PRODUCTION OF PLASTIC MOLDED QUADRANT MISSILE AIRFRAME.

COST: $180,000

Photo courtesy Aviation Week & Space Technology

PLASTIC COMPOSITE MISSILE AIRFRAME

BENEFITS

DEVELOPED METHODS FOR MANUFACTURING A PLASTIC COMPOSITE MISSILE BODY.

COST IS ONLY $34 PER BODY IN A QUANTITY BUY (20,000 UNITS).

USED LOWEST COST AND LOWEST STRENGTH MATERIAL THAT WOULD MEET THE REQUIREMENTS.

TESTED SATISFACTORILY WITH A FALCON ROCKET MOTOR.

Processing Procedures for Adjacent and Intersecting Welds on Missile Components

374 3035

Mr. Donald C. Buffum
Army Materials and Mechanics Research Center
DRXMR-
Watertown, MA 02172

AV 955-3233

RESULTS:

Report No. AMMRC TR 76-42
AD No. A034169

From the work performed on the project the following conclusions were drawn:

1. In welding high-strength steel alloys in relatively thin cross sections it is mandatory that welding procedures be determined and maintained for producing sound welds.

2. Excessive buildup of weldments will not necessarily improve the strength of the joint.

3. Minor variations in electrode configuration, wire feeding geometry, joint preparation and fixturing of the joint to be welded can have a large effect on the soundness of the welded joint.

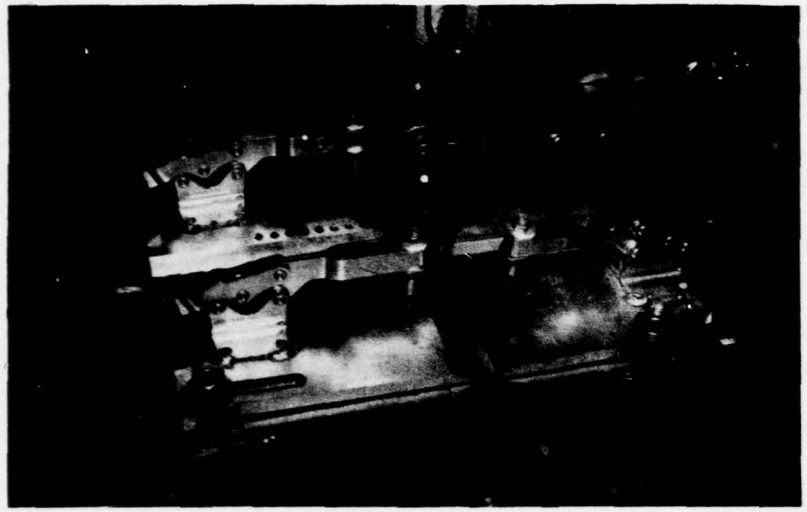
4. Manual repair of lack of penetration faults in intersecting welds is not a feasible solution.

5. Minor changes in welding variables of voltage, amperage, travel speed, and wire feeding rate did not affect the mechanical properties of the weldment.

6. There are no interrelated effects between parallel welds down to 1/2 inch spacing between weldments.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

MISSILE BODY WELDING



GTA WELDING SET-UP FOR
PARALLEL AND INTERSECTING WELDS

PROJECT NO: 374 3035

TITLE: PROCEDURES FOR ADJACENT AND INTERSECTING WELDS ON MISSILE COMPONENTS

COST: $87,000

BENEFITS

Developed a holding set-up for welding thin plates at four intersecting edges.

Demonstrated that welding parameters (electrode shape, wire feed, joint preparation and fixturing) have a large effect on joint soundness.

Showed that excessive buildup of the weld does not improve joint strength.

Minor changes in welder voltage, current, speed and wire feed rate do not affect the properties of the weld.

REPORTS ARE AVAILABLE FROM DDC; AD NO. A034169

Processing of Large Thin Wall Ceramic Shapes	374 3037	Mr. George M. Harris Army Materials and Mechanics Research Center DRXMR Watertown, MA 02172	AV 955-3258 (617) 923-3258
		Mr. Douglas Saunders Army Missile Research and Development Command DRDMI-EAT Redstone Arsenal, AL 35809	AV 746-3321 (205) 876-3321

Direct technological benefits can be summarized as follows:

a. A simple and rapid technique for the fabrication of large thin wall fused silica radome shapes has been completely standardized and specifications set forth.

b. Impregnation techniques to densify and to strengthen low to medium density large fuzed silcia radome shapes have been completely standardized.

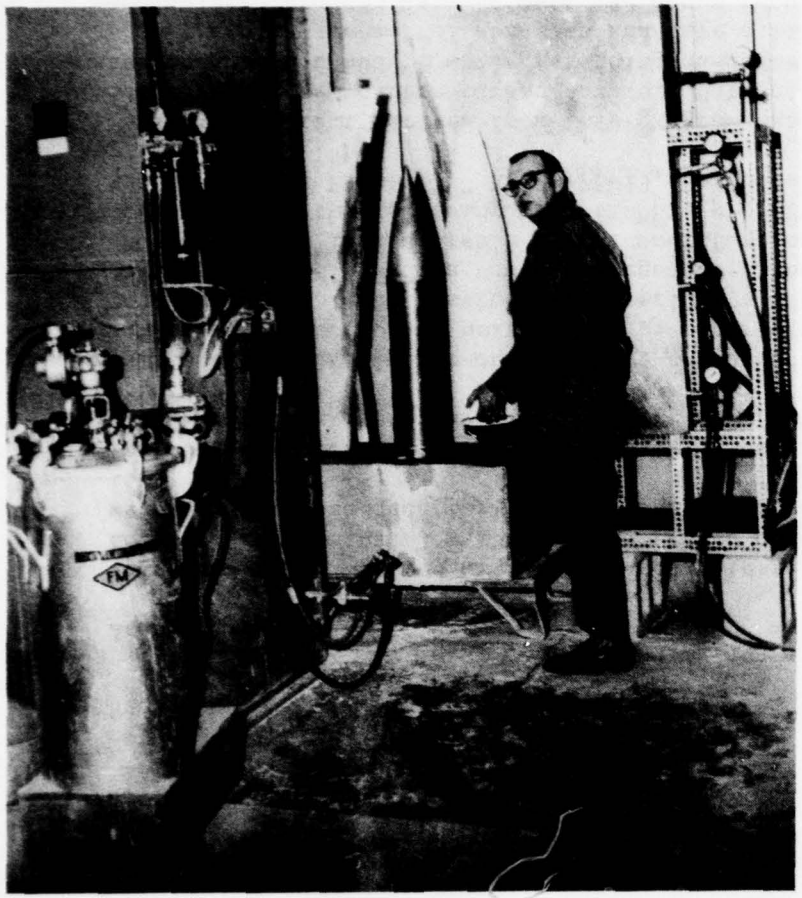
c. The slip-spraying of large fused silica radome shapes is accomplished using readily available commercial raw materials and equipment.

d. The slip-spraying process employs a machined mandrel onto which the slip is sprayed and the internal dimensions and surface finish are almost completely defined--only finish machining is required after firing.

e. The use of a binder in the slip imparts excellent green strength to the radome and after all impregnation and binder-cure firings the radome structure has sufficient strength to be machined on its exterior surface, a much less costly operation than machining after final firing which would require diamond tooling.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

RADOMES



SPRAYED SILICA RADOME AND
SLIP-SPRAYING EQUIPMENT

PROJECT NO: 373 3037, 374 3037

TITLE: PROCESSING OF LARGE THIN WALL CERAMIC SHAPES

COST: $165,000 AND $215,000

BENEFITS

AMMRC developed a new slip-spraying process for forming silica radomes over a precision mandrel.

Unfired radomes can be rough machined in the green state, reducing finishing time 20%, a $320 savings.

An inorganic silica binder gives excellent green strength.

A polished mandrel eliminates inside machining.

Equipment, tooling & material specs are now available, as is a 16mm color film illustrating the process.

High Temperature Solid Propellant Nozzles	374 3044	Mr. William Crownover U.S. Army Missile Research and Development Command DRDMI Redstone Arsenal, AL 35809	AV 746-5821 (205) 876-5821

Contractor: Hercules, Inc.
P.O. Box 210
Cumberland, MD 21502

Contract No: DAAH01-73-C-0383

Accomplishment:

This project culminated with a full scale test firing using a resin densified carbon-carbon composite nozzle. This material was selected because of its low cost-one piece potential, high strength to weight ratio, and acceptable performance in a severe motor environment.

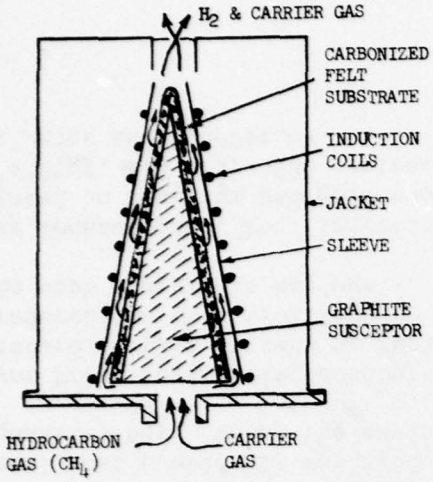
The work was documented in the following report: "Study of Production Methods for High Temperature Solid Propellant Motor Nozzles", RK-CR-74-5, Hercules Inc., 1 March 1974.

Full scale motor firings demonstrated the structural advantages of the one piece, rosette layup, carbon-carbon composite nozzles for high performance motors. MIRADCOM then examined alternate candidate one-piece construction materials systems. These systems were a vapor consolidated carbon particle composite and a vapor impregnated carbon fiber composite. These components were fabricated and test fired in a suitable high temperature environment. This portion of the program was documented in the following report: "Study of Production Methods for High Temperature Solid Propellant Motor Nozzles, Phase II," RK-CR-76-13, Hercules Inc., December 1975.

The major benefit derived from this program was the successful production demonstration of a full scale one piece, carbon-carbon nozzle. Current requirements call for nozzles which must withstand temperatures of 6000^{o}F while retaining adequate strength, be resistant to thermal and mechanical shock, resist mechanical abrasion and have a high strength to weight ratio. This project has accumulated process data to meet the above requirements.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

NOZZLES



SCHEMATIC OF CVD DENSIFICATION TECHNIQUE

AFT VIEW OF C-C NOZZLE

PROJECT NO: 373 3044, 374 3044

TITLE: PRODUCTION METHODS FOR HIGH TEMPERATURE SOLID PROPELLANT MOTOR NOZZLES

COST: $131,000, $150,000

BENEFITS

Demonstrated production of a full scale one piece carbon-carbon nozzle.

Nozzle will withstand 6000°F, resist thermal and mechanical shock, and has a high strength to weight ratio.

Provided densification technology (TGCVD) needed to produce adequate carbon - carbon materials.

Eliminated multi-component subassembly currently required for high performance rocket motors.

Manufacturing Process for Laser Terminal Seekers	374 3096	Mr. Charles P. Bailey Army Missile Research and Development Command DRDMI Advanced Sensors Redstone Arsenal, AL 35809	AV 746-2625 (205) 876-2625

BENEFITS:

As a result of this MM&T effort, several changes have been made to the manufacturing methods used for producing spinning mass seekers. The number of industive coils in the baseline seeker gyro was reduced from 16 to 7 using gimbal pots for gyro position location; the coil form was reduced from 5 parts to a one-piece injection molded part, which is used as the winding form for the precession coil. New interference filter mass production techniques have been identified; the gyro-drive circuitry has been modified for the baseline seeker utilizing two saturable reactors instead of four, thus reducing gyro inefficiency. These changes can be applied to the generic class of spinning mass seekers.

The time savings resulting from the changes listed result in substantial savings. For instance, previous designs used 4 matched saturable reactors which cost approximately $120 per set. The new two saturable reactor scheme costs approximately $10 per pair in the same quantity buy. The seeker head coil cost previously was $250 and greater. The MM&T head coil costs approximately $45 in the same quantity buy. Thus, the savings are considerable.

Teledyne Brown Engineering subcontracted to Diverse Technologies, Inc. to injection mold high temperature acrylic mirrors to replace ground glass mirrors in the Hellfire fire-and-forget missile. This reduced the cost from $650 to $6.50. Molded plastic mirrors may also be applied to the Copperhead missile with comparable savings.

Diverse Technologies, Inc. injection molded 3.75 inch diameter aspheric structures and then Dyn-Optics evaporated on aluminum and gold coatings. The process was also briefed to the Air Force MAVERIC office. MICOM's Proj. 374 (75) 3096 contracted to Teledyne Brown who subcontracted the mirror work to Diverse Technologies and Dyn-Optics.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

SEEKER PRODUCTION

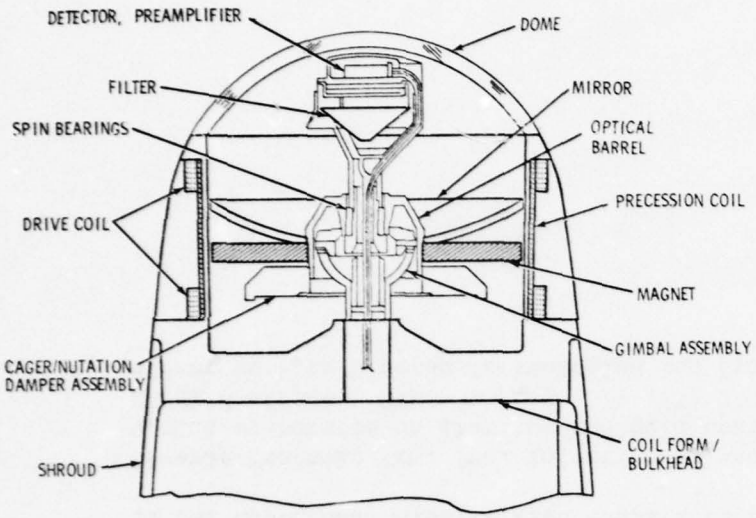


FIGURE 1-1. MM&T BASELINE SEEKER DESIGN

PROJECT NO: 374 3096

TITLE: MANUFACTURING PROCESS FOR LASER TERMINAL SEEKERS.

COST: $450,000.

BENEFITS

Teledyne Brown studied manufacturing methods and developed detailed reports on these spinning mass seeker areas:

- **Molded mirror technology**
- **Spectral filter technology**
- **Head coil integration**
- **Gyro balancing**
- **Automatic testing**
- **Silicon quadrent detector**
- **Molded plastic structures**
- **Powdered metal parts**

Cost of molded mirror for hellfire was reduced from $650 to $6.50.

Manufacturing Process for Laser Terminal Seekers	374 3096	Mr. Charles P. Bailey Army Missile Research and Development Command DRDMI Advanced Sensors Redstone Arsenal, AL 35809	AV 746 2625 (205) 876-2625

BENEFITS:

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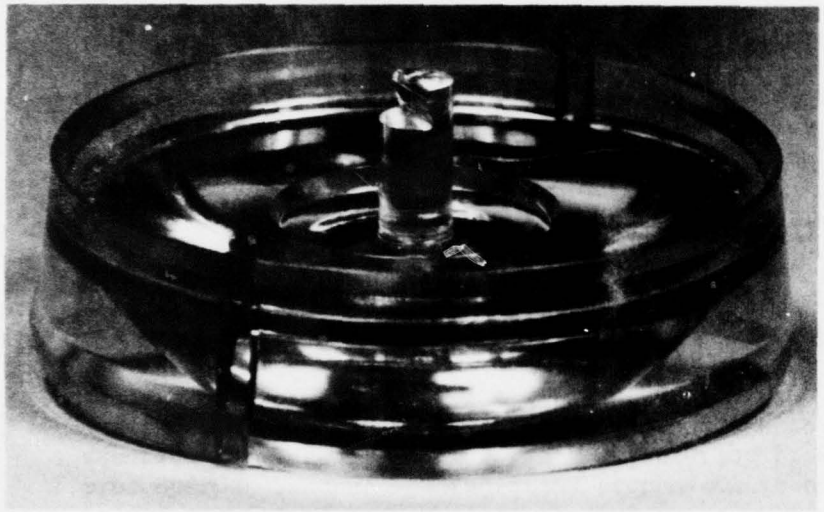
DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT



MOLDED MIRROR FOR MISSILE SEEKER

PROJECT NO: 374 3096

TITLE: MANUFACTURING PROCESSES FOR LASER TERMINAL HOMING SEEKERS.

COST: $450,000

BENEFITS

3.75 Aspheric Mirrors were injection molded of acrylic as substitutes for expensive ground and polished glass mirrors. Aluminum and gold were evaporated on.

Cost of the Hellfire Missile Mirror was reduced from $650 to $6.50.

Molded plastic mirrors may be applied to the Copperhead Missile with comparable savings.

RCA, Montreal, developed processes for making silicon quadrent detectors for the seeker.

CALIBRATION

Engineering for Metrology and Calibration	375 3115	Mr. M. L. Fruechtenicht U.S. Army Metrology and Calibration Center DRSMI-MM Redstone Arsenal, AL 35809	AV 746-5638 (205) 876-5638

ACCOMPLISHMENTS:

This project provided advanced technology calibration systems and equipment required in the Army Calibration Program. Work included: investigation of new and unique measurement systems; adaption of new measurement techniques; testing of new systems, components and accessories; testing to determine whether present manufacturing technology is capable of producing items that meet performance, accuracy, and stability criteria. Calibration program sub-projects include mechanical, physical, electronic, and electromagnetic systems and technology. Sub-projects are listed below with a brief summary of status.

a. Voltage Standard. A Josephson effect Laser Interferometer Gage Block Comparator - From preliminary estimates it appears the cost of this system will exceed the benefits to be derived. This completes all work in this subproject.

b. Pressure Transducer Systems - A solid dielectric transducer consisting of an automatic ratio transformer bridge was designed and assembled at the NBS. A manual bridge was also tested. These tests were conducted to find their response to temperature change and their accuracy over the dynamic measurement range. The calcite crystals being tested by the NBS for use as a transducer sensor have proven unstable and, despite much work to correct the problem, appear unsuitable for this application.

The pneumatic transducer work consisted of determining the sensitivity of the differential transducer to prevailing atmospheric pressure and different gas species. Field trials at the transfer team level used a breadboad prototype system with thermostatic temperature control, and a pressure manifold system for calibrating these transducers.

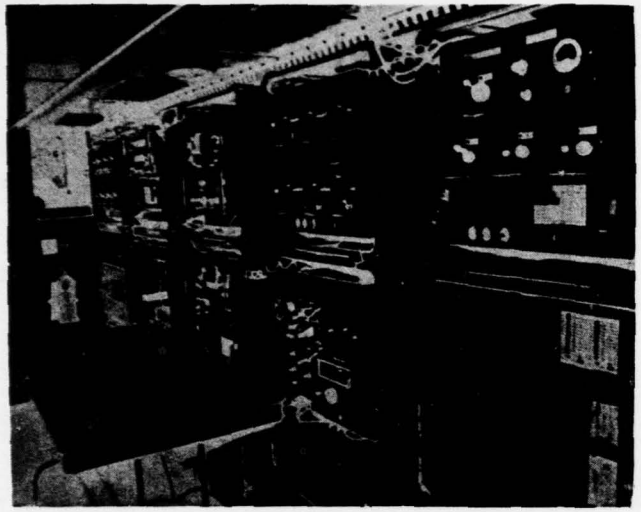
c. Automated system standards for calibrating one-part devices were set.

d. IR Standard Detectors - The final report documents the low light level calibration facility. It provides capability for calibration of self-luminous radiant standards used in production verification and quality assurance of various night vision devices.

e. Work on electromagnetic, laser, and heat standards contined under a follow-on project.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

METROLOGY AND CALIBRATION



TYPICAL CALIBRATION EQUIPMENT
IN A CALIBRATION VAN

ALSO DEVELOPED A SELF-CALIBRATION SYSTEM FOR CHECKING OUT TEST SYSTEMS.

PROJECT NO: 375 3115

TITLE: MM&T ENGINEERING FOR METROLOGY AND CALIBRATION

COST: $560,000

BENEFITS

Developed these equipments:

A. Voltage standard For low voltage, high frequency work. Provides step voltages to 10 millivolts at 10 gigahertz. Accurate to one part per million.

B. Pressure Transducer for measuring high pressures. Developed a temperature stable element and vessel good to 10,000 PSI.

C. Automated system standards. Modified software for calibrating one-port devices.

D. Infrared standard detector. Coordinated a tri-service standard for IR & laser devices. Useful for acceptance testing.

E. Continued work on electromagnetic, laser, and heat standards.

Quantity Production Techniques for Diode Phase Shifter Elements

375 3157

Mr. Richard A. Kotler
U.S. Army Missile Research and Development Command
DRDMI-EAT
Redstone Arsenal, AL 35809

AV 746-3321
(205) 876-3321

Contractor: Hughes Aircraft Co.
Fullerton, CA 92634

Contract No: DAAH01-75-C-0752

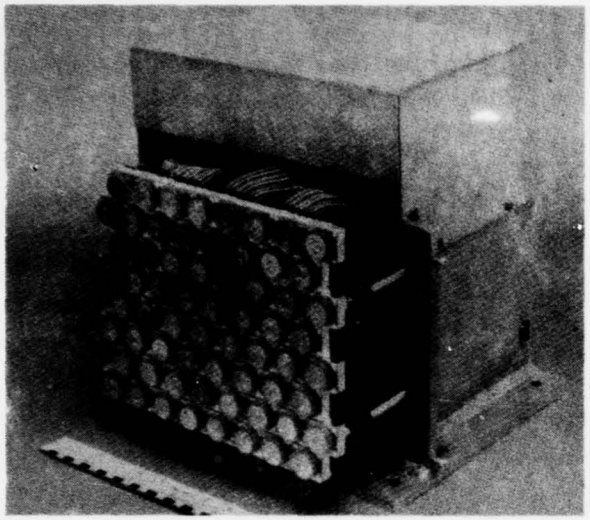
Hughes Aircraft Company automated thick film screening processes to make Microstrip, radiators and power dividers. The key manufacturing break-thru was to fabricate two microstrip diode phase shifters, two disc radiators, and a power divider on one common dielectric substrate.

Thirty-two of these substrates were combined into a module containing 64 radiators, 64 phase shifters, and 64 power distribution networks. The module forms a lightweight package shown below and serves as a building block for large phased array antennas as employed with Army's Patriot and Navy's Aegis guidance and control antennas.

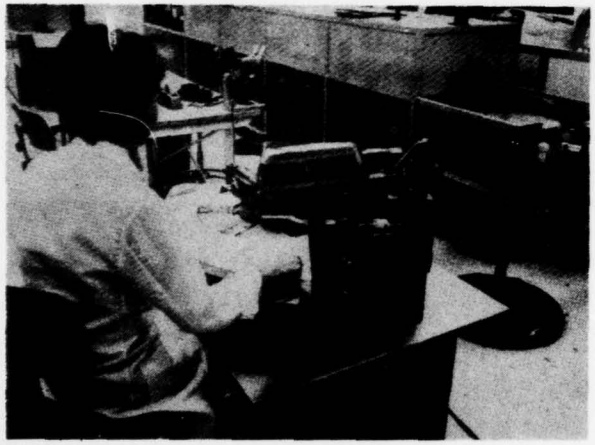
This project was conducted jointly with the Navy. Full-up working antennas are being contracted for both missile systems.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PHASE SHIFTERS



64 ELEMENT MODULE



PRODUCTION PRINTER

PROJECT NO: 375 3157

TITLE: QUANTITY PRODUCTION TECHNIQUES FOR DIODE PHASE SHIFTER ELEMENTS

COST: $650,000

BENEFITS

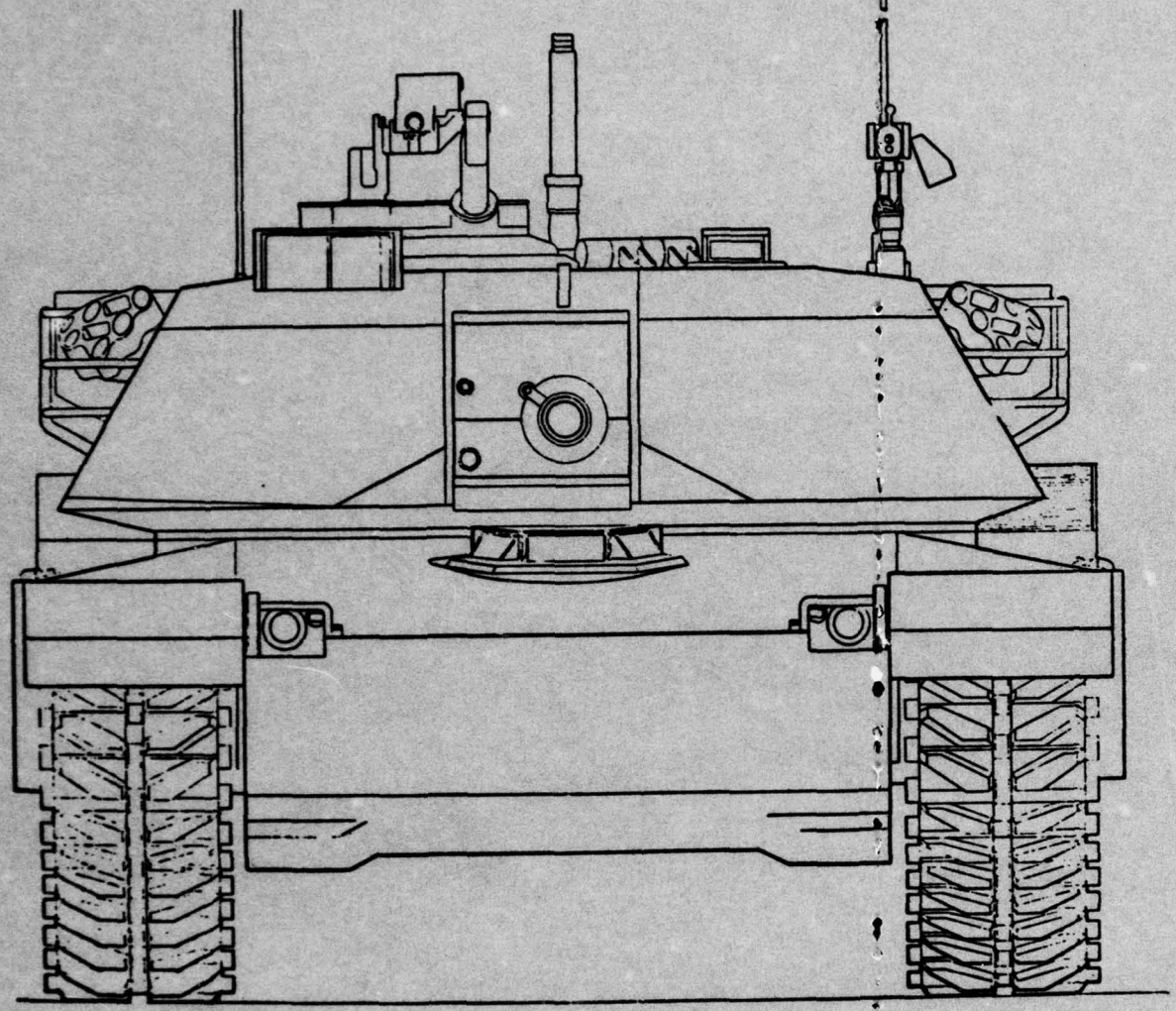
Hughes Aircraft Co. converted phase shifters from multi-component designs to mass-produceable thick film configurations.

Hughes combined 64 radiators, phase shifters, and power distribution networks in each subarray module.

Pairs of phase shifters are formed of ceramic in its "green" state, screened with conductive circuitry, and fired to form long-life components.

The modules will be used in both army's Patriot (SAM-D) and navy's Aegis guidance and control antennas.

SAVINGS ARE PROJECTED AT $26 MILLION OVER A SIX YEAR PERIOD.



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TANK-AUTOMOTIVE R&D COMMAND

(TARADCOM)

TARADCOM

MM&T Representatives:	COL Warren T. Palmer US Army Tank-Automotive R&D Command ATTN: DRDTA-R Warren, MI 48090	AV 273-2485 (313) 573-2485
	Mr. Basel Armstead US Army Tank-Automotive R&D Command ATTN: DRSTA-EB Warren, MI 48090	AV 273-2485 (313) 573-2485

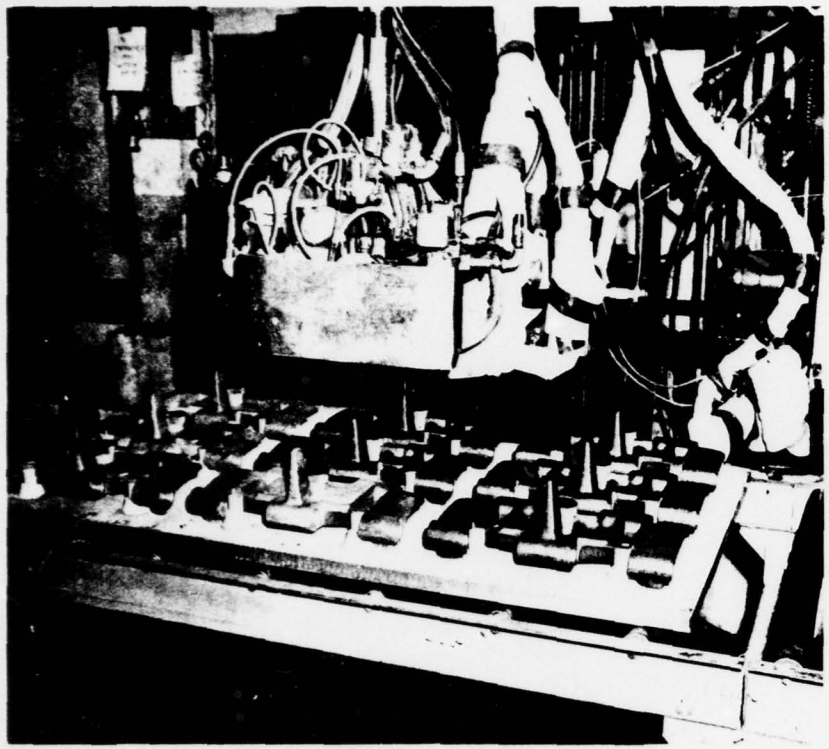
TARADCOM

INDEX

Cast-in-Place Track Shoe Backing Inserts	474 4270	Mr. E. J. Kvet US Army Tank-Automotive R&D Command Warren, MI 48090	AV 273-2531 (313) 573-2531
		Contractor: Uniroyal, Inc. Mishawaka, IN	
		Contract: DAAE07-74-C-0059	

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TANK TRACK



TRACK FILLING EQUIPMENT

PROJECT NO: 4 74 4270

TITLE: MM&T CAST IN PLACE TRACK SHOE BACKING INSERTS.

COST: $150,000

BENEFITS

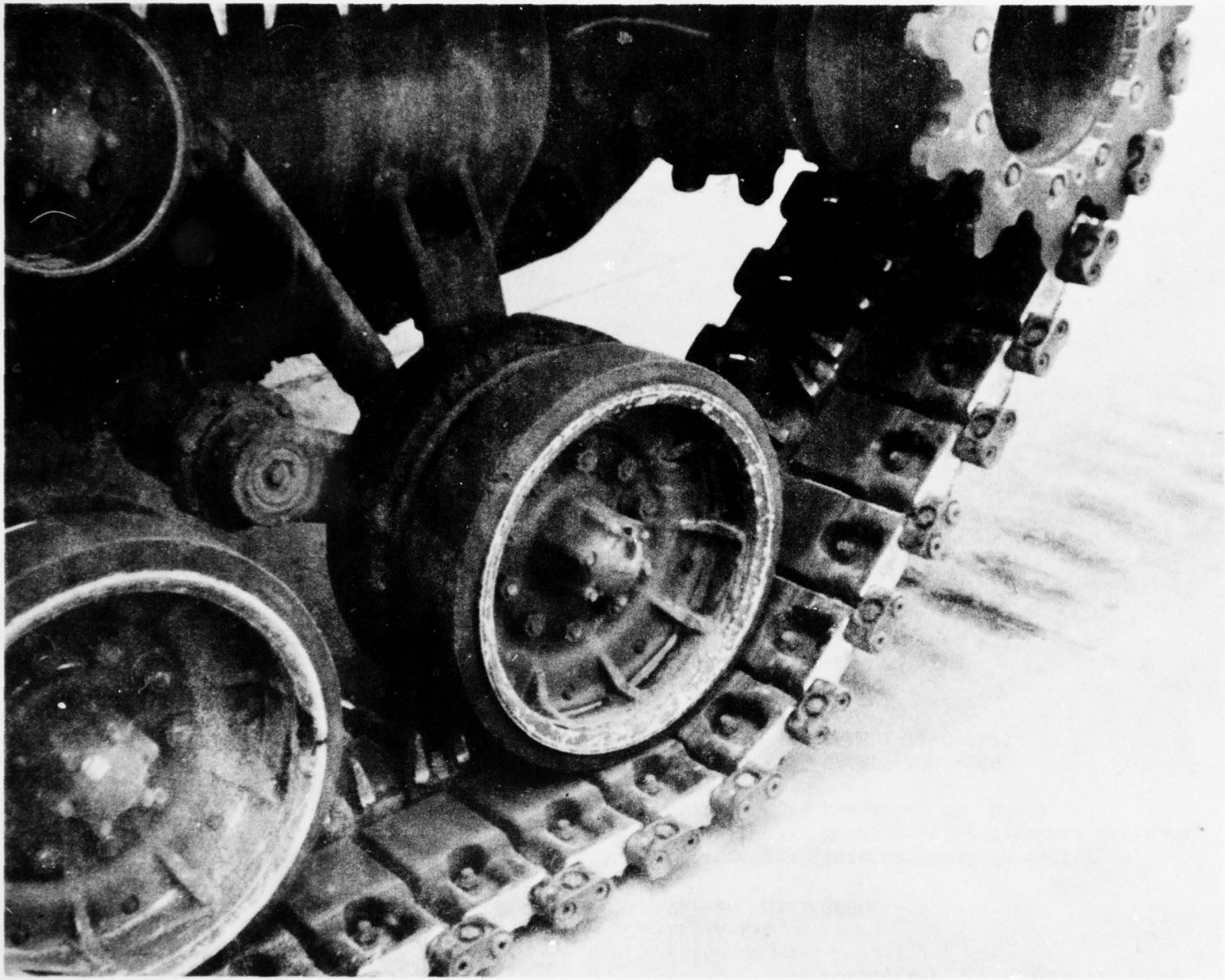
Uniroyal developed equipment for casting a polyurethane pad in the cavity on the roadwheel side of the track shoe.

Uniroyal first optimized the polyether polyurethane formulation for long road life and room temperature curing. Also, no molds are needed.

A processing line was built, proven, and shipped to Red River Army Depot where it is now in use.

The new process was written into the spfc.

Cast-in-Place Track Shoe Backing Inserts	474 4270	Mr. E. J. Kvet US Army Tank-Automotive R&D Command Warren, MI 48090	AV 273-2531 (313) 573-2531
		Contractor: Uniroyal, Inc. Mishawaka, IN	
		Contract: DAAE07-74-C-0059	



Track ran 8050 test miles with no apparent deficiency.
Equipment will be installed at rebuild shop in Germany.

TEST

Soundness Evaluation of Heavy Armor Castings Using Automated Ultrasonics

471 4271

Mr. Donald Matichuk
US Army Tank-Automotive R&D Command
DRDTA-RKA
Warren, MI 48090

AV 273-2084
(313) 573-2084

Contractor: International Harvester Co.
Manufacturing Services Division
Hinsdale, IL 60521

Contracts: DAAE07-69-C-2601
DAAE07-71-C-0173

AD-A059 656 ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY ROCK ISLAND IL F/G 13/8
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM ACCOMPLISHMENTS.(U)
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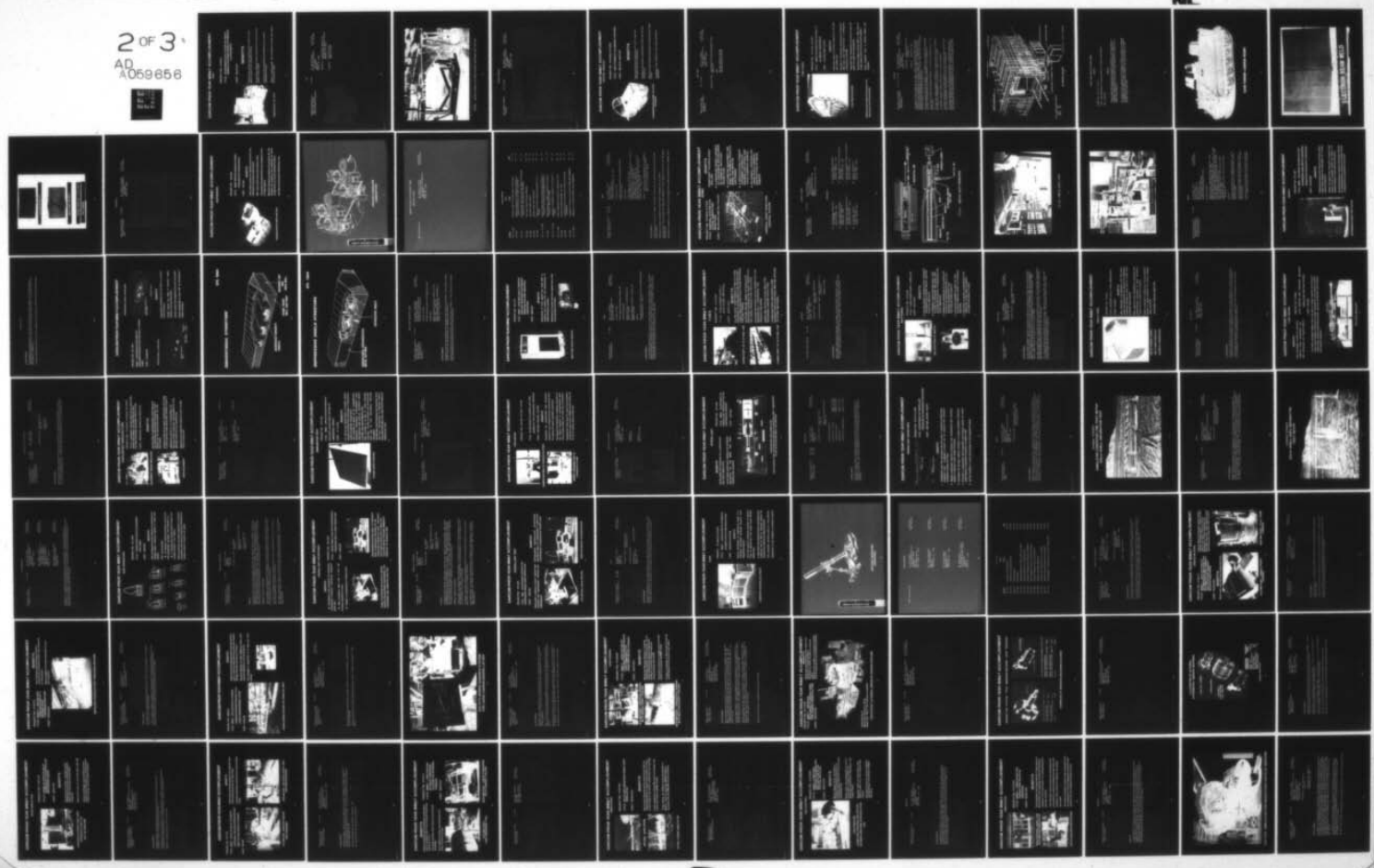

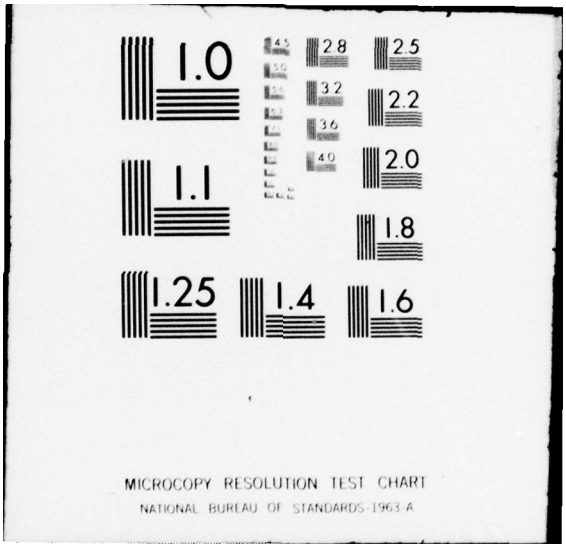
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TEST

PROJECT NO: 4714271

TITLE: SOUNDNESS EVALUATION OF HEAVY ARMOR CASTINGS USING AUTOMATED ULTRASONICS

COST: $125,000

COMPUTERIZED TEST SETUP

BENEFITS

Ultrasonic test methods are considerably more reliable and have greater resolution than radiographic methods.

An automated inspection system with print-out of defect size and location is now available.

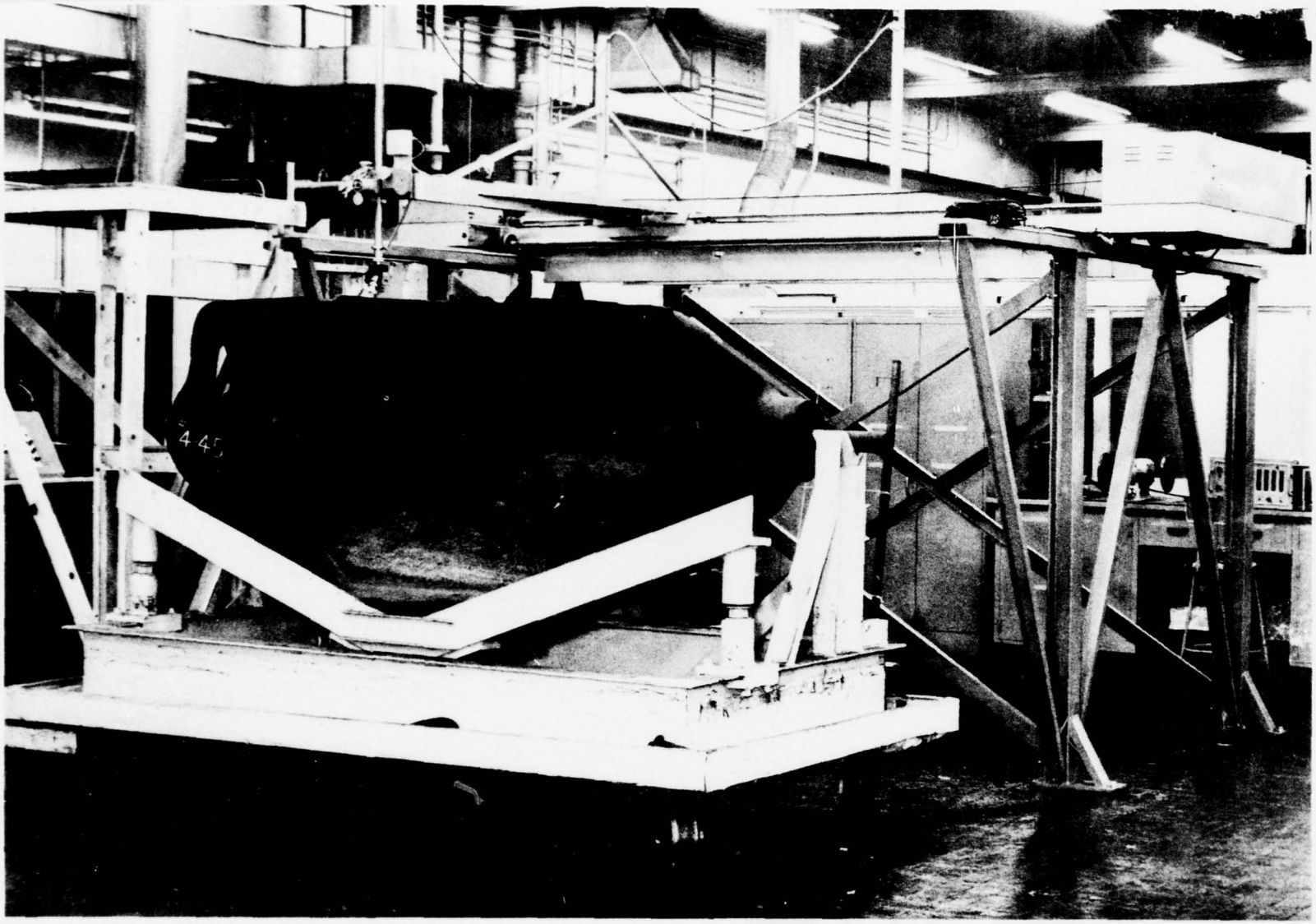
Intricate surface topographies are inspected with no personal interpretation required.

Repair or welding salvage cost is significantly reduced since defects are accurately located.

Soundness Evaluation of Heavy Armor Castings Using Automated Ultrasonics	471 4271	Mr. Donald Matichuk US Army Tank-Automotive R&D Command DRDTA-RKA Warren, MI 48090	AV 273-2084 (313) 573-2084

Contractor: International Harvester Co.
Manufacturing Services Division
Hinsdale, IL 60521

Contracts: DAAE07-69-C-2601
DAAE07-71-C-0173

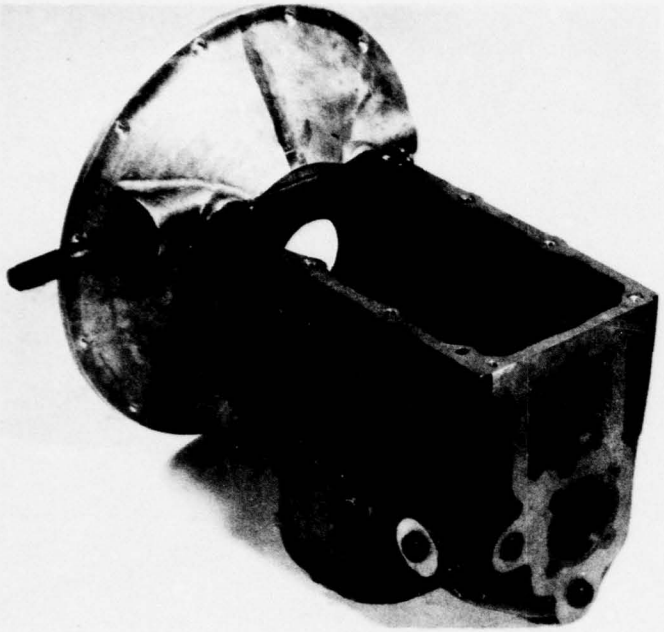


471 4271 SCANNING BRIDGE WITH WATER SQUIRTER POSITIONED OVER TANK HULL

High Strength Aluminum Castings	470, 71 4282	Mr. Edward W. Moritz US Army Tank-Automotive R&D Command DRDTA-RKA Warren, MI 48090	AV 273-1347 (313) 573-1347

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TACTICAL VEHICLES



TRANSMISSION CASE/CLUTCH HOUSING

PROJECT NO: 4704282; 4714282

TITLE: HIGH STRENGTH ALUMINUM CASTINGS

COST: $80,000; $164,000

BENEFITS

Sand cast aluminum transmissions run 5° to 8° F cooler than *conventional cast steel transmissions.*

Durability of cast aluminum transmissions is better than cast steel transmissions.

Significant weight savings are associated with using aluminum instead of steel.

Technology is easily transferred to other vehicle transmission applications.

MM&T For Hard Face Coating to Aluminum Components	471, 72 4312	Mr. K. F. Chesney US Army Tank-Automotive R&D Command Warren, MI 48090	AV 273-1446 (313) 573-2084

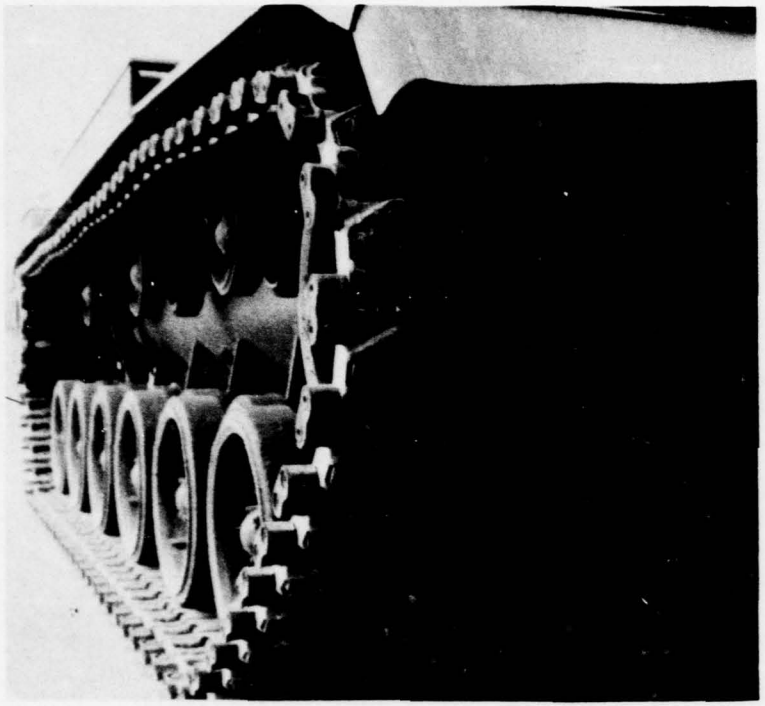
Location of Work: Tank-Automotive Systems Development Center
Warren, MI

and

Test and Evaluation Command
Aberdeen Proving Ground, MD

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TANK TRACK



T142 TRACK ON TANK

Reduced track weight 2,850 pounds, and makes tank more maneuverable.

PROJECT NO: 471 4312, 472 4312

TITLE: MM&T FOR HARD FACE COATING TO ALUMINUM COMPONENTS.

COST: $150,000 AND $182,385

BENEFITS

Aluminum track is a strong contender for the XMI main battle tank.

Chrysler is conducting engineering development (ED) tests, and aluminum track is undergoing evaluation for the XMI.

Improved heat conductivity of aluminum lets the pads run cooler for extended life.

Aluminum bodies provide 5000 to 7000 miles of rough usage, better than any track available.

Alcoa supplied track to General Motors and Chrysler.

Fabrication of Armored Vehicles by Electron Beam Welding	474, 75, 76 4330	Mr. Donald Phelps US Army Tank-Automotive R&D Command Warren, MI 48090	AV 273-1389 (313) 573-1389

Contractor: Grumman Aerospace Corp.
Bethpage, NY

Contract: DAAE07-76-C-3251

The purpose of this project was to design, develop, and fabricate soft tooling and fixturing for an electron-beam (EB) welding system capable of supporting and positioning the plate components of an aluminum armored hull. The operation of the EB welding system was demonstrated by fabricating a prototype near-full size M-113 armored personnel carrier hull from 5083 aluminum alloy.

A modular approach was used by Grumman. Subassemblies were fabricated by EB welding and then the subassemblies were EB welded together to form a complete hull.

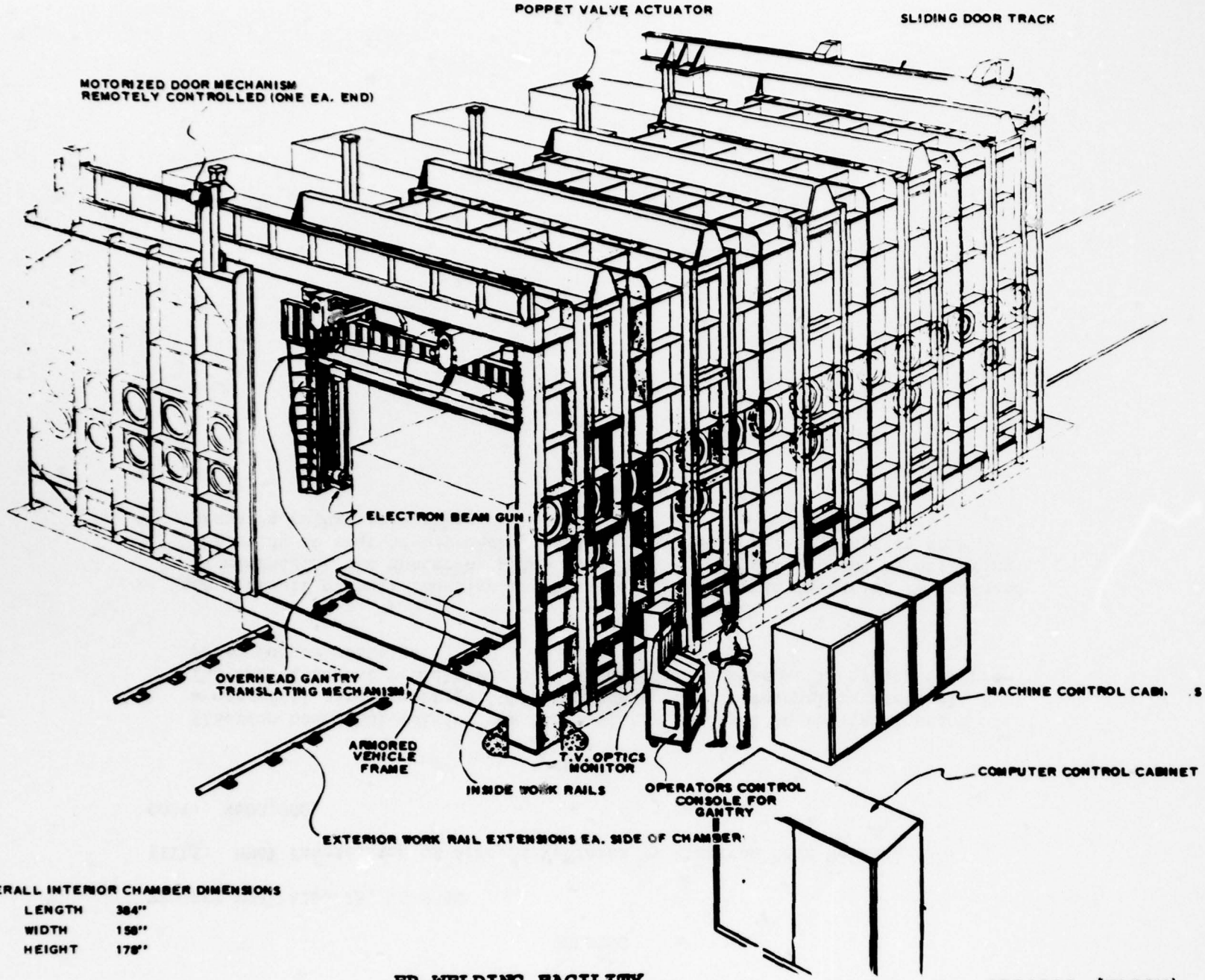
Twenty-three EB welds were employed (external) to the hull on components up to 1 3/4 inches thick.

The total cost savings achieved by fabricating aluminum armored hulls by EB welding in production is approximately 25 to 30 percent compared to GMA welding.

An estimated savings of nearly $500 per hull is readily achievable.

A trade-off between EBW vs. GMAW equipment cost and consumables alone suggest break-even after approximately 9000 vehicles or three years of production.

The inherent advantages of EBW include deep-penetration single-pass welding capability, high welding speeds, exceptional weld quality, retention of near-base metal weld properties, and minimal shrinkage and distortion, even in thin-gage structures.



OVERALL INTERIOR CHAMBER DIMENSIONS

LENGTH	384"
WIDTH	156"
HEIGHT	176"

EB WELDING FACILITY

Project No. 4754330 (TACOM)

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

WELDING

PROJECT NO: 474, 75, 76 4330

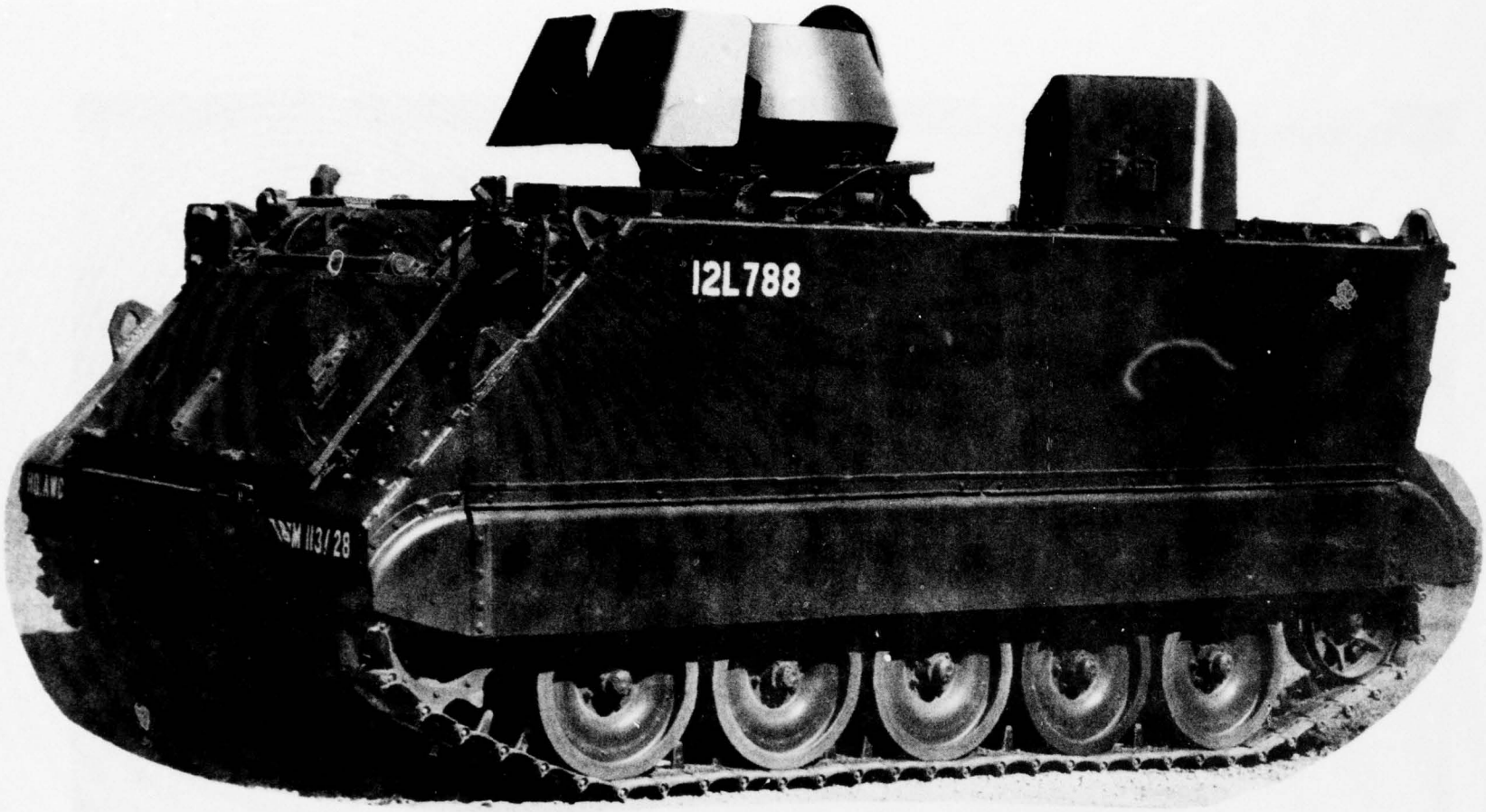
TITLE: MM&T Fabrication of Armored Vehicles by Electron Beam Welding

COST: $400,000

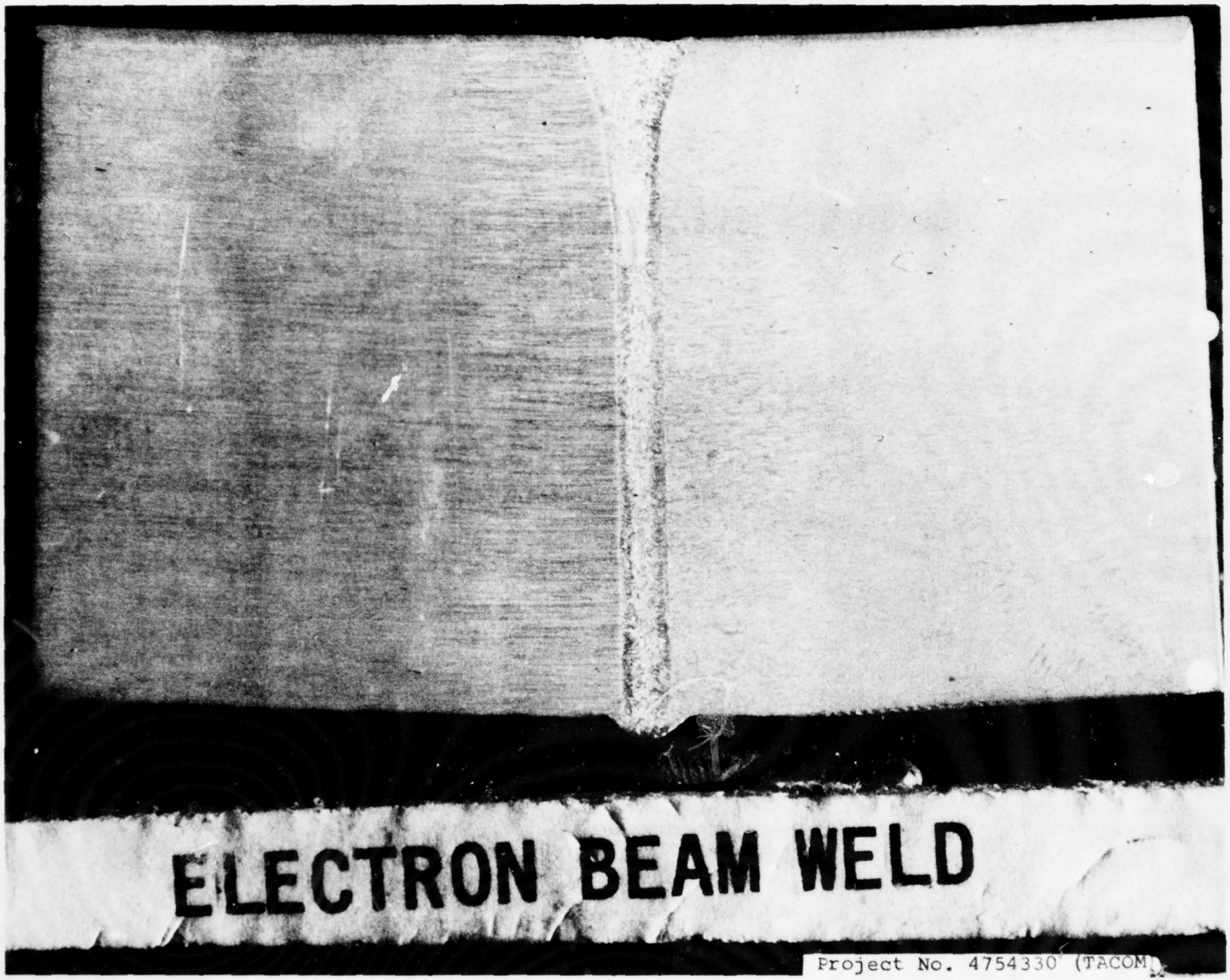
BENEFITS

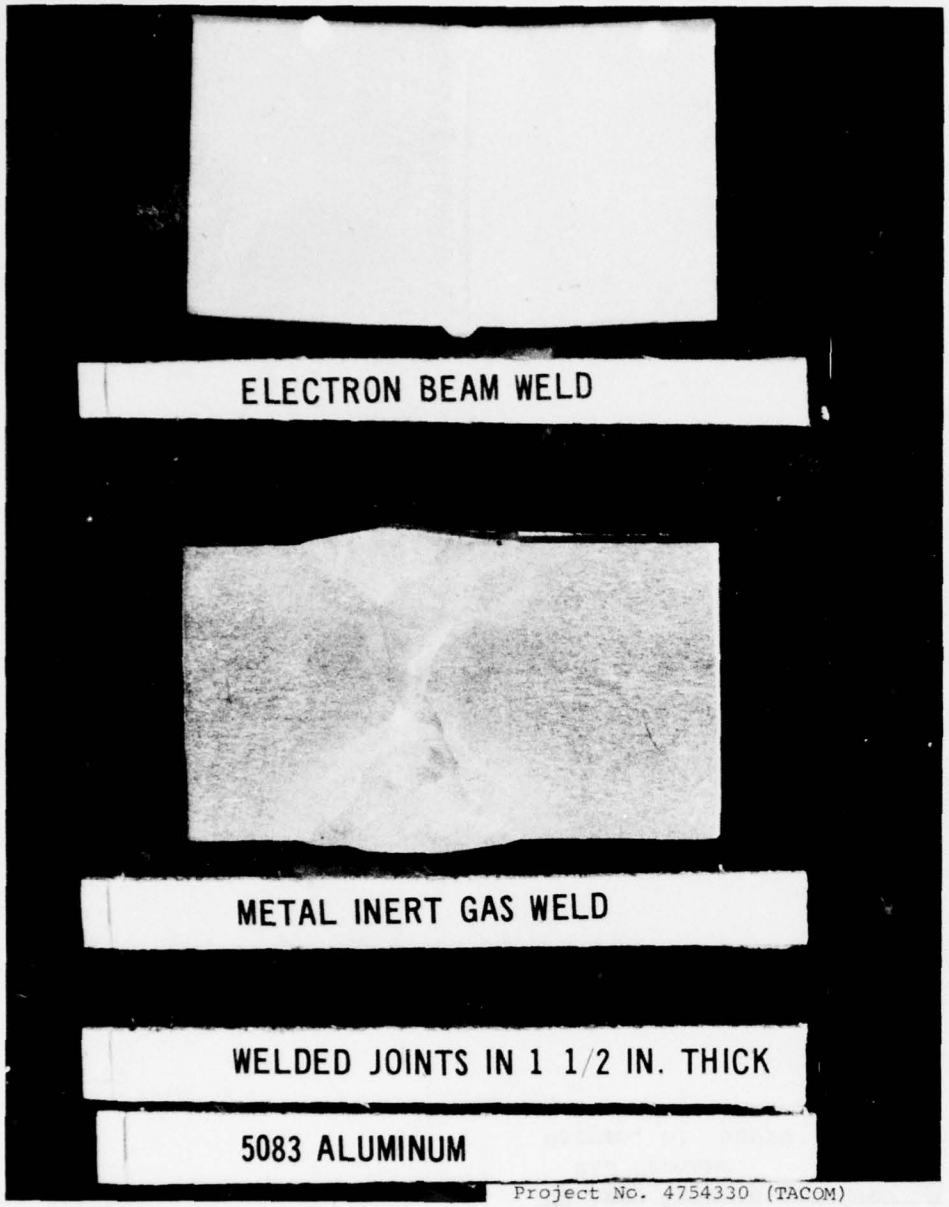
Electron beam (EB) welding was successfully employed in the fabrication of a near-full size prototype 5083 aluminum armored personnel carrier hull. The M113A1 combat vehicle was used as a model because it is typical of proposed future vehicles.

As a result of hull redesign for EB welding, ballistic integrity is enhanced by minimizing the number of welds "visible" to projectiles and by orienting the welds so that high-probability impacts will load the joints in compression rather than shear.



TACOM PIONEERED ALUMINUM WELDING


ELECTRON BEAM WELD
Project No. 4754330 (TACOM)

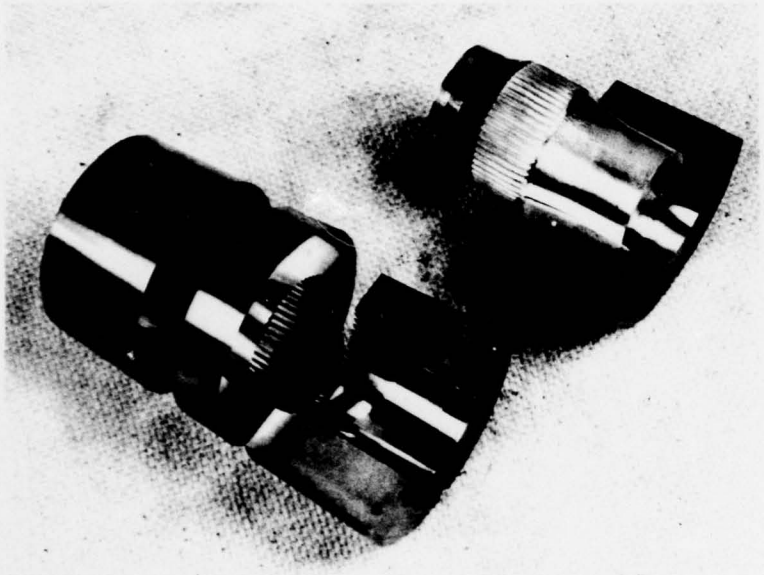


Project No. 4754330 (TACOM)

Improve Manufacturing Process for Torsion Bars	465 6342	Mr. Edward R. Makiewicz US Army Tank-Automotive R&D Command Warren, MI 48090	AV 273-2414 (313) 573-2414

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

SUSPENSIONS



TORSION BAR SPLINES AND DIES

PROJECT NO: 465 6342

TITLE: MM&T IMPROVE MANUFACTURING PROCESS FOR TORSION BARS

COST: $91,000

BENEFITS

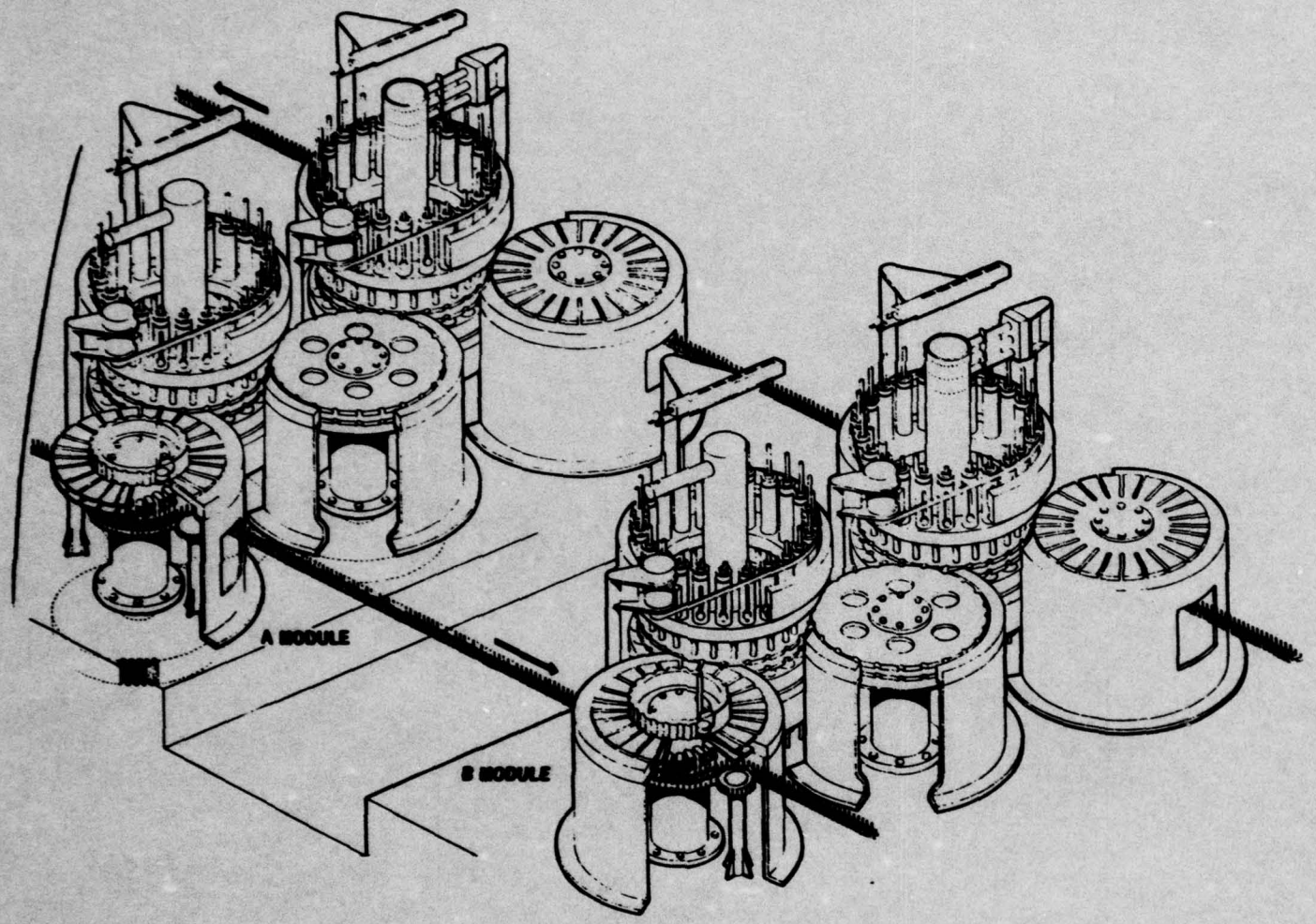
Cold forged torsion bar splines provide both cost reduction and product improvement.

XM-1 tank torsion bars will be spline rolled.

The torsion bar specification was changed in favor of rolled splines.

Machine Products Company of LaCrosse, WI. and Chrysler are installing new equipment for spline rolling which is now the preferred method.

Savings are estimated at $84,000 per year.



ARRCOM/ARRADCOM
(AMMUNITION)

ARMAMENT RESEARCH AND DEVELOPMENT COMMAND

AMMUNITION RELATED

MM&T Representative	Mr. Darold L. Griffin PM for Production Base Modernization and Expansion DRCPM-PBM-DP Dover, NJ 07801	AV 880-6708 (201) 328-6708

ARRCOM/ARRADCOM

INDEX

Disposal System for Lethal Agents and Munitions	570 1215 571 1215	Mr. Donald L. Pugh Project Officer Chemical Systems Lab Aberdeen Proving Grounds, MD 21010	AV 584-2041 (310) 671-2041

Location of Work:

Aberdeen Proving Grounds, MD (Edgewood Arsenal)
Tooele Army Depot

Contractors:

Stearns-Roger, Inc., Denver, CO
Surface Combustion Div. of Midland-Ross Corp., Toledo, OH
Milwaukee Boiler Mfg. Co., Milwaukee, WI
IIT Research Institute, Chicago, IL
Atlantic Mobile Corp., Baltimore, MD
Amman and Whitney Consulting Engineers, New York, NY
Teller Environmental Systems, Inc., New York, NY
Wasteco, Inc., Tualatin, OR

Report: "Final Project Status Report for the Chemical Agent Munitions Disposal System (CAMDS)", March 77, (see above for address).

ACCOMPLISHMENTS:

Established the process, pilot support and design criteria for the Chemical Agent Munitions Disposal System (CAMDS).

Fabricated, procured, installed and tested various components for the system.

Developed safe, efficient means for large scale disposal of lethal chemicals (H, HD, HT, VX, GB) agents and munitions.

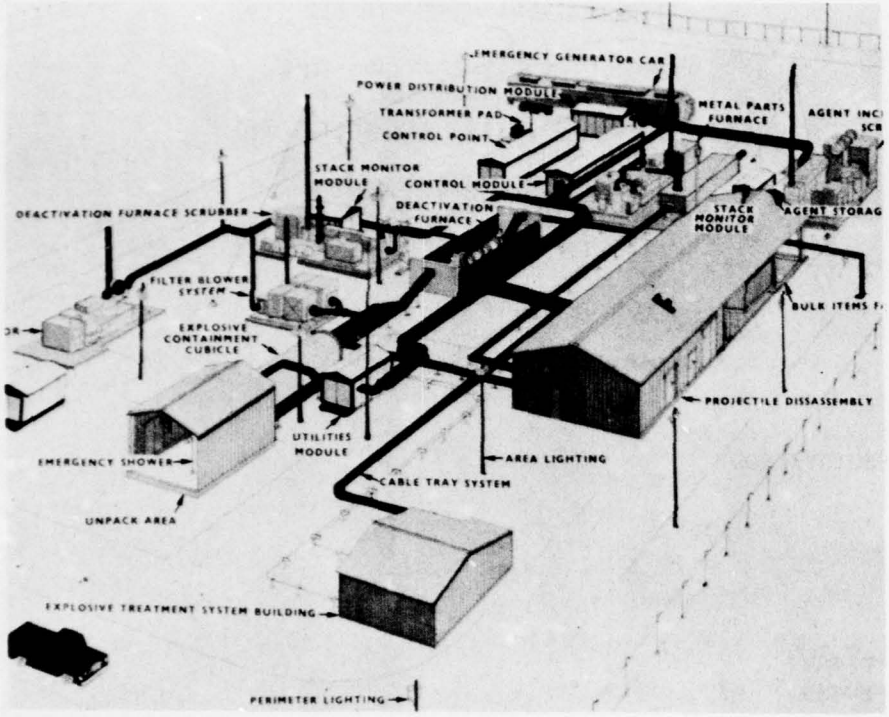
Built Mobile equipment to eliminate the need for shipping toxic agents and munitions to disposal sites.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT
DEMIL

PROJECT NO: 5701215, 5711215

TITLE: DISPOSAL SYSTEM FOR LETHAL AGENTS AND MUNITIONS

COST: $8,081,000 AND $2,730,000



CHEMICAL AGENT MUNITIONS DISPOSAL SYSTEM

BENEFITS

SIGNIFICANT TECHNOLOGIES INCLUDE:

- **A PRESSURE VESSEL CAPABLE OF CONTAINING AN EXPLOSION OF CHEMICAL ARTILLERY PROJECTILES.**
- **AUTOMATED MACHINERY FOR DEMIL OF CHEMICAL ROCKETS, MINES, AND MORTAR CARTRIDGES.**
- **A DEACTIVATION FURNACE/ SCRUBBER CAPABLE OF BURNING EXPLOSIVES AND TOXIC CHEMICAL AGENTS.**
- **AN OVERALL PROCESS FOR LARGE SCALE CHEMICAL DESTRUCTION OF NERVE AGENTS.**

DISPOSAL SYSTEMS

MMT Study of Disposal Systems for Lethal Agents and Munitions	570 1215	Mr. William Weber Chief of Environmental Technology Division Chemical Systems Laboratory DRDAR-CLT Aberdeen Proving Ground, MD 21010	AV 584-2346 (301) 671-2346

CONTRACTORS

(1) Stearns-Roger, Incorporated
P. O. Box 5888
Denver, Colorado 80240

(2) Surface Combustion Division
Midland-Ross Corporation
Toledo, Ohio 43601

(3) Milwaukee Boiler Manufacturing Co.
1101 South 4th Street
Milwaukee, Wisconsin 53246

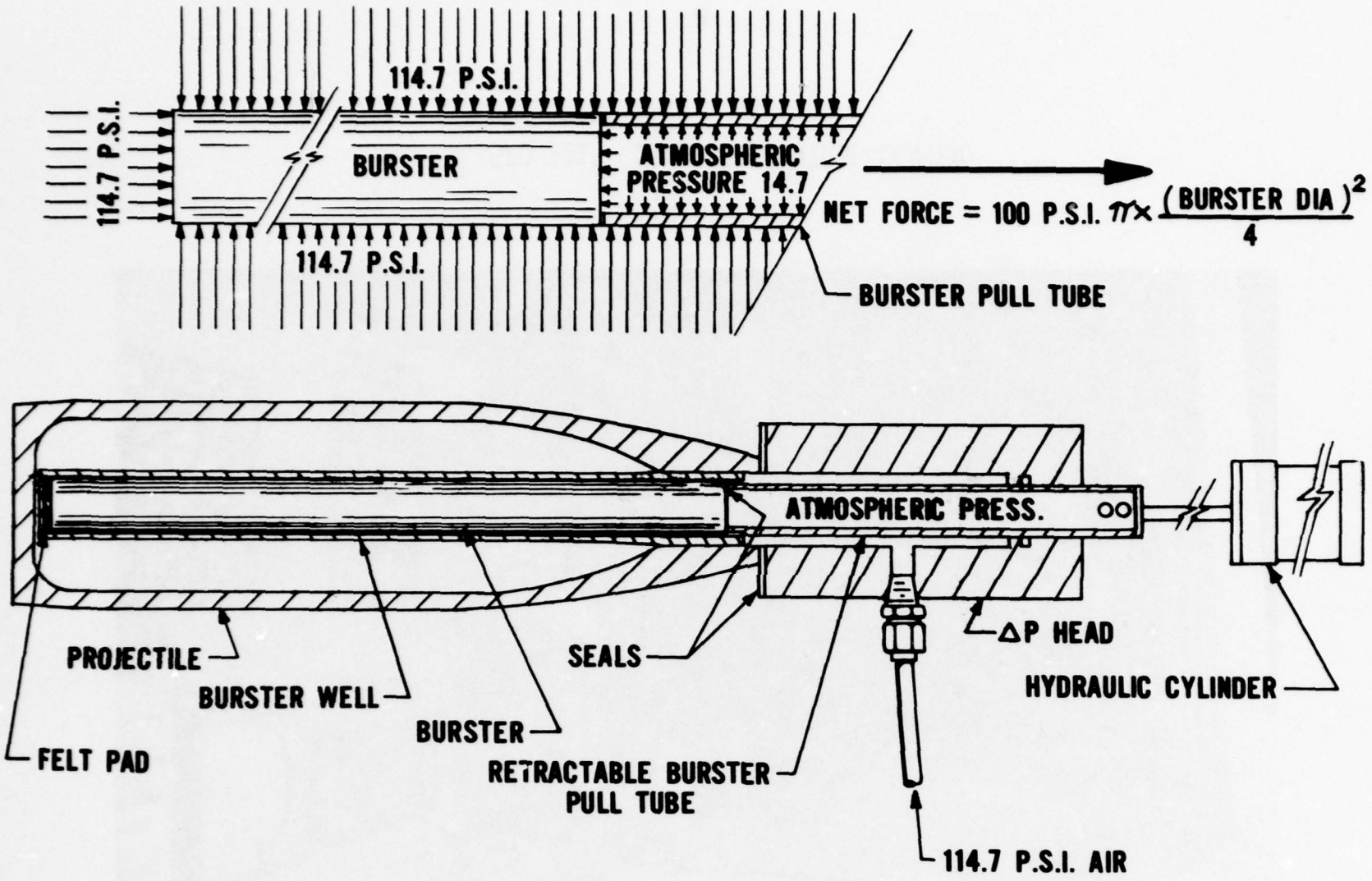
(4) IIT Research Institute
10 West 35th Street
Chicago, Illinois 00616

(5) Atlantic Mobile Corporation
Executive Plaza 2
Baltimore, Maryland 21030

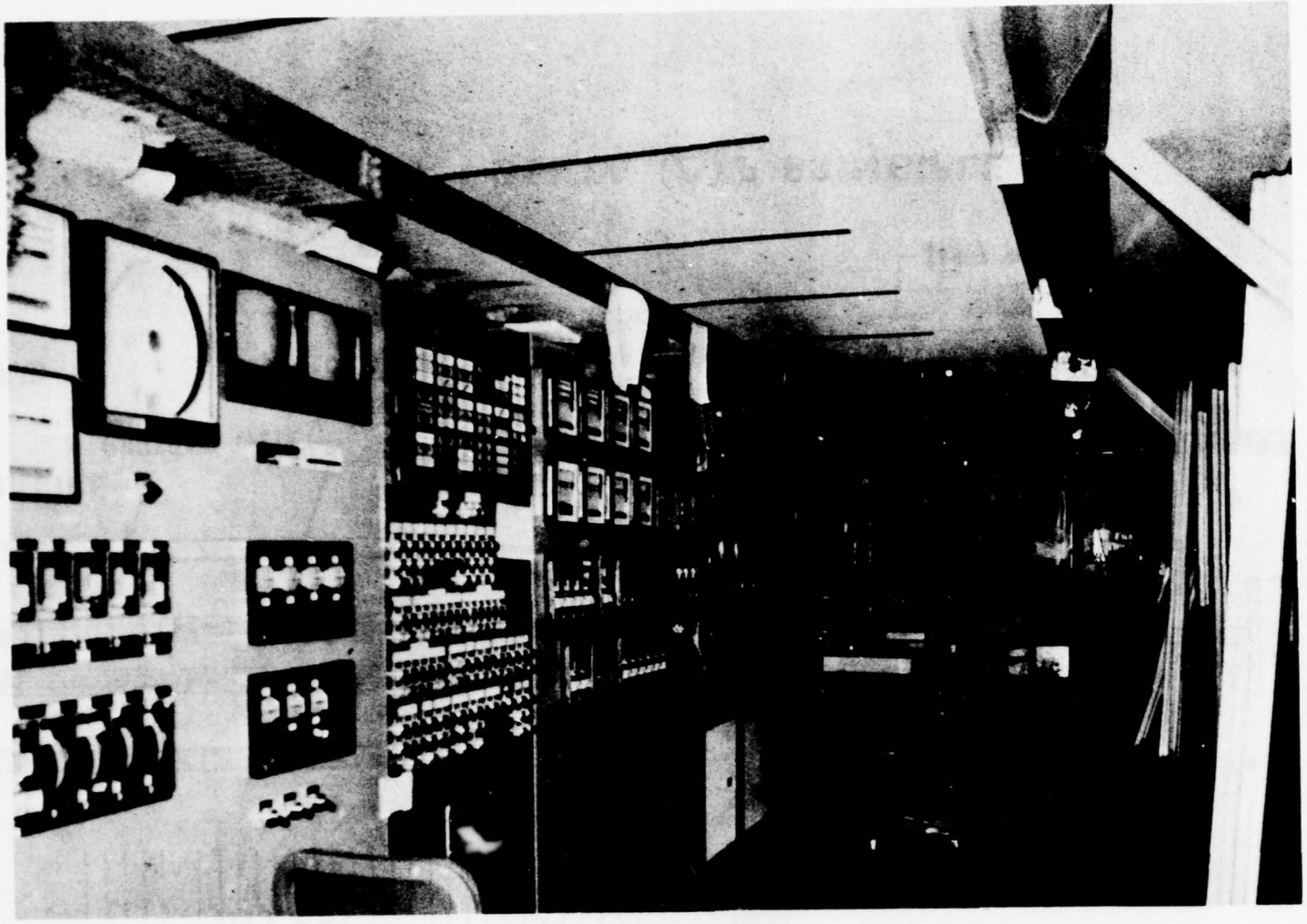
(6) Amman and Whitney Consulting Engineers
1118th Avenue
New York, New York 10011

(7) Teller Environmental Systems, Incorporated
295 Fifth Avenue
New York, New York 10016

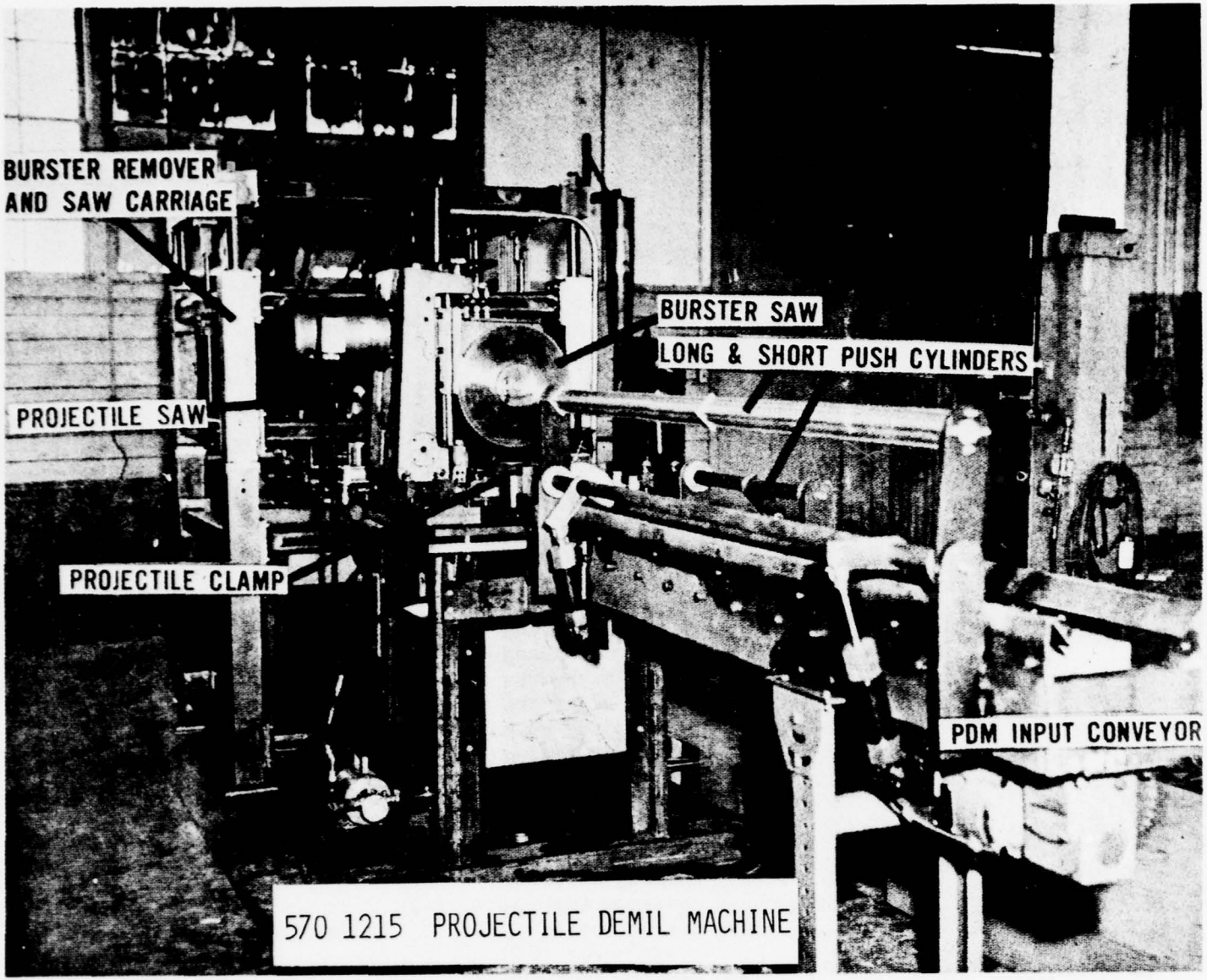
(8) Wasteco, Incorporated
20675 SW 105th
Tualatin, Oregon 97062



570 1215 **DELTA (Δ) P PRINCIPLE**



570 1215 COMPUTER CONTROL CENTER



570 1215 PROJECTILE DEMIL MACHINE

Advanced Technology for Suppressive Shielding of Hazardous Production and Supply Operations	575 1264	Mr. Bruce W. Jezek Project Officer Chemical Systems Lab Mfg. Tech. Dir. CB Detection and Alarm US Army Armament R&D Command Aberdeen Proving Grounds, MD 21010	AV 584-2984 (310) 671-2984

Location of Work:

Edgewood Arsenal, Aberdeen Proving Ground, MD 21010
Dugway Proving Ground, Dugway, Utah 84022
NASA National Space Technology Labs, Bay St. Louis, MO 39520
Ballistic Research Labs, Aberdeen Proving Ground, MD 21005
Southwest Research Institute, San Antonio, TX 78284
Corps of Engineers, Huntsville, AL
Naval Surface Weapons Center, White Oak Lab, Silver Spring, MD 20910
USAMC Intern Training Center, Red River Army Deport, Texarkana, TX

Reports:

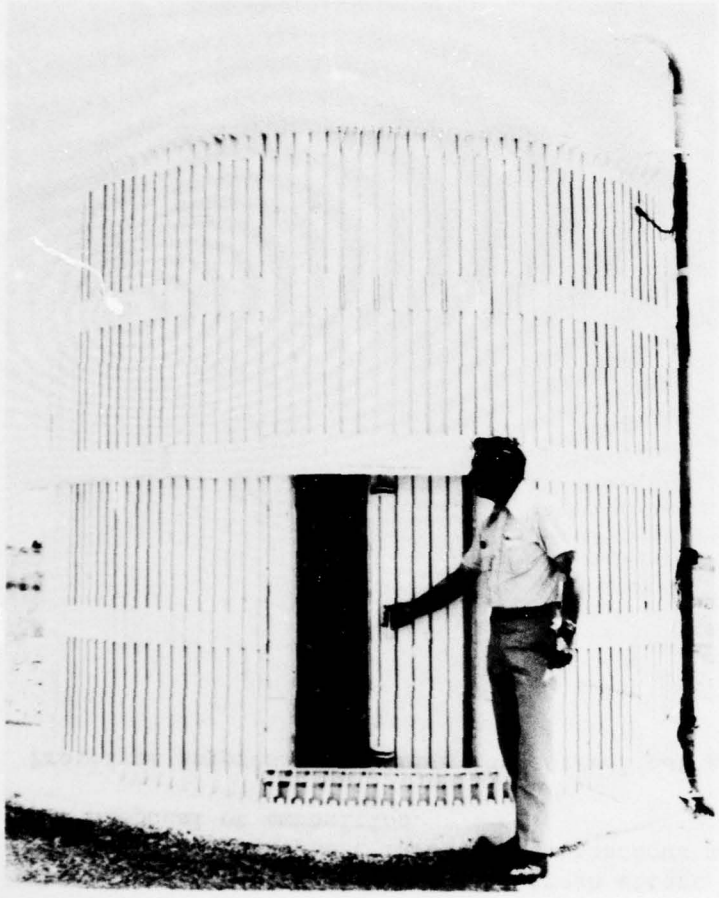
"Analysis and Evaluation of Suppressive Shields", Jan 78, Southwest Research Institute, ARCFL-CR-77028, Contract DAAA15-75-C-0083

"Near Field Blast Effects from Bore Charges", Jan 77, Edgewood Arsenal Resident Lab, National Space Technology Lab, EM-TR-77002

"Preliminary Design Procedures for Suppressive Shield", Dec 76, Edgewood Arsenal, Manuf. Tech. Dir., EM-TR-76089

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

SAFETY



SUPPRESSIVE SHIELD TEST FIXTURE

PROJECT NO: 575 1264

TITLE: MM&T - ADVANCED TECHNOLOGY FOR SUPPRESSIVE SHIELDING OF HAZARDOUS PRODUCTION AND SUPPLY OPERATIONS.

COST: $3,300,000

BENEFITS

Edgewood Arsenal and several contractors developed shield designs for immediate use in seven levels of protection.

Global and Nasa Tech Labs built a quarter scale model of the prototype shield and tested it at Ballistic Research Labs, Nasa and Aberdeen.

Southwest Research Institute developed methods for predicting blast overpressures outside various configurations of suppressive structures.

ACCOMPLISHMENTS:

This program was accelerated to a crash effort for vented protection shields for increased safety to personnel and equipment involved in hazardous manufacturing, transportation, storage, demilitarization, and disposal of ammunition.

Prototype suppressive shields for several categories were designed, fabricated and successfully tested.

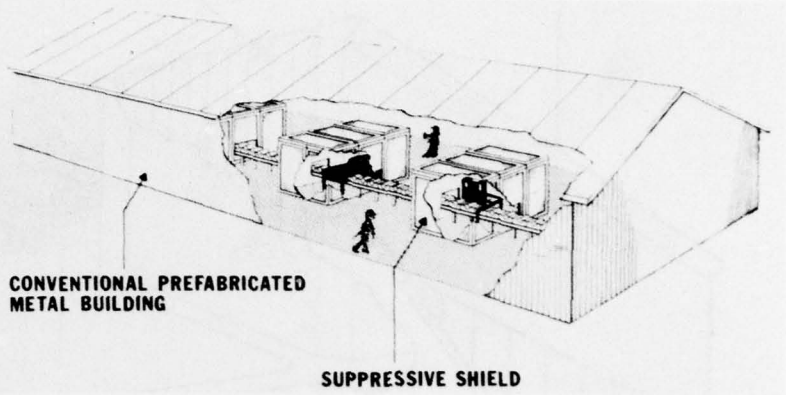
DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROJECT NO: 575 1264

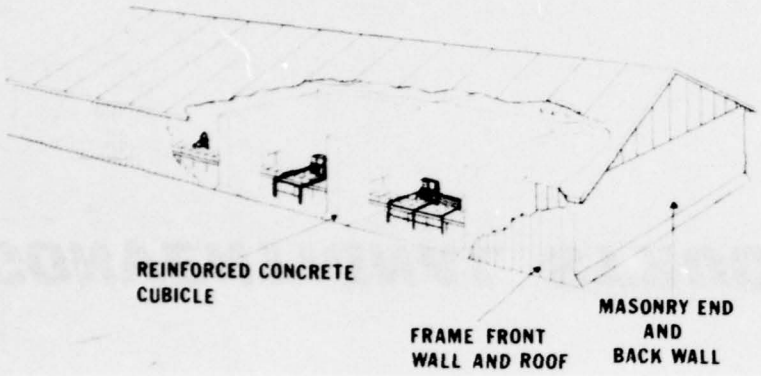
MM&T - SUPPRESSIVE SHIELDING OF HAZARDOUS PRODUCTION AND SUPPLY OPERATIONS.

COST: $3,300,000

SUPPRESSIVE SHIELD STRUCTURE



CONVENTIONAL STRUCTURE



BENEFITS

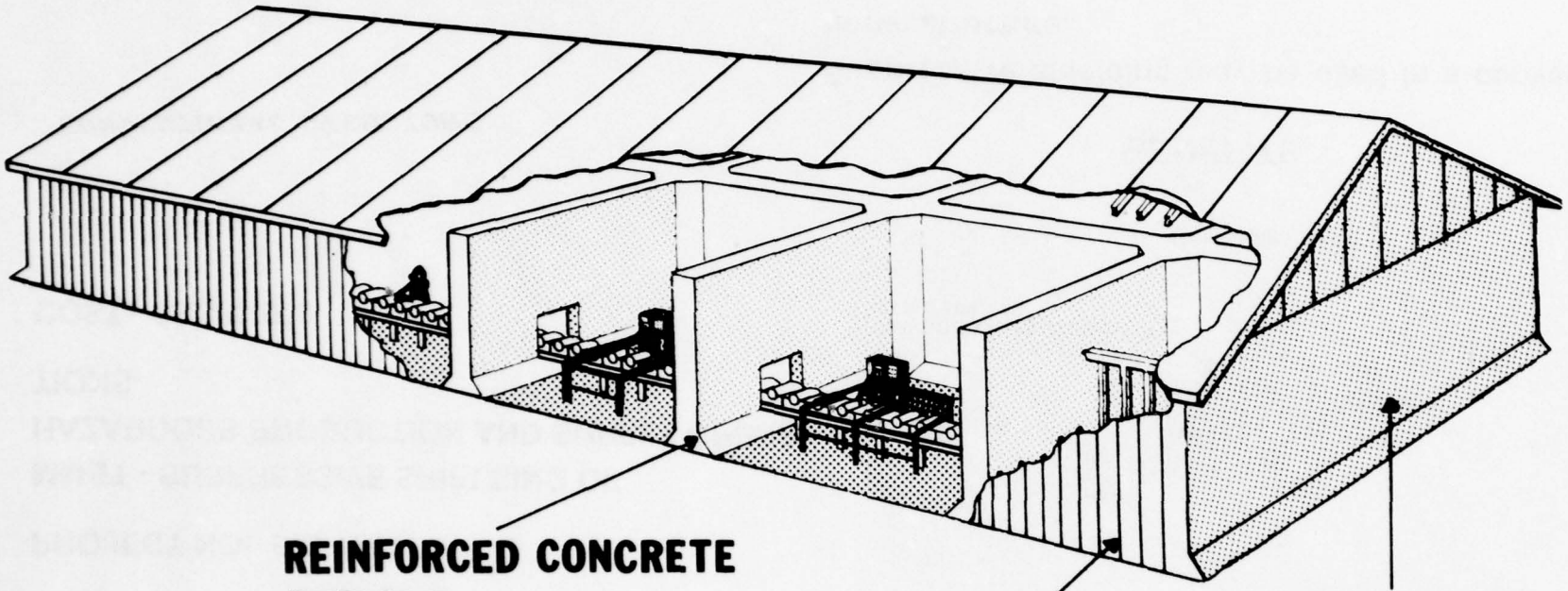
Suppressive shielding may be used in a conventional structure.

Vented panels are made of standard angles, I-Beams, and louvered plates.

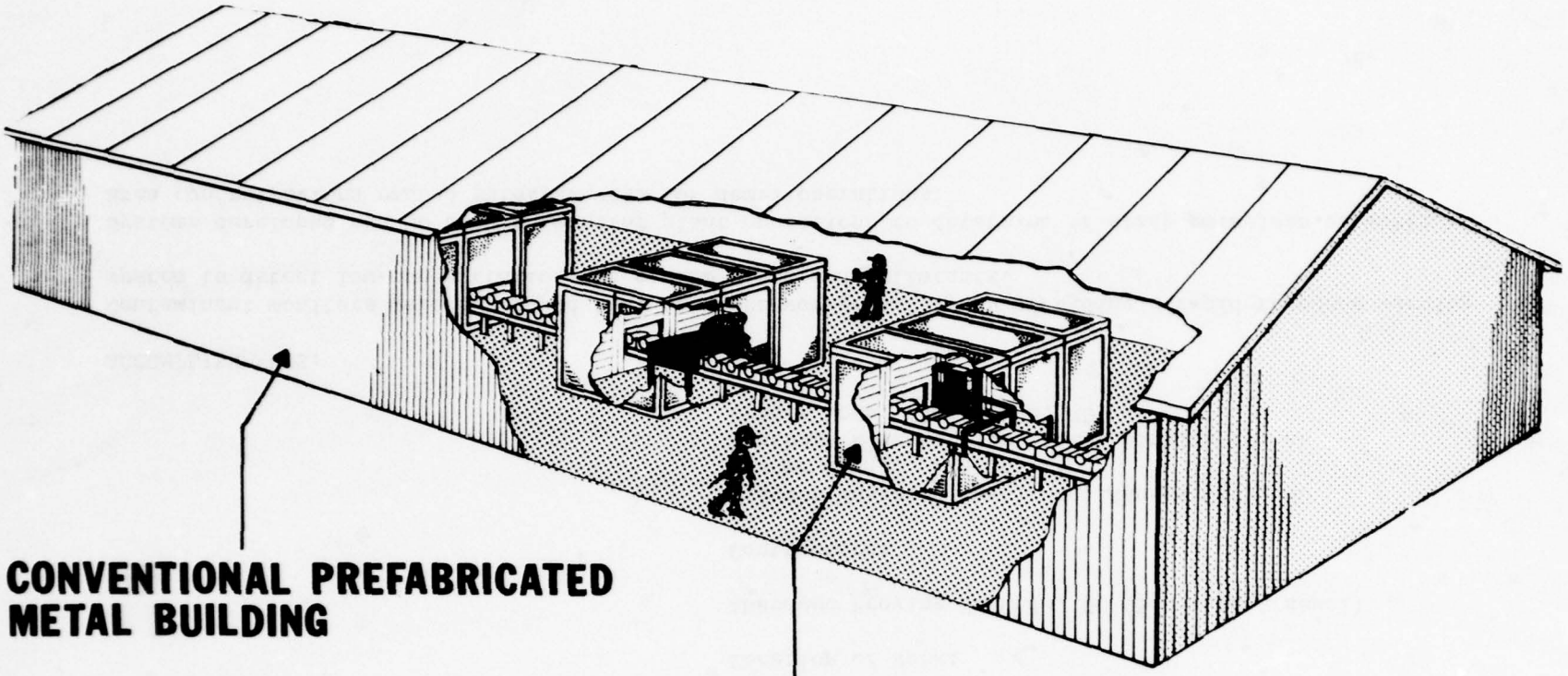
Panels contain the fragments and cool the fireball.

Saved $2,800,000 at Iowa AAP by eliminating a costly conveyor.

CONVENTIONAL STRUCTURE



SUPPRESSIVE SHIELD STRUCTURE



TOXIC AGENTS DETECTION SYSTEM

Provided Highly Sensitive and Fast Response Contaminant Monitors for Army Industrial Operations	575 1277	Mr. Donald C. Behringer Defense Systems Division Development & Engineering Div Aberdeen Proving Grounds, MD	AV 584-2974 (301) 671-2974

Location of Work:

Aberdeen Proving Grounds, MD (Edgewood Arsenal)

Contractors:

Midwest Research Institute, Kansas City, MO
Tracor Corp., Austin, TX
Southern Research Institute, Birmingham, AL
Bendix Corp., Baltimore, MD

ACCOMPLISHMENTS:

Contaminant monitors were developed that increase worker safety by providing a rapid-response warning system to detect low concentrations of contaminants and pollutants.

Systems developed can be used to monitor plant operations to determine if stack emissions or working area concentrations exceed safety levels for demil operations.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

NEW TOXIC AGENT MONITOR

PROJECT NO: 575 1277

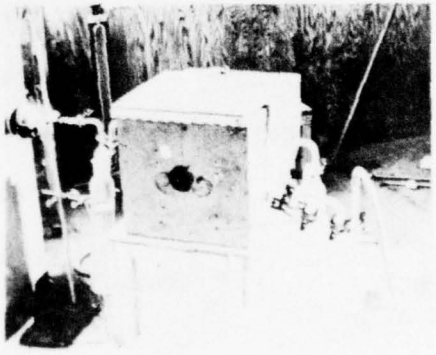
TITLE: MM&T - PROVIDED HIGHLY SENSITIVE AND FAST RESPONSE CONTAMINANT MONITORS FOR ARMY INDUSTRIAL OPERATIONS.

COST: $990,000

BENEFITS

Destruction of Toxic agents was made safer to workers and civilians thru the development of better detection systems.

Monitors for mustard and nerve agents were made more sensitive and faster.



Fuze Power Supply
Electrode Material

571 3025

Mr. A. A. Benderly
Harry Diamond Laboratories
Adelphi, MD 20783

AV 290-3114
(202) 394-3114

Location of Work:

Harry Diamond Laboratories, Adelphi, MD

Contractor/Contract:

Orbital Electric, Co, Phillipsburg, NJ
DAAG39-72-C-0051

Battelle Memorial Institute, Columbus, OH
DAAG39-72-C-0051

Report:

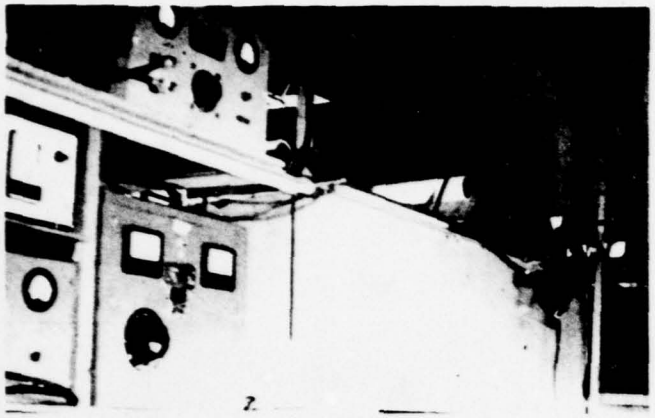
HDL Report R940-75-2, "Strip Plates for Lead/Lead Dioxide Electrode Stock", 15 May 75

ACCOMPLISHMENTS:

The lead/lead dioxide battery is one type of power supply used in many electronic fuzes. Electrical energy is produced in this power supply by the electro-chemical reaction between fluorboric acid electrolyte and lead/lead dioxide electrodes or plates. This project provided a manufacturing and testing procedure for producing reserve energizer electrode stock.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

FUZES



UPPER PART OF PLATING LINE

LOWER PART OF PLATING LINE

PROJECT NO: 5713025

TITLE: FUZE POWER SUPPLY
ELECTRODE MATERIAL

COST: $200,000

BENEFITS

A LOW COST CONTINOUS STRIP PLATING PROCESS IS AVAILABLE FOR PRODUCING LEAD/LEAD DIOXIDE ELECTRODE MATERIAL FOR BATTERIES.

SYSTEM CAN BE USED TO EVALUATE PROCESS CHANGES WITHOUT IMPACTING ON LARGE PRODUCTION FACILITIES.

SYSTEM PROVIDES AN ALTERNATIVE FOR MODERATELY EXPANDING THE PRODUCTION BASE.

BASELINE DATA IS AVAILABLE FOR DESIGNING LARGER FACILITIES.

OTHER BATTERY MATERIALS AND NON-BATTERY COATINGS MAY BE APPLIED TO STRIP MATERIAL.

Fuze Power Supply Ampules 571 3026

Mr. A. A. Benderly
Harry Diamond Laboratories
Adelphi, MD 20783

AV 290-3114
(202) 394-3114

Location of Work: Harry Diamond Laboratories
Adelphi, MD

Contractor/Contract Report: Camin Industries, Inc.
Brooklyn, NY

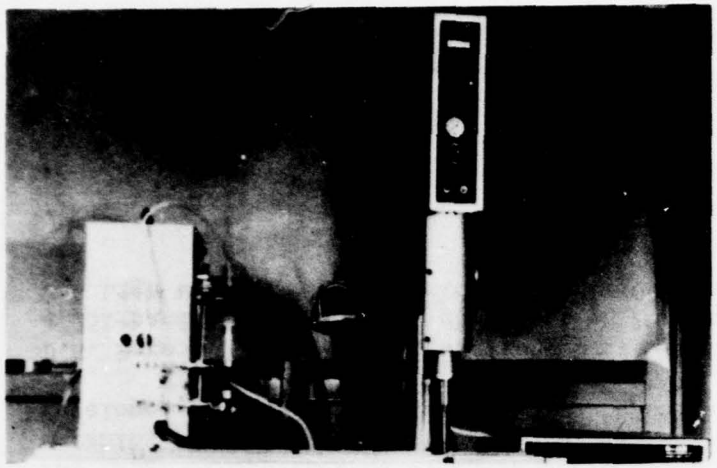
DAAAG39-73-C-0069

ACCOMPLISHMENTS:

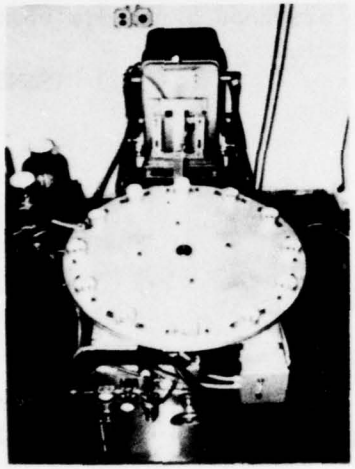
Harry Diamond Laboratories established the assembly line manufacturing technology to produce metal-coated plastic ampules containing acid. In the past this type of ampule was made from glass or copper. These ampules are used in the lead/lead dioxide reserve power supply for fuzes.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

BATTERIES



SECTION VIEW OF AMPULE



PROJECT NO: 5713026

TITLE: FUZE POWER SUPPLY AMPULES

COST: $275,000

BENEFITS

- ESTABLISHED A PRODUCTION PROCESS FOR MANUFACTURING METAL COATED PLASTIC AMPULES.
- COMBINED INJECTION MOLDING, ACID FILLING, ULTRASONIC WELDING, AND PLATING ON PLASTIC TO PRODUCE LOW COST AMPULES.
- IMPROVED ADHESION OF PLATING ON PLASTIC BY INCORPORATING AL-SI-BRONZE POWDER INTO THE POLYPROPYLENE PLASTIC.
- ACHIEVED KERMETIC SEAL OF THE PLASTIC AMPULE USING ULTRASONIC WELDING.
- PROCESS IS BEING CONSIDERED FOR AMPULES TO BE USED IN SMALL CALIBER PROXIMITY FUZES.

Acoustic Delay Line Fabrication	575 3061	Mr. S. I. Lieberman Harry Diamond Laboratories 2800 Powder Mill Road Adelphi, MD 20783	AV 292-2036 (202) 394-2036

Location of Work: Harry Diamond Laboratories
Adelphi, MD

ACCOMPLISHMENTS:

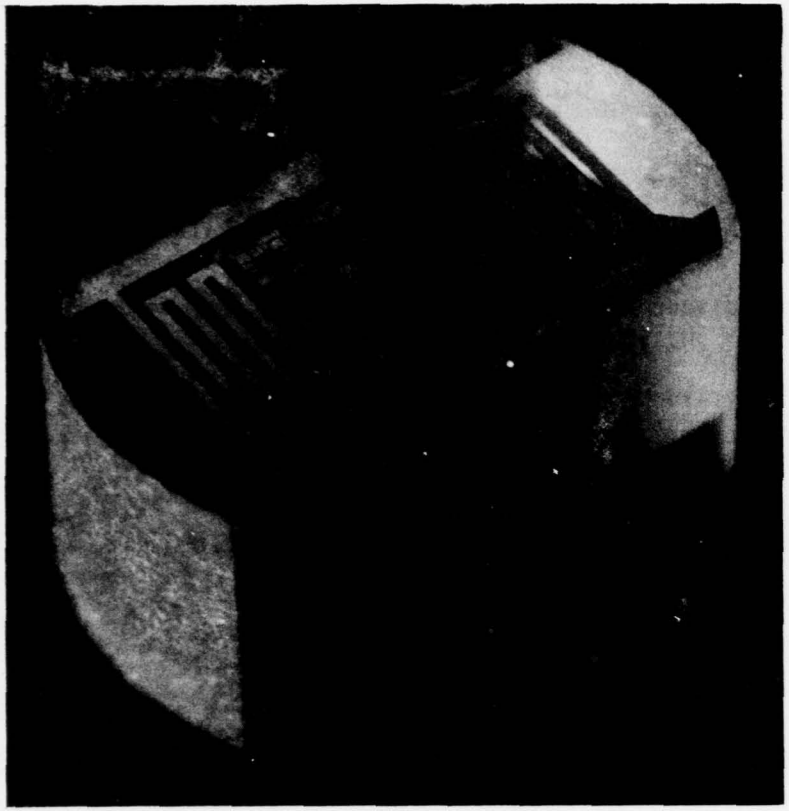
The most common microwave acoustic delay device (delay line) consists of a small crystal with thin-film transducers on each end. The first transducer converts an electro-magnetic signal into a microacoustic wave which propogates through the crystal at the speed of sound (10^4 times slower than electromagnetic waves). The signal is then reconverted to an electromagnetic signal by the other transducer. This signal emerges delayed in proportion to the crystal length.

The range of application of these devices had been slowed by high initial cost, questionable ruggedization, matching problems at high frequencies and some tendency to drift with time. Harry Diamond Laboratories developed new manufacturing processes to solve these problems.

U.S. Patent 3,893,042 was awarded for the self-matched, series array acoustic delay line. Devices had a 25% bandwidth, and 35-40 db insertion loss at 3-4 GHz. They withstood 12,000 to 14,000 g shock and high temperature 80°C storage for 5,000 hours.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

DELAY LINES



DELAY ELEMENT HAVING
SELF-TUNED ARRAYS OF
ACOUSTIC TRANSDUCERS

PROJECT NO: 5753061

TITLE: ACOUSTIC DELAY LINE FABRICATION

COST: $150,000

BENEFITS

HDL developed and patented a thin film transducer that eliminates the need for an impedance matching network at each end of a bulk wave *acoustic delay element.*

HDL used thin film metallization processes and photo-etching techniques to apply transducer arrays on two surfaces of a crystal.

Data is available for setting up a mass production facility for delay elements for fuzing, ranging, radar and ECM.

US PATENT 3,893,048 RESULTED.

Mortar and Artillery Ballistic Simulation for Fuze Testing	576 3095	Mr. Herbert D. Curchack Harry Diamond Laboratories ATTN: DRXDO-TSE Adelphi, MD 20783	AV 290-2804 (202) 394-2804

ACCOMPLISHMENTS:

The project objective was to provide economical evaluation of fuse performance to validate manufacturing methods introduced while undergoing transition from final prototype design into full scale production.

A spin-catcher was developed for evaluating power supplies and safing and arming fabrication methods in the laboratory. This will permit reduction of field tests.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

FUZE TESTING

BENEFITS

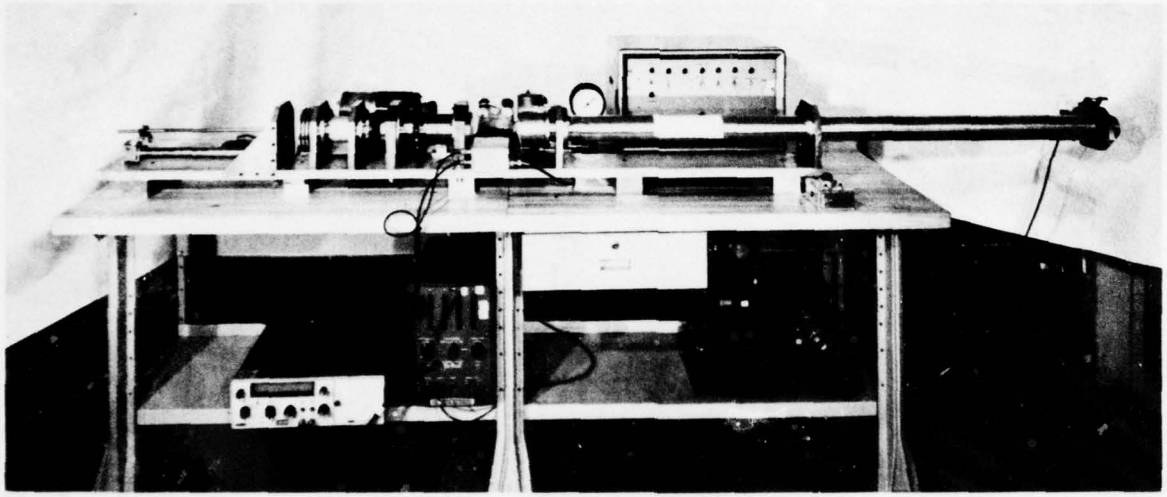
HDL developed a tester for providing 2,000 G's linear acceleration and 300 revolutions per second rotation.

PROJECT NO: 5763095

TITLE: MORTAR AND ARTILLERY BALLISTIC SIMULATION FOR FUZE TESTING.

COST: $139,000

The tester simulates setback force and spin to reduce need for live firing of fuzes, power supplies, electronics, & other components. Unit includes an acceleration tube, vacuum accelerating system, spinning deceleration block (below), and readout equipment.



BALLISTIC SIMULATOR

Convert E-Bldg (Batch Filtration Wash Building) to Continuous RDX Filtration and Washing Prototype	572 4016 573 4016 574 4016	Mr. James Turner Picatinny Arsenal	AV 880-3859 (201) 328-3859

Location of Work: Picatinny Arsenal
Dover, NJ

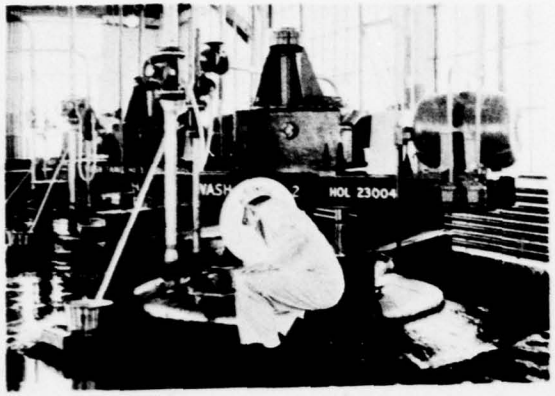
Holston AAP
Kingsport, TN

ACCOMPLISHMENTS:

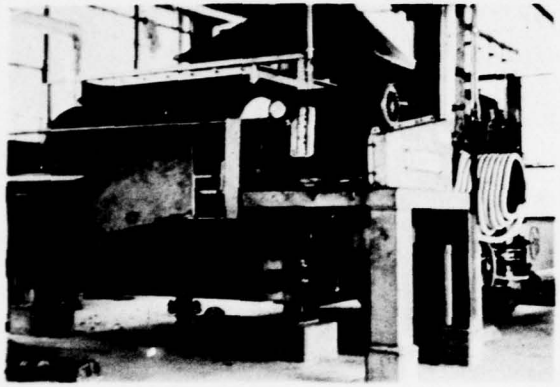
This program provided a prototype facility for continuoulsy filtering and washing RDX at the rate of 4.5 million pounds per month. In subsequent operations the RDX will be recrystallized and coated with wax to form Composition A-7. The A-7 will then be incorporated with TNT to form Composition B.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

EXPLOSIVES MANUFACTURE



EQUIPMENT BEING REPLACED



NEW EQUIPMENT

PROJECT NO: 5724016; 5734016; 5744016

TITLE: CONVERT E-BLDG (BATCH FILTRATION WASH BUILDING) TO CONTINOUS RDX FILTRATION AND WASHING PROTOTYPE

COST: $840,000; $480,000; $150,000

BENEFITS

DEVELOPED A MODERNIZED CONTINUOUS FILTRATION AND WASH PROCESS THAT RESULTS IN LESS EXPLOSIVE IN THE BUILDING.

PRODUCTION RATE WAS INCREASED 50% AND FLOOR SPACE WAS REDUCED SIGNIFICANTLY.

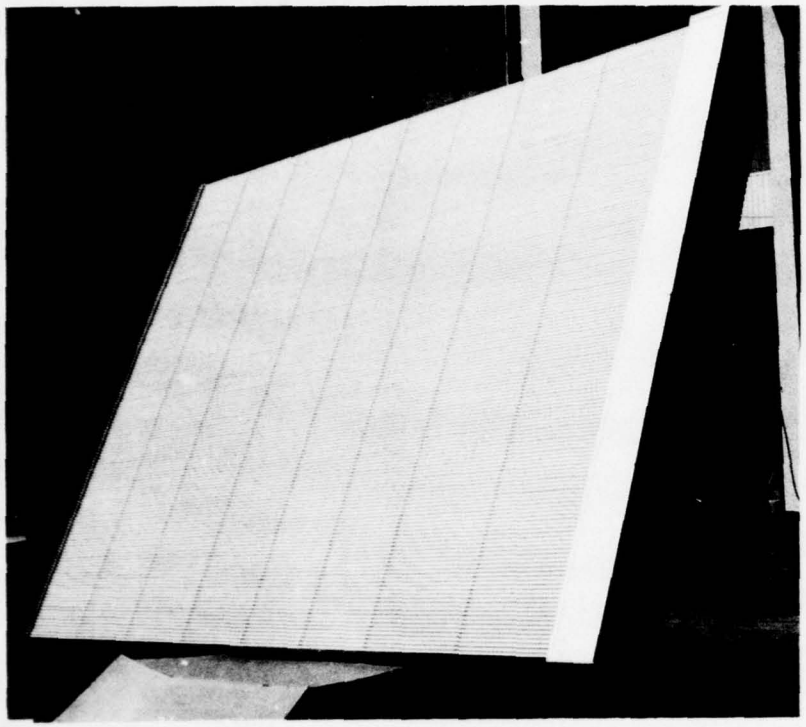
IMPROVED SAFETY TO PERSONNEL BY RELOCATING CONTROL INSTRUMENTATION BEHIND PROTECTIVE BARRIERS.

SERVES AS A DESIGN BASIS FOR FUTURE FACILITIZATION.

MM&T Application of Radar to Ballistic Acceptance Testing of Ammunition (ARBAT)	574 4139	Mr. O. A. Briedis Army Armament R&D Command Picatinny Arsenal DRDAR- Dover, NJ 07801	AV 880-3776
		Mr. Fred Fitzsimmons Army Armament R&D Command DRDAR-QAS Dover, NJ 07801	AV 880-5528

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

AMMUNITION TEST



PHASED ARRAY ANTENNA

PROJECT NO: 574 4139

TITLE: MM&T APPLICATION OF RADAR TO BALLISTIC ACCEPTANCE TESTING OF AMMUNITION (ARBAT)

COST: $1,110,000

BENEFITS

ITT GILFILLAN DEVELOPED A PHASED ARRAY RADAR SYSTEM FOR CHECKING A PROJECTILE OVER ITS ENTIRE TRAJECTORY.

THE SYSTEM IS MADE UP OF TRANSMITTER-RECEIVER, FREQUENCY SYNTHESIZER, DATA PROCESSOR AND DISPLAY, ANTENNA, SERVO SYSTEM, AND INSTRUMENTATION.

ONE SYSTEM IS IN USE AT YUMA PROVING GROUND. OTHER SYSTEMS ARE ANTICIPATED FOR USE AT FIVE ADDITIONAL PROVING GROUNDS.

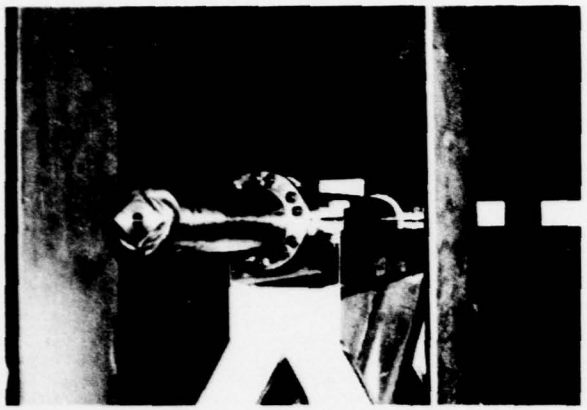
ROUND MALFUNCTIONS MAY BE TRACKED OVER THE FULL TRAJECTORY TO REDUCE COSTLY MALFUNCTION ANALYSIS, AND ACCEPTANCE OF DEFECTIVE LOTS.

PROPELLANT ACCEPTANCE

Acceptance of Propellant Produced Via Continuous Processes	573 74 75 4186	Mr. Patrick Serao Army Armament Research and Development Command DRDAR-QAS Dover, NJ 07801	AV 880 6534 (201) 328 6534

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

EXPLOSIVES



COMBUSTION END OF DYNAGUN IN STAND

ENERGY ABSORBER END OF DYNAGUN IN STAND

PROJECT NO. 5734186, 5744186, 5754186

TITLE: ACCEPTANCE OF PROPELLANT PRODUCED BY THE CONTINUOUS PROCESS.

COST: $507,000; $325,000; $160,000

BENEFITS

Developed the computerized data acquisition system in use at Radford Army Ammunition Plant for testing all batch propellant production.

Developed the DYNAGUN, a ballistic simulator for the 155mm Howitzer, to non-ballistically determine charge weight and uniformity of propellant.

Established a data base for single base propellant production upon which CASBL product limits can be set to assure quality production.

Acceptance of Propellant Produced Via Continuous Processes	574 4186	Mr. Patrick Serao Army Armament Research and Development Command DRDAR-QAS Dover, NJ 07801	AV 880 6534 (201) 328 6534

Contractor:
CALSPAN Corp.

Contract:
DAAA 21-74-C-0401

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROPELLANT

BENEFITS

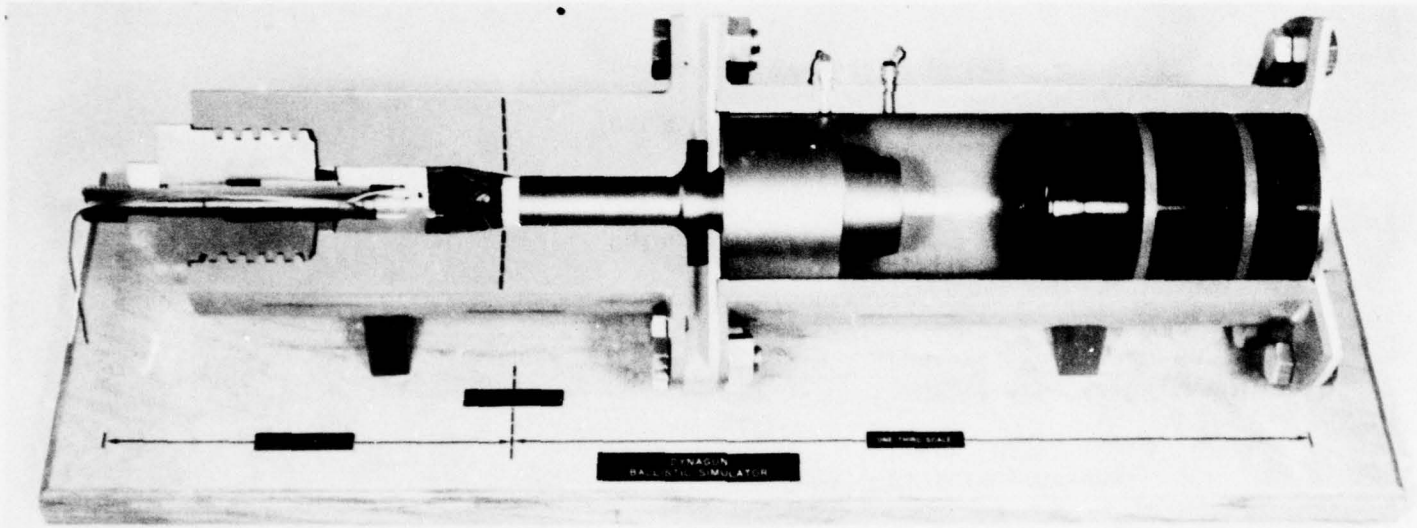
DEVELOPED THE DYNAGUN AS A LABORATORY BALLISTIC SIMULATOR.

ALSO DEVELOPED MATH MODELS OF INTERIOR BALLISTICS OF THE M86E1 AND M4A2 PROPELLING CHARGES.

PROJECT NO: 574 4186

TITLE: MM&T ACCEPTANCE OF PROPELLANT PRODUCED VIA THE CONTINUOUS PROCESS

COST: $325,000



DYNAGUN BALLISTIC SIMULATOR

THE DYNAGUN TEST SYSTEM WAS PROVEN AT RADFORD ARMY AMMUNITION PLANT AS AN ACCEPTABLE TEST METHOD

Acceptance of Propellant Produced by the Continuous Process	573 4186 574 4186 575 4186	Mr. Patrick Serao Picatinny Arsenal SARPA-QA-X Dover, NJ	AV 880-5364 (201) 328-5364

Location of Work: Picatinny Arsenal
Dover, NJ

Radford Army Ammunition Plant
Radford, VA

Contractors/Contracts:

University of Illinois	-	DAAA21-73-C-0549 DAAA21-75-C-006
Princeton University	-	DAAA21-74-C-0332
CALSPAN Corp	-	DAAA21-74-C-0411
University of Massachusetts	-	DAAA21-74-C-0511

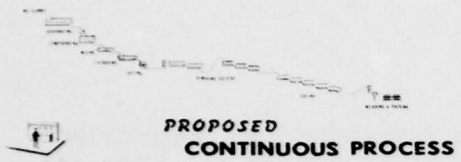
ACCOMPLISHMENTS:

The advent of high volume, continuous production of propellant required improved methods for propellant acceptance. This project established new testing techniques for rapid testing and analysis of propellants and a Quality Assurance Plan for continuous manufacture of single base propellant.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROPELLANT ACCEPTANCE

CURRENT
BATCH METHOD



PROPOSED
CONTINUOUS PROCESS

PROJECT NO: 573 74 75 4186

TITLE: ACCEPTANCE OF PROPELLANT PRODUCED VIA CONTINUOUS PROCESSES

COST: $507,000; 325,000; 160,000

BENEFITS

1. Established rapid test techniques and test ports in continuous single base propellant lines. Acceptable product can be assured with minimum acceptance testing and firing.
2. Applied accelerated chemical extraction and computerized gas chromatography to analysis of both dough and grains.
3. Developed the dynagun ballistic simulator to assess propellant uniformity.
4. Procured a computerized data acquisition and analysis system for closed bomb testing of propellant production at Radford AAP.
5. All this resulted in a tech data package for M1 propellant testing.

Safety Engineering in Support of Ammunition Plants	574 4201	Mr. Richard M. Rindner Project Coordinator ARRADCOM, LCWSL Manufacturing Technology Division DRDAR-LCM Dover, NJ 07801	AV 880-3828 (201) 328-3828

Location of Work: Picatinny Arsenal, several Army Ammunition Plants, and other installations

ACCOMPLISHMENTS:

ARRCOM initiated a program in 1971 to upgrade the safety standards of existing and new ammunition plants. This project provided the required data to upgrade designs of protective structures, processes, and facilities in support of Army's Modernization and Expansion Program. The areas of consideration for the FY 75 project were: a) TNT equivalency tests, b) sensitivity studies, c) blast effects and loading, d) structural response and design, e) hazard classification and special design studies.

5744201, 5754201

SIMULATED CONVEYOR LINE TEST SETUP
155mm SHELL SEPARATION TEST

Safety Engineering in Support of Ammunition Plants	574 4201	Mr. Richard M. Rindner Project Coordinator ARRADCOM, LCWSL Manufacturing Technology Division DRDAR-LCM Dover, NJ 07801	AV 880-3828 (201) 328-3828

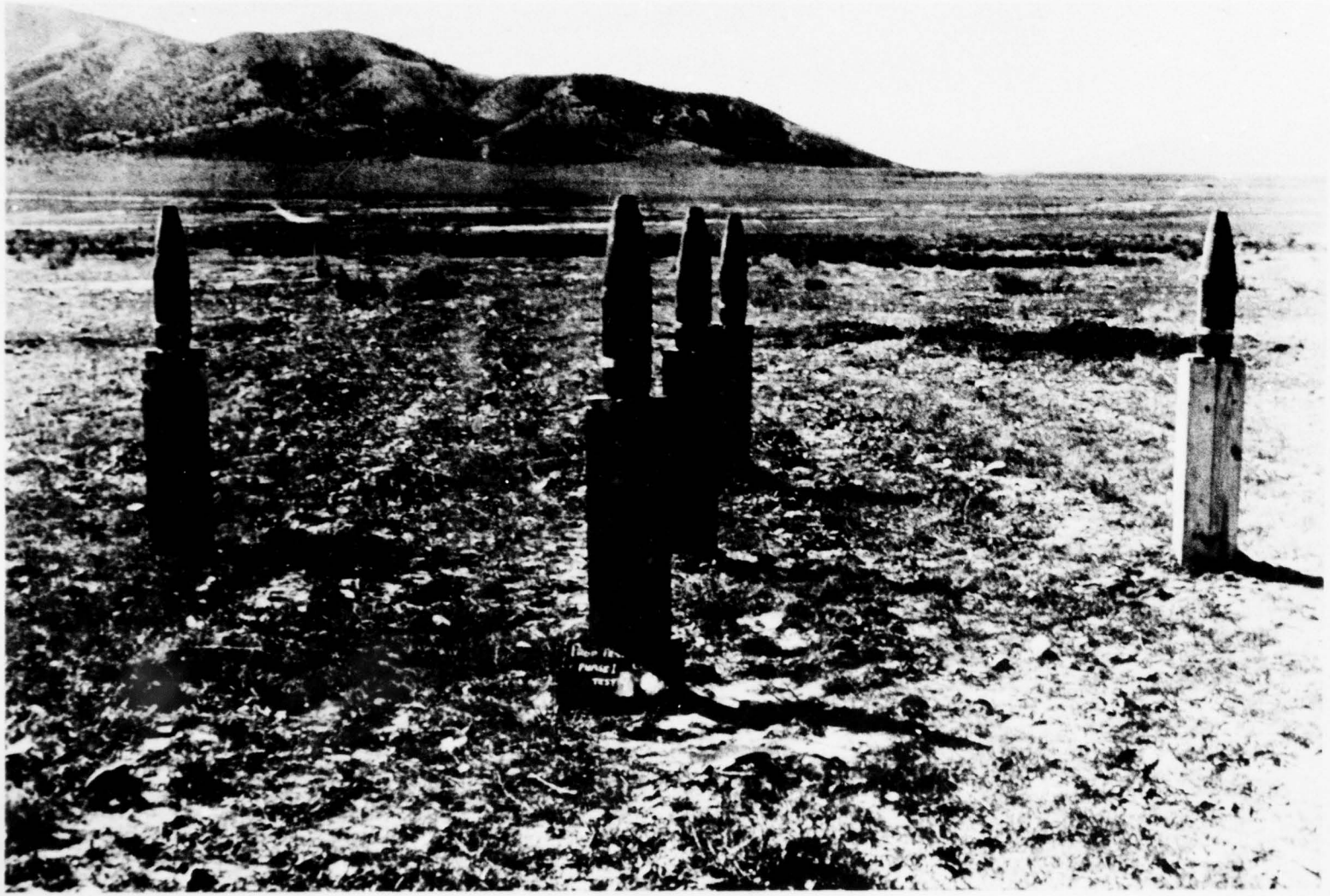
Location of Work: Picatinny Arsenal, several Army Ammunition Plants, and other installations

ACCOMPLISHMENTS:

ARRCOM initiated a program in 1971 to upgrade the safety standards of existing and new ammunition plants. This project provided the required data to upgrade designs of protective structures, processes, and facilities in support of Army's Modernization and Expansion Program. The areas of consideration for the FY 75 project were: a) TNT equivalency tests, b) sensitivity studies, c) blast effects and loading, d) structural response and design, e) hazard classification and special design studies.

5744201, 5754201

155mm SHELL SAFE SEPARATION TEST SETUP

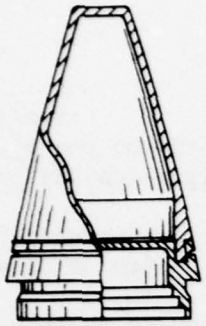


Production Sealing Equipment for Fuzes	575 4204	Mr. Ray P. Mutchler Army Armament Research and Development Command DRDAR-SCF-DD Dover, NJ 07801	AV 880-6109 (201) 328-6109
		Mr. Andrew T. Devine Army Armament Research and Development Command Large Caliber Ammunition Organics & Adhesives DRDAR-LCA-OA Dover, NJ 07801	AV 880-3187 (201) 328-3187
		Harry Diamond Laboratories 2800 Powder Mill Road Adelphia, MD	AV 290-1551 (202) 394-1551

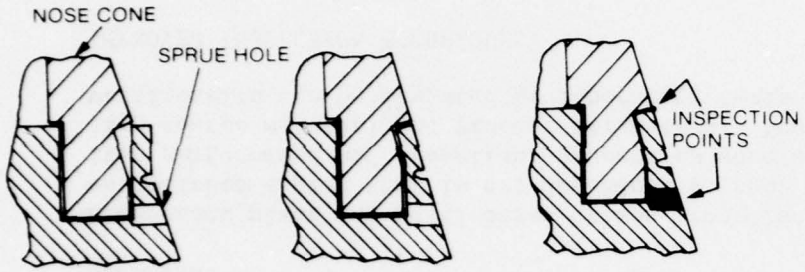
Twenty-four (24) methods of waterproofing a fuze were researched. Many were inadequate and ineffective. Guidelines were then developed for future designs of fuzes having optimum leak-proofness and production economy. Technical Report 4937, Seal Integrity of Selected Fuzes as Measured by Three Leak Test Methods, Sept 1976, resulted.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

FUZE PRODUCTION



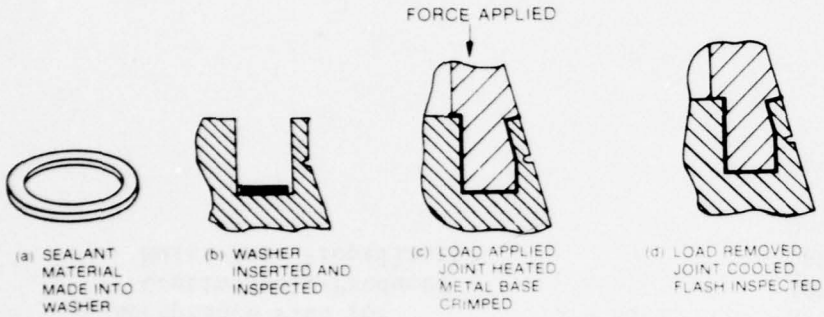
SEALED M728 FUZE RADOME



(a) NOSE CONE SET INTO METAL BASE

(b) METAL BASE CRIMPED

(c) THERMOPLASTIC SEALANT INJECTED



(a) SEALANT MATERIAL MADE INTO WASHER

(b) WASHER INSERTED AND INSPECTED

(c) LOAD APPLIED JOINT HEATED METAL BASE CRIMPED

(d) LOAD REMOVED JOINT COOLED FLASH INSPECTED

PROJECT NO: 575 4204

TITLE: PRODUCTION SEALING EQUIPMENT FOR FUZES

COST: $425,000

BENEFITS

HDL developed several methods for attaching and sealing plastic radomes (ogives) to metal fuze bodies.

HDL recommended:

- **An injection sealing technique using a hot-melt polyamide—versalon 1140—adhesive, or**
- **A compression sealing method using a pre-molded versalon 1140 "washer".**

Both processes are readily adaptable to automatic production, and result in seals that withstand temperature shock, humidity, and aging.

Acceptance Plan for Continuously Produced Multi-Base Propellants

576 4301

Mr. Patrick Serao
ARRADCOM
DRDAR-QAS
Dover, NJ

AV 880-6534
(201) 328-6534

Location of Work: HQ, ARRADCOM
Dover, NJ

Radford Army Ammunition Plant
Radford, VA

Princeton University
Princeton, NJ

BENEFITS:

Acceptance plans for multi-based cannon propellants were based on ballistic firings. This project established a plan that is not dependent on such testing. Mathematical relationships between end item performance and propellant properties were established. These relationships were translated into source material and process parameters. Now, gun firings for charge assessment for uninformity verification can be replaced by laboratory tests and process controls.

IMPROVED INSPECTION TECHNIQUES:

A new procedure for making physical measurements of propellant granules is being evaluated at Radford Army Ammunition Plant (RAAP). The new technique will provide results in 30 minutes compared to the 24 hours required by the present technique.

The change to automated continuous propellant manufacturing, necessitated faster and more efficient analytical techniques for propellant acceptance.

The present system (left figure) involves microscopic examination, hand recording of 210 measurements, key punching and computer analysis for each lot while the new system (right figure) utilizes an image analyzer.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROPELLANT ACCEPTANCE

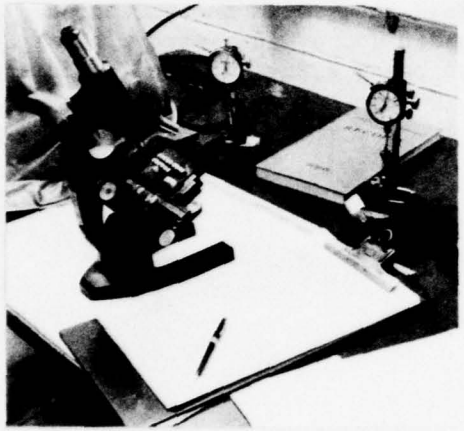
BENEFITS

- Developed a new procedure for measuring continuously produced multi-based propellant grain size.
- New procedure takes only ½ hour that formerly required 24 hours.
- System is implemented at Radford AAP.

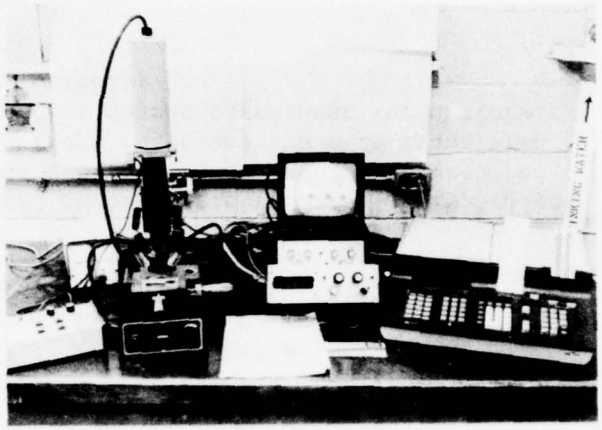
PROJECT NO: 576 4301

TITLE: ACCEPTANCE PLAN FOR CONTINUOUSLY PRODUCED MULTI—BASE PROPELLANT

COST: $395,000



HAND PROCEDURE INVOLVED 210 MICROSCOPIC EVALUATIONS, RECORDINGS, KEY PUNCHINGS AND COMPUTER ANALYSIS.



MECHANIZED SYSTEM USES A TV MONITOR WITH A GRATICULE MOVABLE BY AN OPERATOR ACROSS ITS FACE. THE GRATICULE INPUTS DATA INTO A DESK CALCULATOR WHICH PROVIDES IMMEDIATE PRINTOUT OF GRANULE SIZE.

Acceptance Criteria for Continuous Single Base Propellant	576 4302	Mr. Patrick Serao ARRADCOM DRDAR-QAS Dover, NJ	AV 880-6534 (201) 328-6534

Location of Work: HQ, ARRADCOM
Dover, NJ

Radford Army Ammunition Plant
Radford, VA

Princeton University
Princeton, NJ

BENEFITS:

Acceptance plans for single based cannon propellants were based on ballistic firings. This project established a plan that is not dependent on such testing. Mathematical relationships between end item performance and propellant properties were established. These relationships were translated into source material and process parameters. Now, gun firings for charge assessment for uniformity verification can be replaced by laboratory tests and process controls.

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A new procedure for making physical measurements of propellant granules is being evaluated at Radford Army Ammunition Plant (RAAP). The new technique will provide results in 30 minutes compared to the 24 hours required by the present technique.

The change to automated continuous propellant manufacturing necessitated faster and more efficient analytical techniques for propellant acceptance.

The present system (left figure) involves microscopic examination, hand recording of 210 measurements, key punching and computer analysis for each lot; the new system (right figure) utilizes an image analyzer.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROPELLANT TEST

PROJECT NO: 576 4302

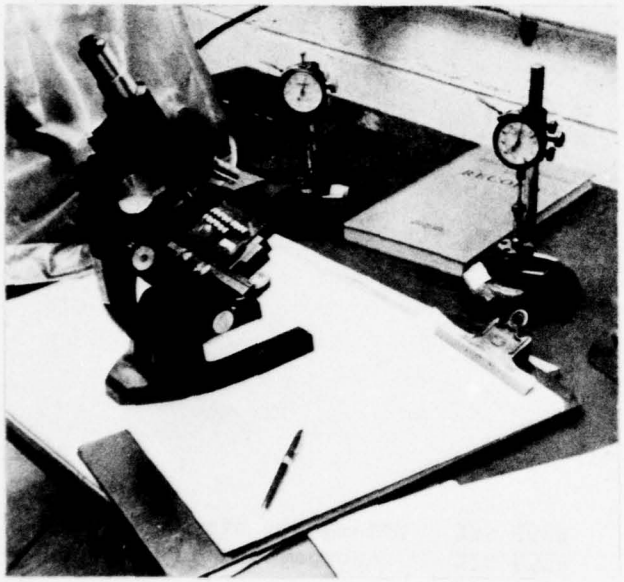
TITLE: MMT ACCEPTANCE CRITERIA FOR CONTINUOUS SINGLE BASE PROPELLANT

COST: $440,000

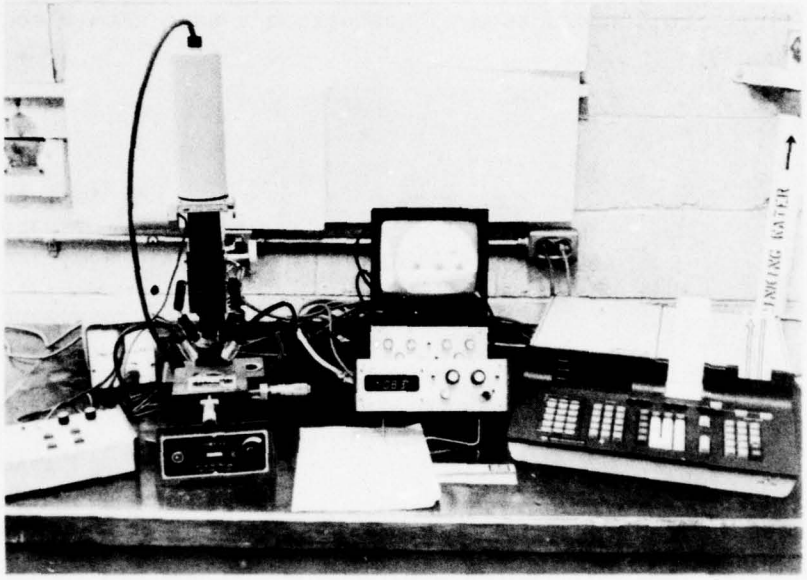
BENEFITS

REPLACES A MANUAL-VISUAL INSPECTION SYSTEM FOR MEASURING PROPELLANT DIMENSIONS.

ESTABLISHED NON-BALLISTIC ACCEPTANCE METHODS AND LOT HOMOGENEITY LIMITS FOR CONTINUOUSLY PRODUCED M1 PROPELLANT.



OLD MANUAL-VISUAL METHOD



SEMI-AUTOMATED TELEMICROSCOPE

Adaptation of Automatic/ Dynamic Static Regulation

574 6558
575 6558

Mr. David J. Reap
ARRADCOM
DRDAR-LCU-P
Dover, NJ

AV 880-3790
(201) 328-3790

Location of Work: Frankford Arsenal
Philadelphia, PA

Contractor/Contract:

Westclock Div.
General Time Corp.
LaSalle, IL

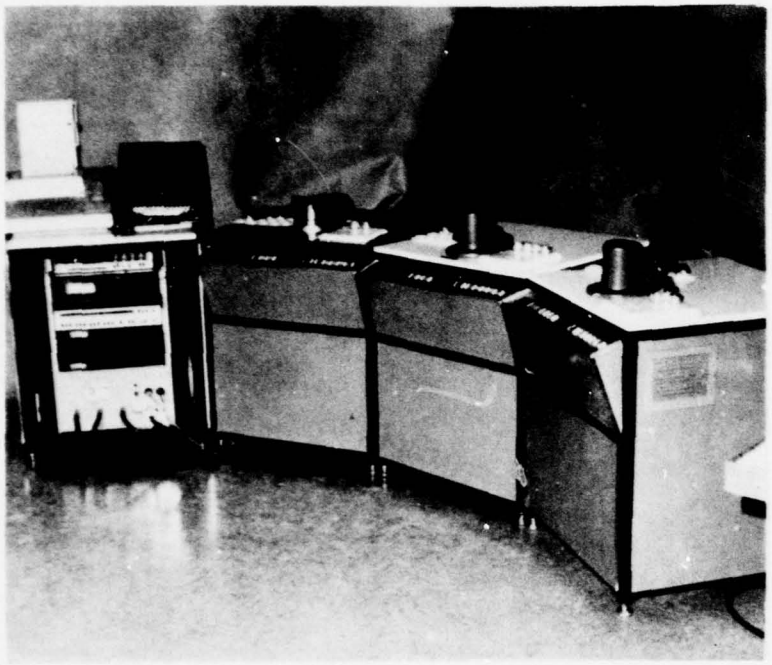
DAAA25-76-C-0097

ACCOMPLISHMENTS:

Regulation adjustment of fuze timing movements has always been a bottleneck to mass production. This operation was performed on a manual trial and error basis by highly skilled operators. This problem has been overcome by the application of the computer controlled Automatic Fuze Regulation System.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

FUZES



COMPUTER CONTROLLED TESTER

PROJECT: 574 6558 & 575 6558

TITLE: MM&T — ADAPTATION OF AUTOMATIC/ DYNAMIC STATIC FUZE REGULATION

COST: $250,000 & $315,000

BENEFITS

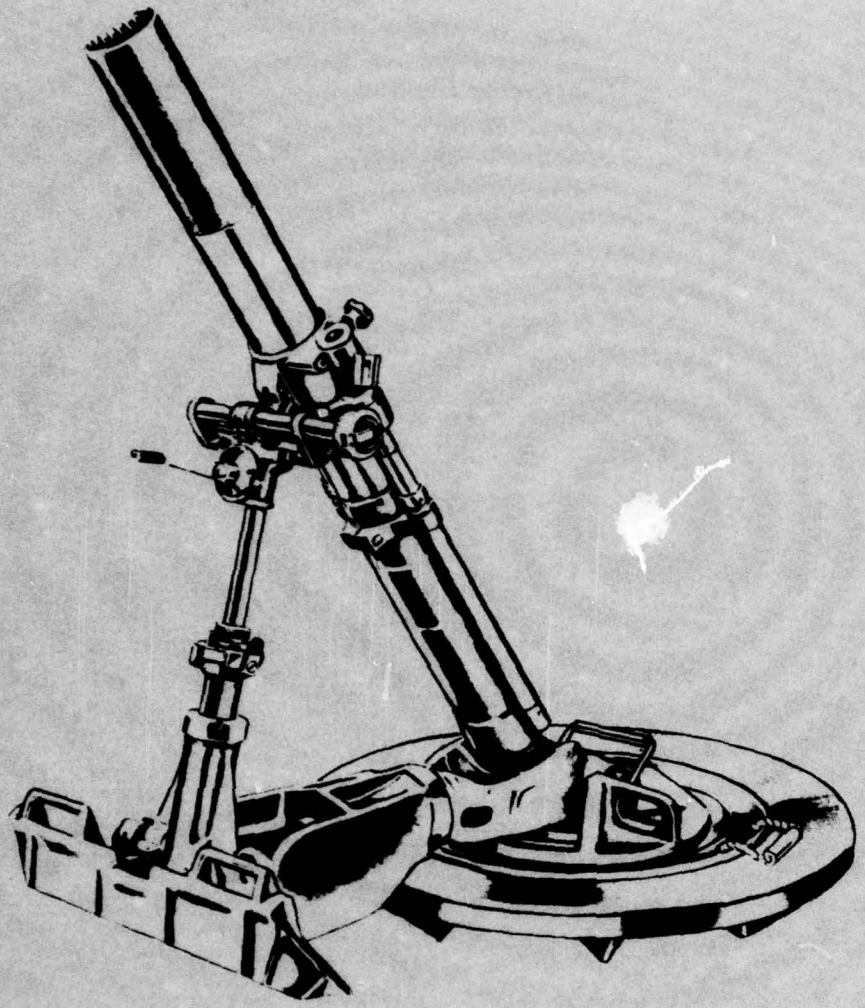
Bulova developed an engineering model of a Computer Controlled Automatic Dynamic Fuze Regulation System.

Unit was tested at Westclox Division of General Time on Mechanical Time Super Quick (MTSQ) M564 fuzes.

A light beam and photocell detect oscillating lever frequency and an SPC-12 computer adjusts the fequency by setting the adjusting blocks.

One computer monitors work at 3 test stations.

Equipment is now installed at Frankford Arsenal.



ARRCOM/ARRADCOM
(WEAPONS)

ARRCOM/ARRADCOM

MM&T Representatives:

Mr. Arnie Madsen
US Army Armament Materiel
Readiness Command
DRSAR-IRW
Rock Island Arsenal
Rock Island, IL 61299

AV 793-3166
(309) 794-3166

Mr. Joseph DiBenedetto
Rock Island Arsenal
SARRI-EN
Rock Island, IL 61299

AV 793-4627
(309) 794-4627

Mr. Leonard Slawsky
Watervliet Arsenal
DRDAR-LCB-S
Watervliet, NY 12189

AV 974-5125
(581) 266-5125

Mr. Eugene Kelly
US Army Armament R&D Command
Large Caliber Weapons Systems
Laboratory
DRDAR-LC
Dover, NJ 07801

AV 880-4240
(201) 328-4240

A R R C O M

INDEX

Application of An Improved Machine for Automatic Step Threading of Rotary Breech Blocks and Rings

671 6771

Mr. Charles Rose
U.S. Army Armament Research and Development Command
DRDAR-LCB-SE
Watervliet Arsenal, NY 12189

AV 974-5611
(518) 266-5611

Work done at: Large Caliber Weapon System Laboratories
DRDAR-LCB-TL
Watervliet, NY 12189

Report: ARLCB-TR-77033

ACCOMPLISHMENTS:

The project covered the engineering design, development and application of equipment to produce step threads (constant lead thread of two or more diameters) on the breechblocks of cannon.

The equipment uses a blade type tool with the part being threaded through shaper type cuts until finish size is reached. The use of this equipment reduces floor-to-floor time from 7.5 hours to 2.0 hours while producing better thread finishes and more accurate dimensions.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

BREECH BLOCKS

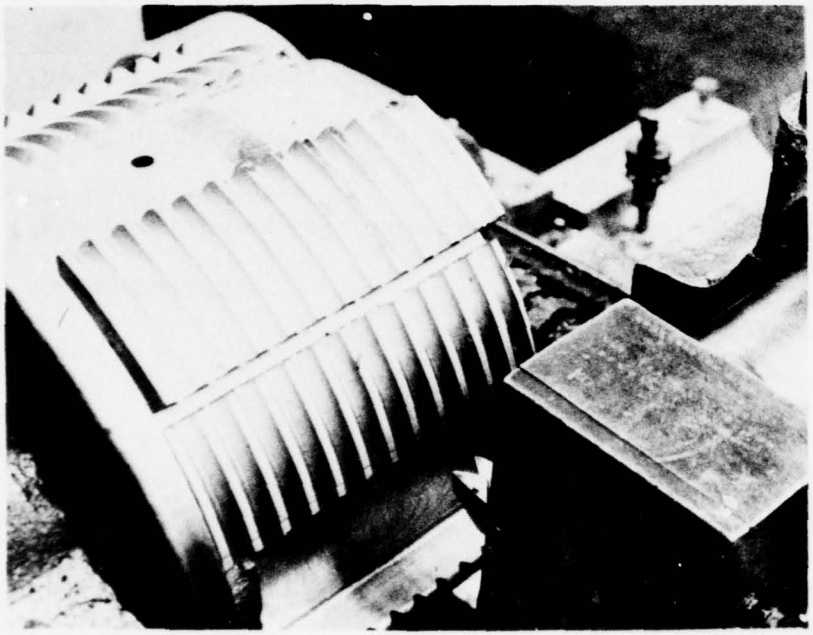
PROJECT NO: 6716771

TITLE: MM&T -- APPLICATION OF AN IMPROVED MACHINE FOR AUTOMATIC STEP THREADING OF ROTARY BREECH BLOCKS AND RINGS.

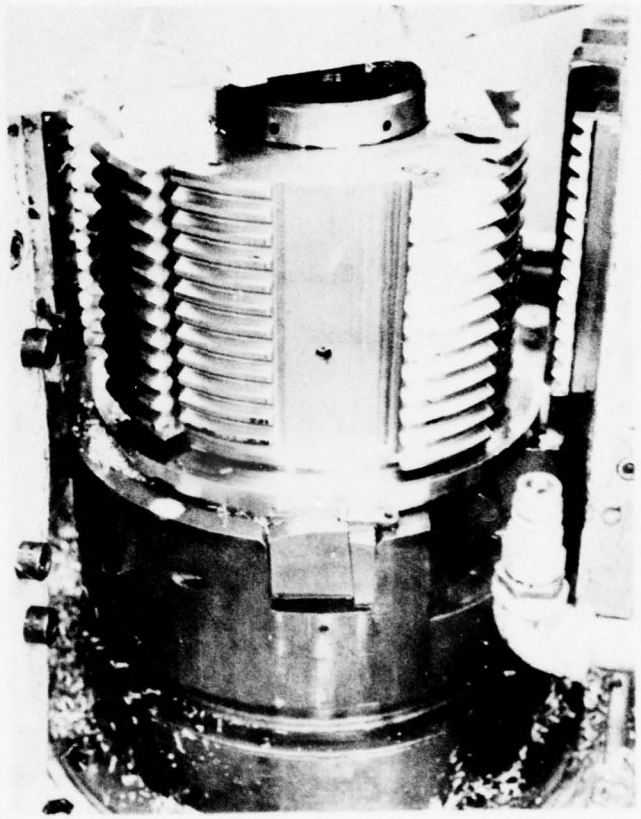
COST: $125,000

BENEFITS

Watervliet built full form tooling that cuts step threads as the part on the center spindle oscillates past it. Floor-to-floor time is cut from 7.5 hrs to 2 hrs. Savings on 175mm breeches are $37,000 per year. Also reduces finish machining and inspection time 3 hours.



OLD METHOD -- SINGLE POINT TURNING



NEW METHOD -- FULL FORM TURNING

Design and Construction of a Refined Step Threading Machine	674 6771	Mr. Charles H. Rose U.S. Army Armament Research and Development Command DRDAR-LCB-SE Watervliet Arsenal, NY	AV 974-5611 (518) 266-5611

ACCOMPLISHMENTS:

Fairfield Machine Co., Columbiana, OH, rebuilt the Fairfield step threader machine supplied by Watervliet Arsenal.

Cutter blades were built by Custom Tool Co., Holyoke, MA and Trojan Machine Co., Watervliet, MA.

The step threader is in use at Watervliet Arsenal's Machine Processer Shop on 175mm and 8 inch breech rings. Gaging takes place while the ring is on the machine.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROJECT NO: 6746771

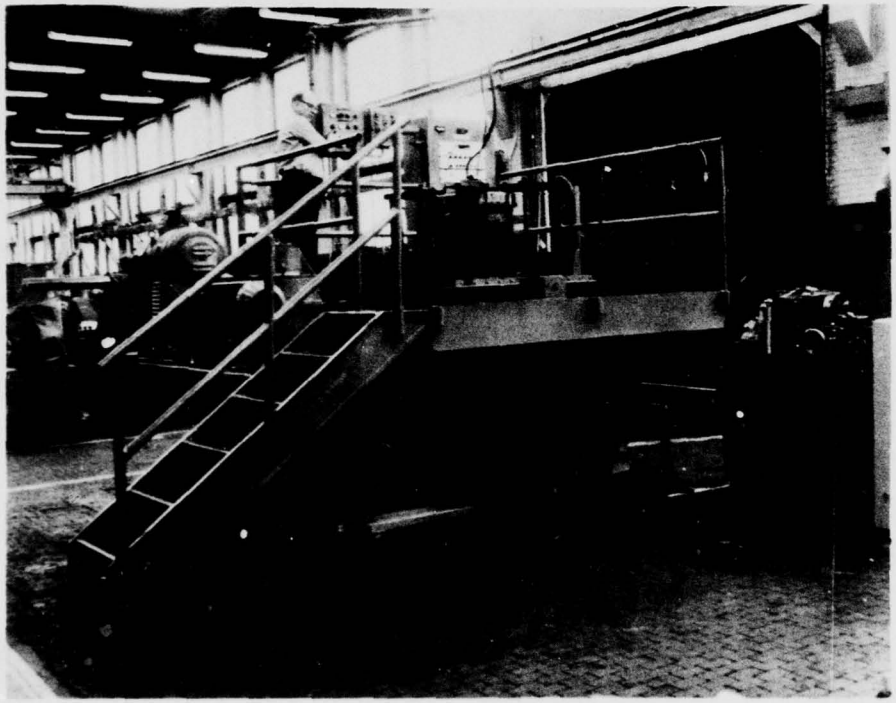
TITLE: MM&T -- DESIGN AND CONSTRUCTION OF A REFINED STEP THREADING MACHINE

COST: $195,000

BENEFITS

The Fairfield step threading machine procured on an earlier project was improved on this project.

Allows gaging of breech ring while it is on the machine.



IMPROVED FAIRFIELD STEP THREADING MACHINE

Application of a Boring Guidance System Package To All Large Cannon Boring Lathes	669 6776	Mr. Phillip Casey DRDAR-LCB-SE Chief, Machine Processes Div. Benet Weapons Lab.	AV 974-5737 (518) 266-5737

ACCOMPLISHMENTS:

The 155mm boring system package was integrated with a boring lathe and problems with alignment, lubrication and coolant were solved.

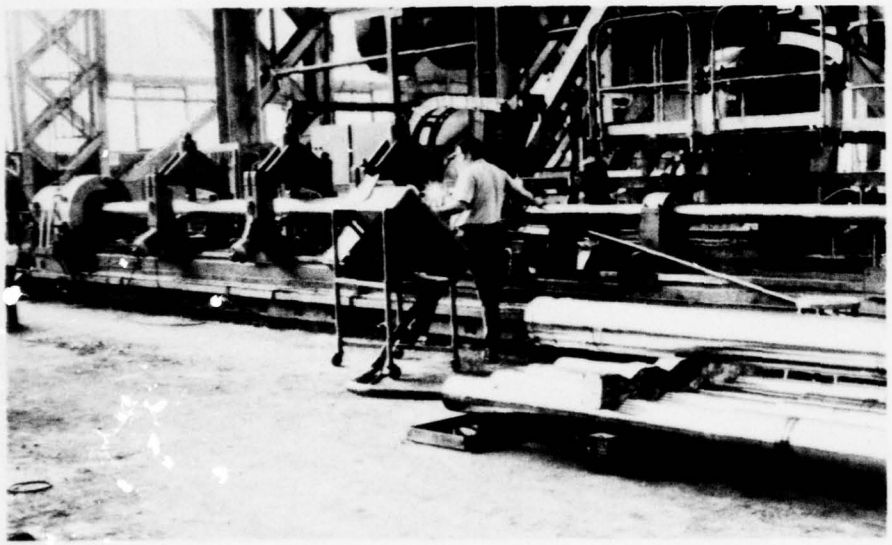
A servo system was applied to maintain a given pressure in the hydrostatic bearing and bearing pads. Following testing, the machine was placed in use at Watervliet Arsenal's Machine Processer Shop where it accurately produces the 155mm tube bore in one pass.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROJECT NO: 6696776

TITLE: MM&T - APPLICATION OF A BORING GUIDANCE SYSTEM PACKAGE TO ALL LARGE CANNON BORING LATHES.

COST: $184,000



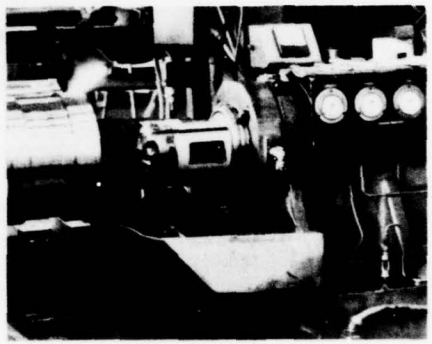
GUIDED BORING MACHINE FOR 155MM GUN TUBES

BENEFITS

Watervliet Arsenal applied a Boring Guidance Package to a Century-Detroit Boring Lathe and reduced Boring Time from 36 hours to 16 hours.

Saved $1,060,000 on 2,000 155MM gun tubes. Also saved $1,800,000 on tool maintenance.

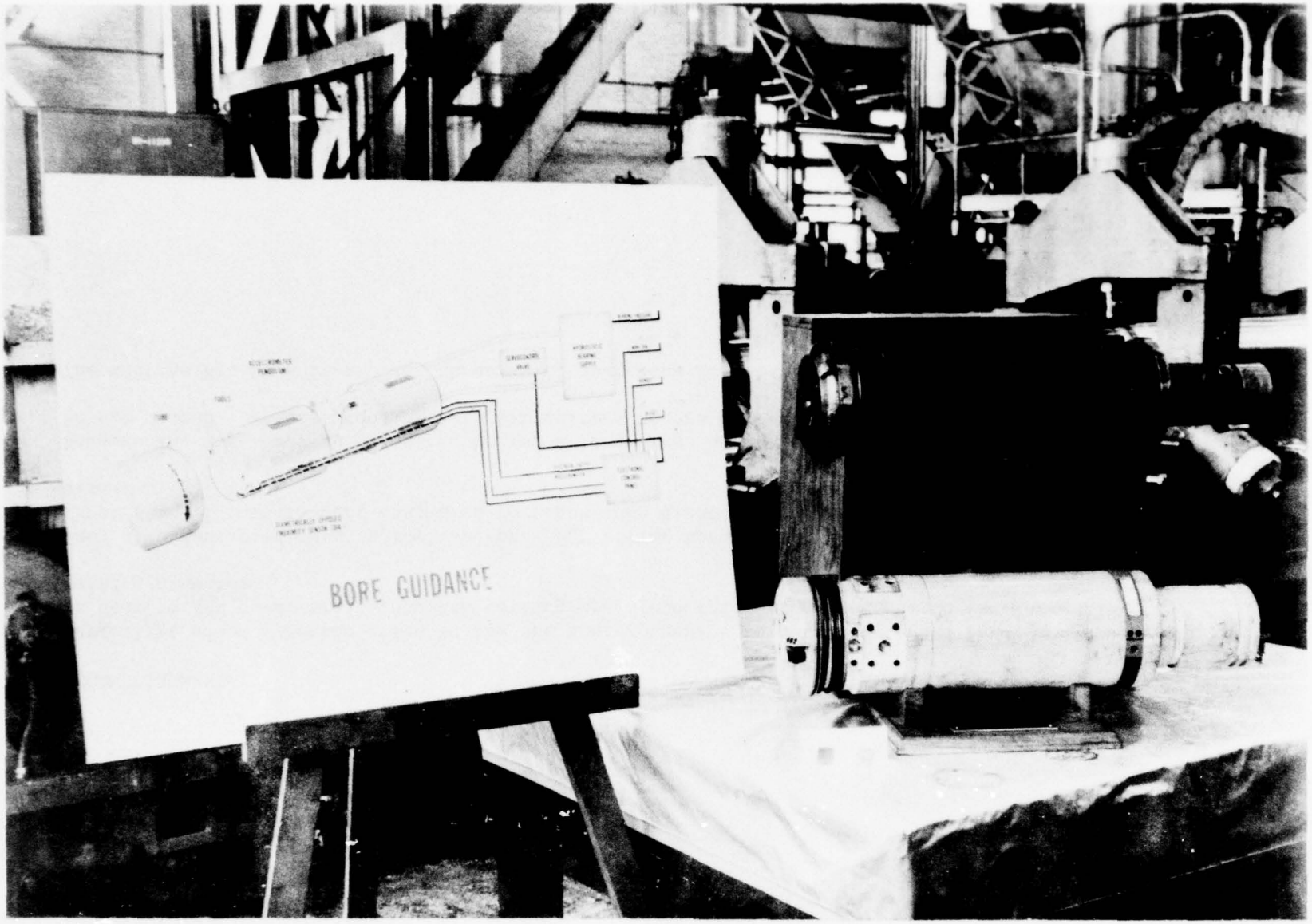
The package is applicable to all large gun tube boring.



Application of a Boring Guidance System To All Large Cannon Boring Lathes	669 6776	Mr. Phillip Casey DRDAR-LCB-SE Chief, Machine Processes Advanced Engineering Div. Benet Weapons Lab. Watervliet Arsenal, NY 12189	AV 974-5737 (518) 266-5737

The chart shows the accelerometers and servo controls in the electro-hydraulic system installed in the boring head.

Heads have been built for boring 155mm and 8 inch gun tubes; the design is adaptable to other sizes.



669 6776 BORING GUIDANCE SYSTEM FOR LARGE CANNON BORING LATHES

Adaptation of Tooling for Boring Hoops for 175mm M113 and 8" Howitzer M2A1E1 Cannon	671 6945	Mr. John Rodd Machine Processes Advanced Engineering Lab. DRDAR-LCB-SE Watervliet Arsenal, NY 12189	AV 974-5737 (518) 266-5737

ACCOMPLISHMENTS:

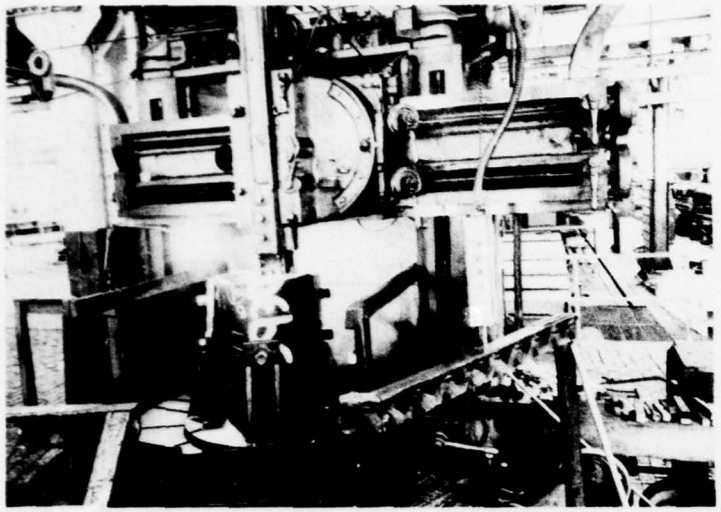
Watervliet added a Newton drive to the trepanning machine to obtain extended feed, and a Dodge reducer to the power train to match cutting speed and torque requirements to the large 17" cutting diameter.

They also developed cutting tool packages for boring hoops for the 175mm and 8 inch gun tubes. Three sets of cutters were assembled for each tube because each gun requiresthree different hoop sizes.

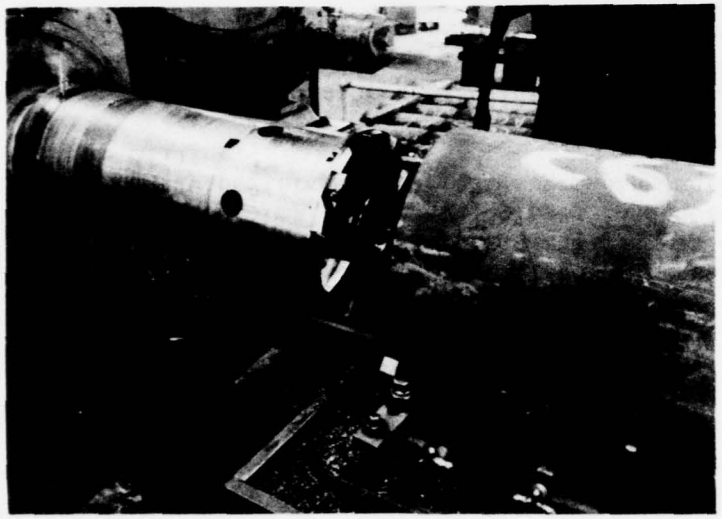
Because the hoop body is a casting having a large mass on one side, a true circle bore tends to be egg shaped. Special tooling with six cutters on one side eliminated 75% of the ovality.

The machine has been in two and three shift operation at Watervliet Arsenal for three years.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT



OLD METHOD -- VERTICAL BORING
WITH SINGLE POINT TOOLING



NEW METHOD -- HORIZONTAL BORING
WITH MULTIPLE POINT TOOLING

HOOP BORING

PROJECT NO: 6716945

TITLE: MM&T -- ADAPTATION OF TOOLING FOR BORING HOOPS FOR 175MM M113 & 8" HOWITZER M2A1E1 CANNON

COST: $100,000

BENEFITS

Watervliet Arsenal adapted a lombard trepanning machine to hoop boring. An 8-cutter boring head replaced single point boring on a vertical boring head and reduced boring time 50%.

The hoop is bored in a single pass and then honed to a smooth 63RMS finish.

Tooling is available at Watervliet for boring recoil hoops for all sizes of gun tubes.

Abrasive Machining of Minor Items for Cannon Manufacture	671 7030	Mr. John Rodd Project Leader Advanced Engineering Div. DRDAR-LCB-SE Benet Weapons Lab Watervliet Arsenal, Watervliet, NY 12189	AV 974 5946/5611 (518) 266 5946/5611

ACCOMPLISHMENTS:

Many developments have contributed to the increased productivity of grinding in the past few years. The one that has attracted the most attention is "abrasive machining." The term "abrasive machining" is generally used to denote stock removal operations that are more economically performed by abrasive grinding methods than the more conventional means of turning or milling.

The two biggest fields for abrasive machining are the production of flat surfaces and form grinding from the solid. This program was concerned with the latter; grinding various complex external shapes from the solid forging, bar stock or hollow cylindrical items.

Abrasive machining has been used in recent years to denote those grinding operations in which metal removal rate, surface finish or accuracy, is the main consideration. It includes all the operations where cost is a major factor in determining whether to grind or to machine with carbide or high speed steel cutters.

Report No. WVT-TR-76044 is available from the above address.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

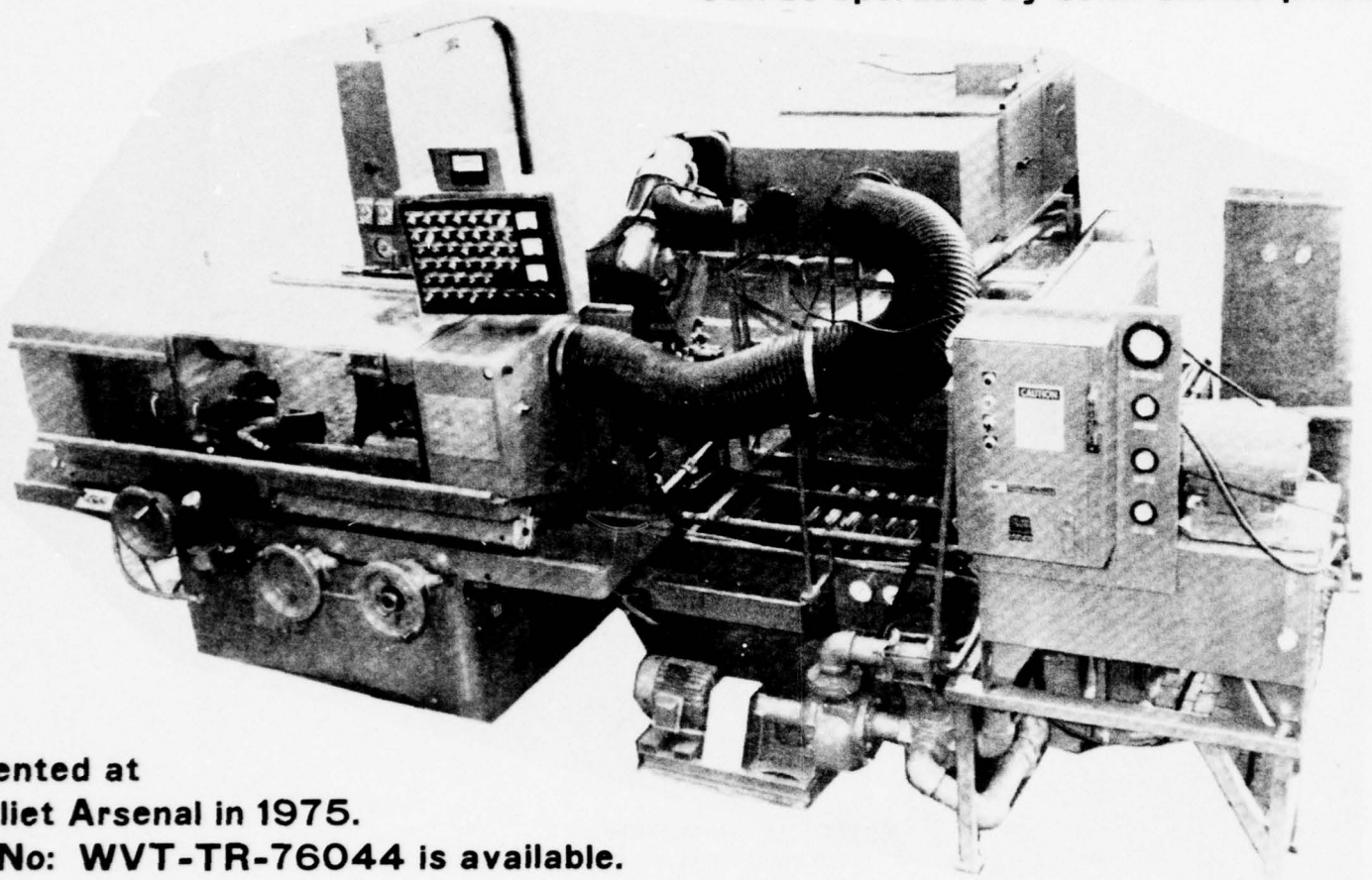
PROJECT NO: 6717030

TITLE: MM&T -- ABRASIVE MACHINING OF MINOR ITEMS FOR CANNON MANUFACTURE

COST: $239,000

BENEFITS

Watervliet demonstrated the speed and simplicity of crush grinding.
Provides an 80% savings on selected items.
Reduces the number of machines needed.
Can be operated by semi-skilled personnel.



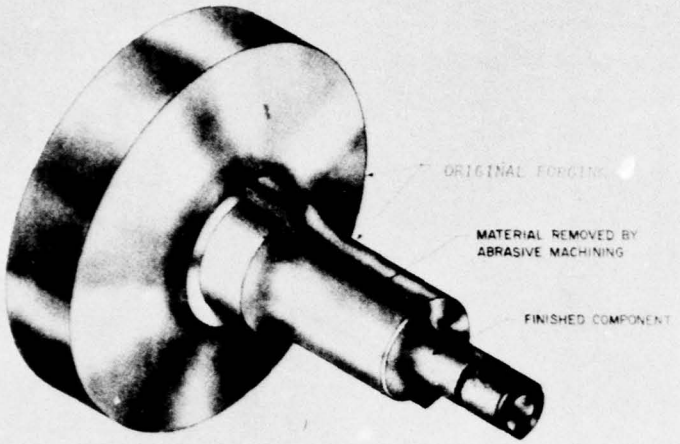
Implemented at Watervliet Arsenal in 1975.
Report No: WVT-TR-76044 is available.

"CRUSHTRUE" EXTERNAL ABRASIVE GRINDING MACHINE

Abrasive Machining of Minor Items for Cannon Manufacture	671 7030	Mr. John Rodd, Project Leader Advanced Engineering Div. DRDAR-LCB-SE Benet Weapons Lab Watervliet Arsenal Watervliet, NY 12189	AV 974-5946/5611 (518) 266-5946/5611

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROJECT NO: 6717030 TITLE: ABRASIVE MACHING COST: $239,000

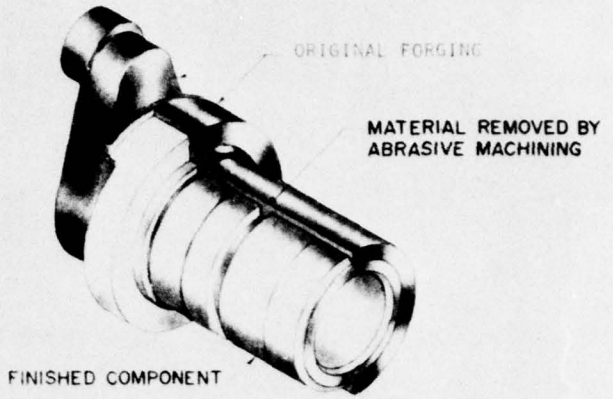


STOCK REMOVED BY ABRASIVE MACHINING 17.7 CU. IN. = 5 LBS.

CURRENT MACHINING METHOD:
AVERAGE TIME FLOOR TO FLOOR 3 HOURS = $ 60.00

ABRASIVE MACHINING METHOD:
AVERAGE TIME FLOOR TO FLOOR 16 MINUTES = $ 5.32

SAVINGS: $ 54.68



STOCK REMOVED BY ABRASIVE MACHINING 7.3 CU. IN. = 2 LBS.

CURRENT MACHINING METHOD:
AVERAGE TIME FLOOR TO FLOOR 1 HR. 15 MIN. = $25.00

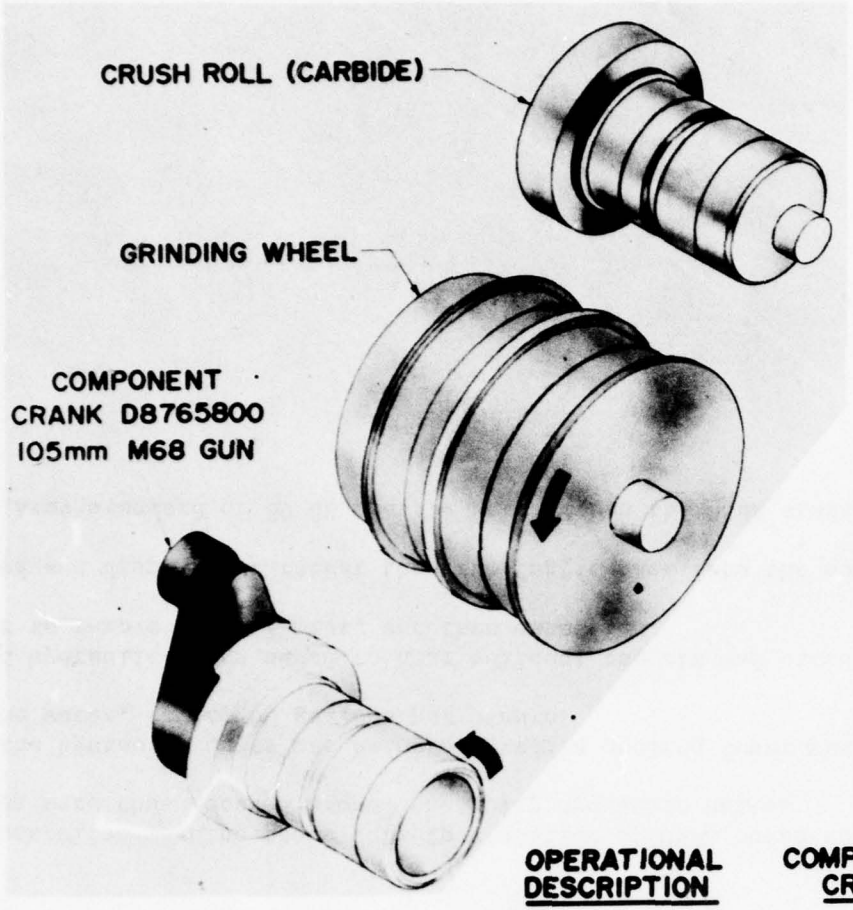
ABRASIVE MACHINING METHOD:
AVERAGE TIME FLOOR TO FLOOR 7 MINUTES = $2.33

SAVINGS $22.67

EXAMPLES OF ABRASIVE MACHINING SAVINGS

Abrasive Machining of Minor Items for Cannon Manufacture	671 7030	Mr. John Rodd, Project Leader Advanced Engineering Div. DRDAR-LCB-SE Benet Weapons Lab Watervliet Arsenal Watervliet, NY 12189	AV 974-5946/5611 (518) 266-5946/5611

ILLUSTRATION OF EXTERNAL EXPERIMENTAL ABRASIVE MACHINING



OPERATIONAL DESCRIPTION	COMPONENT CRANK
WHEEL COST —	$ 245.00
WHEEL COST PER PC. —	$ .40
PCS. PER WHEEL —	600
CRUSHES PER WHEEL —	200
PIECES PER CRUSH —	3

PROJECT NO. 6717030

Noise Attenuation in Numerically Controlled Machining Areas	672 7152	Mr. Albert Janssen Plant Engineering Div. SARRI-AOR Rock Island Arsenal Rock Island, IL 61299	AV 793-4135 (309) 794-4135

ACCOMPLISHMENTS:

Nine numerically controlled machine tools were in violation of OSHA noise standards. Sound-deadening enclosures were thus located around the noisy hydraulic units.

Cooling water for the hydraulic units was being sewered; a cooling tower was installed to permit recycling the water, saving 50 gallons per minute.

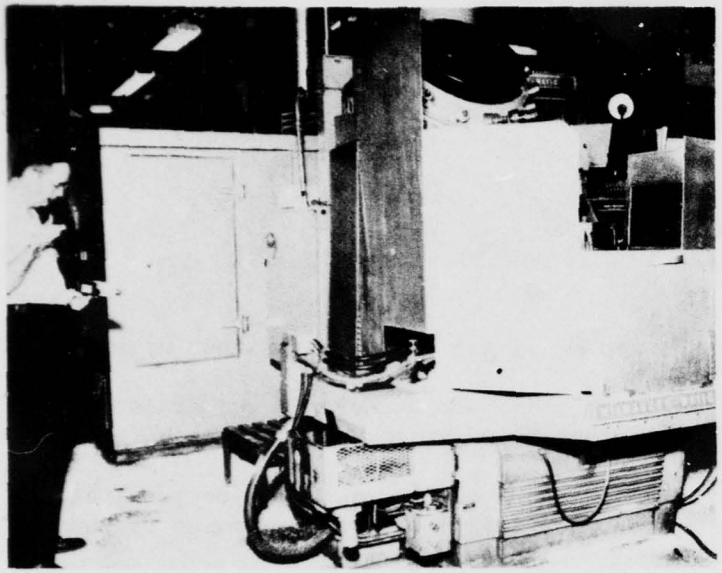
Air in the enclosed hydraulic units added to heat buildup; the air was circulated through an oil mist eliminator to remove the oil mist, and then exhausted.

The oil is collected and disposed of rather than running it back into the sump.

Units now meet the Army standard of 80 dB and are better than the OSHA standard of 85dBs.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

NOISE REDUCTION



ACOUSTIC STRUCTURE OVER
HYDRAULIC UNIT ON
K&T NC MACHINE

PROJECT NO: 6727152

TITLE: NOISE ATTENUATION IN NUMERICALLY CONTROLLED MACHINING AREAS

COST: $25,000

BENEFITS

Kearney and Trecker installed sound-deadening enclosures around hydraulic pump and valve units of nine K&T machines.

Noise level was cut from 90 dB to 80 dB.

A heat exchanger was installed in each cabinet and connected to a cooling tower; water savings are 50 gallons/minute.

Application of Automatic Centering and Supporting Mechanisms for Machining of Cannon	672 7161	Mr. C. H. LaRoss Project Leader, Machine Processes DRDAR-LCB-SE Advanced Engineering Div. Watervliet Arsenal Watervliet, NY 12189	AV 974-5590 (518) 266-5590

ACCOMPLISHMENTS:

A Cushman automatic self-centering power chuck was installed on the large boring lathe. It worked well on all 45 175mm gun tubes bored using it.

A steady-rest was also installed on the machine because it is needed to prevent perturbations that disturb the electronic monitor. It provided superior stability and precision.

Savings in chucking time are $20 to 30 per tube.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

PROJECT NO: 672 7161

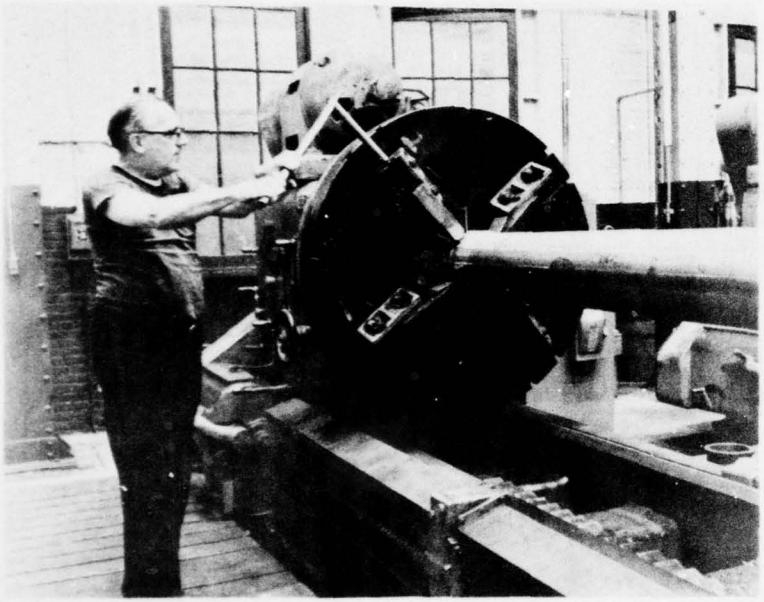
TITLE: MM&T - APPLICATION OF AUTOMATIC CENTERING AND SUPPORTING MECHANISMS FOR MACHINING OF CANNON.

COST: $85,000

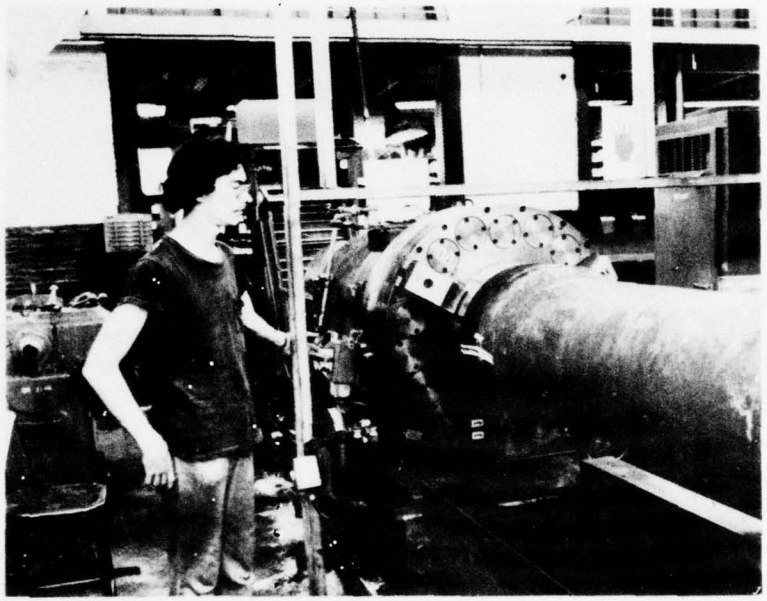
BENEFITS

Watervliet Arsenal developed an air operated automatic centering chuck for large lathes.

Cushman Industries, Hartford, CN., built the power chuck.



OLD METHOD: OPERATOR NEEDED. TIME CONSUMING.



NEW METHOD: AIR CHUCK LOCKS 8 M201 GUN TUBE IN SECONDS.

Application of Rapid Threading System for Internal Threads	672 7171	Mr. Philip M. Casey Chief, Machine Processes Advanced Engineering Div. DRDAR-LCB-SE Watervliet Arsenal, NY 12189	AV 974-5737 (518) 266-5737

ACCOMPLISHMENTS:

Watervliet adapted a boring lathe to perform both internal threading of a breech ring and with a 15 minute change-over, external threading of the gun tube. Threading time for a 105mm breech ring was reduced from 3 hours to 1 hour. On a two-shift basis this permits threading 48 extra components per week.

External threading time was reduced a comparable time.

The system permits the machining of mating parts.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

BENEFITS

Rapid threading and automated cycling allow use of carbide inserts and increase machining speed by 4 to 1.

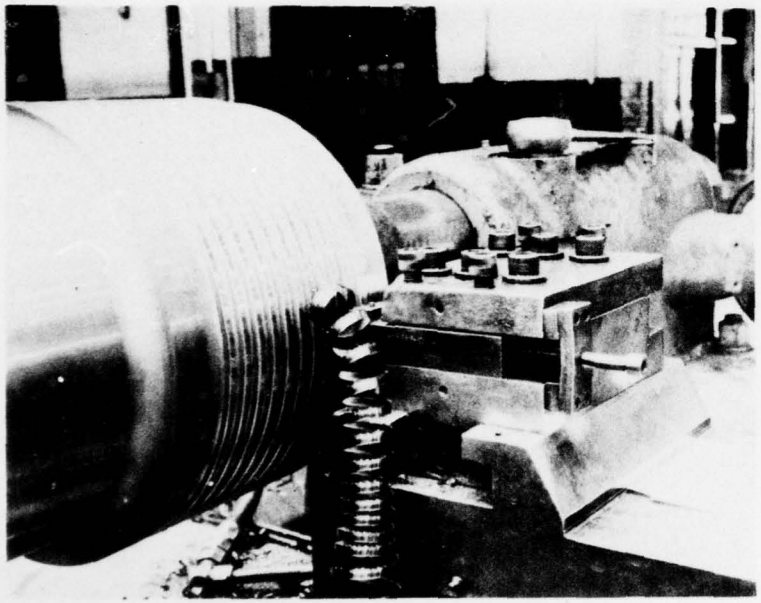
The lathe permits both internal and external threading.

Cuts 105mm breech ring threading time from 3 hours to 1 hour.

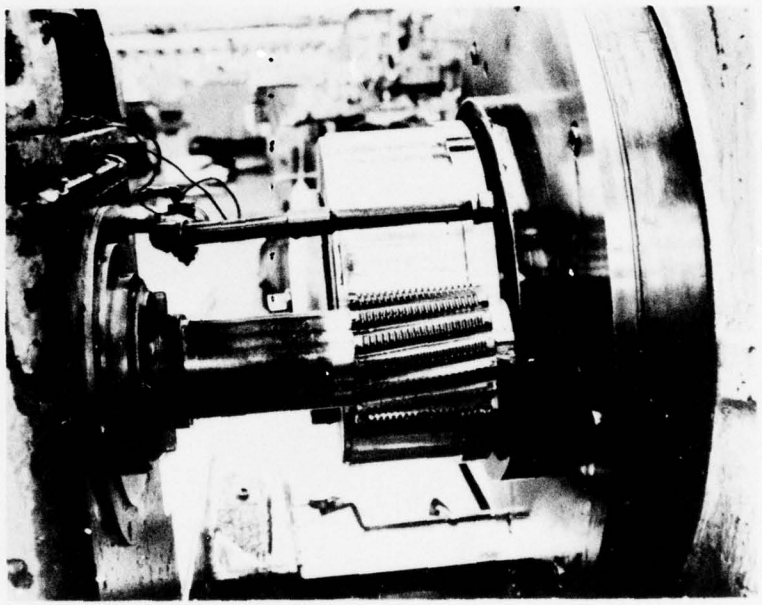
PROJECT NO: 6727171

TITLE: MM&T -- APPLICATION OF RAPID THREADING SYSTEM FOR INTERNAL THREADS

COST: $65,000



OLD METHOD -- HOB THREADING TOOL

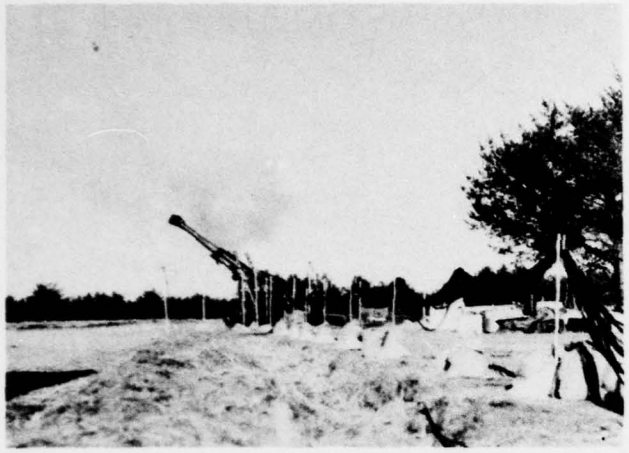


NEW METHOD -- RAPID THREADING WITH CARBIDE TOOLING

Artillery Weapons Firing Test Simulator	673 7201	Mr. Robert Radkiewicz SARRI-ENW Rock Island Arsenal Rock Island, IL 61299	AV 793-4544 (309) 794-4544

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

SIMULATION



BEFORE: OPEN FIRING

AFTER: FIRING SIMULATOR

PROJECT NO: 6737201

TITLE: ARTILLERY WEAPONS FIRING TEST SIMULATOR

COST: $525,000

BENEFITS

Rock Island Arsenal and its contractors built an impulse generator to apply loads similar to those of live firing to the recoil mechanism and carriage.

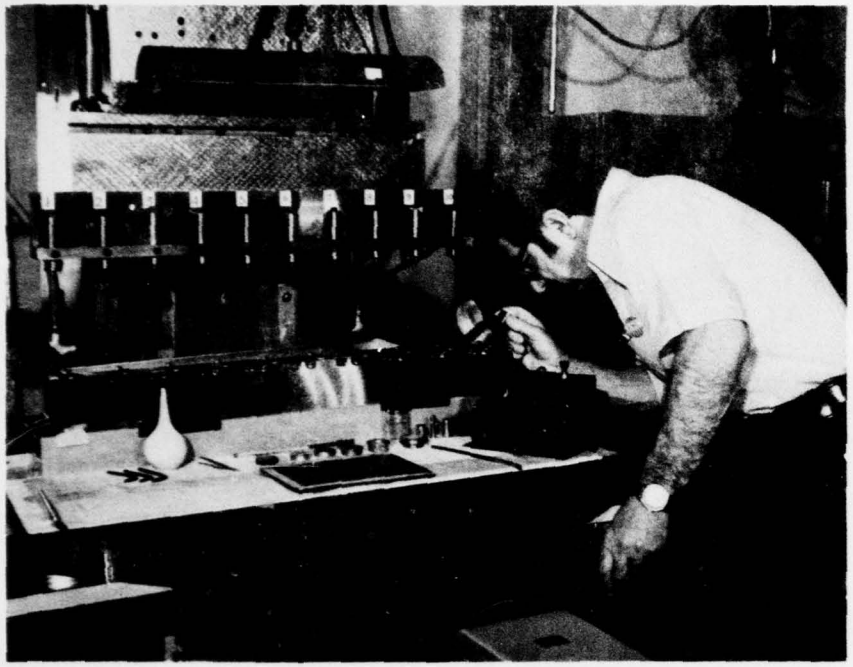
Load is applied by firing $3 worth of powder and saves the firing of $168 rounds.

Total saving per 155mm recoil mechanism is $570. Used to proof the XM198 155mm howitzer, and the M110E2 8 inch howitzer.

Computer Control in Engraving Ballistic Data on Optical Reticles	673 7265	Mr. Harold Richardson Project Officer US Army Armament Research and Development Command DRDAR-SCF-FM Dover, NJ 07801	AV 880 3445 (301) 328-3445

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

FIRE CONTROL



TEN-POSITION COMPUTER-CONTROLLED OPTICAL SCRIBING MACHINE IN PRODUCTION USE

PROJECT NO: 6737265

TITLE: MM&T COMPUTER CONTROL IN ENGRAVING BALLISTIC DATA ON OPTICAL RETICLES.

COST: $150,000

BENEFITS

Boston Digital Corp. developed a computer-controlled engraver for scribing optical patterns on ten reticles simultaneously.

Paper tapes were generated to control the scriber to make reticles for binoculars, periscopes, telescopes, and range finders.

Savings: 60% of preparation cost, 50% of labor cost, with almost zero rejects.

Eliminates need for brass templates and drawings, and operator fatigue and error.

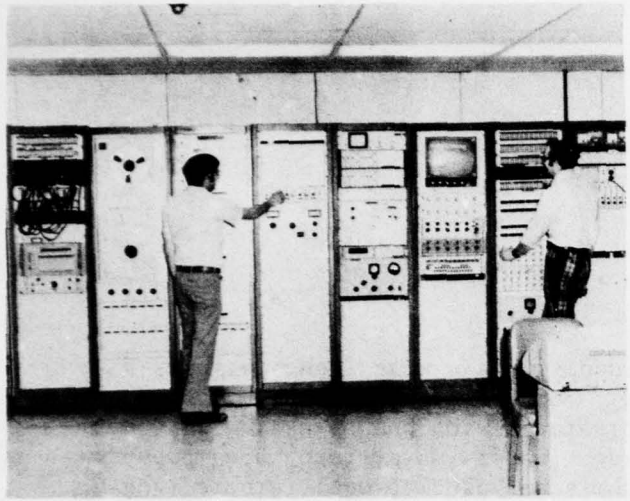
Simulator for Production Tests of Weapons	673 7313	Mr. Carol Schneider U.S. Army Armament Material Readiness Command DRSAR-LEM Rock Island, IL 61299	AV 793-6810 (309) 794-6810

ACCOMPLISHMENTS:

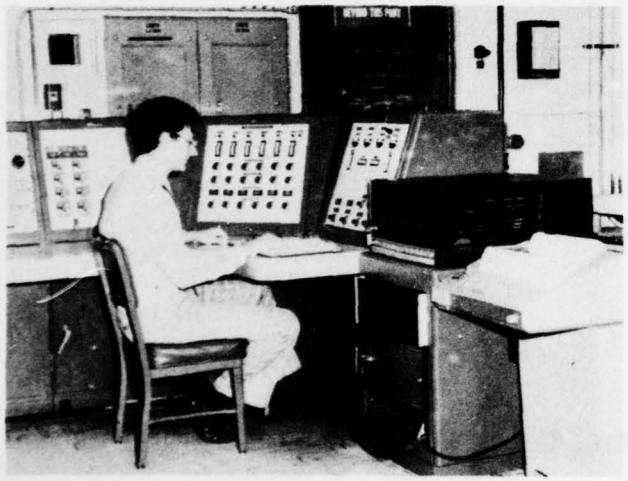
An expanded data acquisition and reduction system was interfaced with the 6 Degree of Freedom (6-DOF) simulator presently used at Rock Island. The tester provided valuable information to the Source Selection Board for AAH, and avoided $1.4 million over field testing costs. The Keith L. Ware Simulation Center can now perform testing, with similar cost savings, on all Army small caliber weapon systems.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

SIMULATION



NEW CONTROL PANEL FOR AUTOMATED SIMULATOR



DATA ACQUISITION SYSTEM

PROJECT NO: 6737313

TITLE: MM&T -- SIMULATOR FOR PRODUCTION TESTS OF WEAPONS.

COST: $250,000

BENEFITS

The simulation and experimental firing center at Rock Island was upgraded to permit helicopter weapons to be fired while it is undergoing pitch and yaw motions.

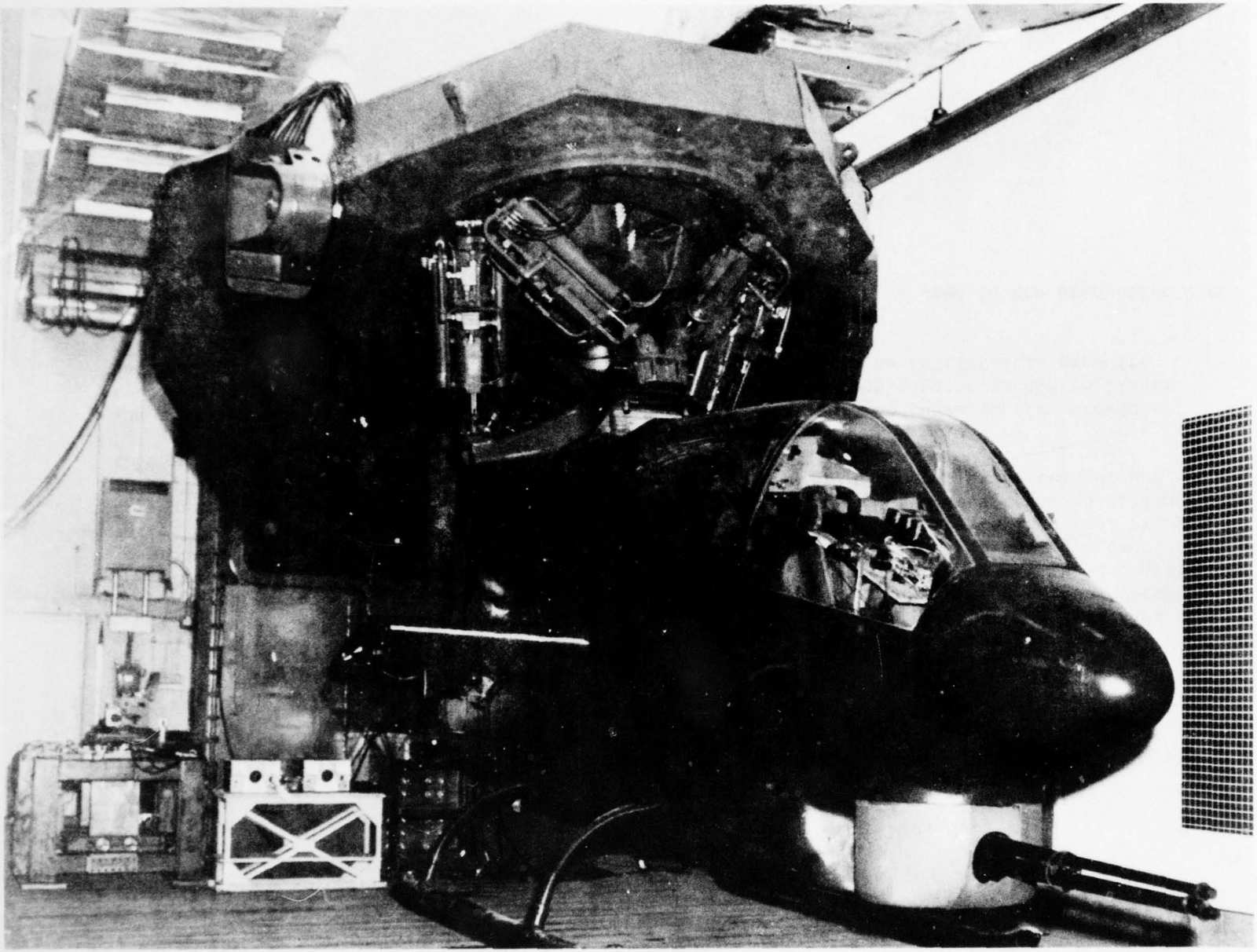
The hydraulic control panel was expanded and automated to permit changing spring rates and damping ratios while the weapons are being test fired.

The data acquisition system was expanded from 14 channels to 75 and upgraded to permit data pickup from the simulator during the test.

Simulator for Production Tests of Weapons	673 7313	Mr. Carol Schneider U.S. Army Armament Material Readiness Command DRSAR-LEM Rock Island, IL 61299	AV 793-6810 (309) 794-6810

BENEFITS:

As illustrated here, Weapon test firings were conducted from the activated six-degree-of-freedom (6-DOF) simulator to demonstrate simultaneous operation of the activated simulator and the expanded Data Acquisition system. Spring rates and damping characteristic of the activated simulator were measured both statically and dynamically using the Data Acquisition and Reduction system shown on the previous page. The system is capable of monitoring up to 70 charnels of data simultaneously from systems mounted on this 6-DOF simulator.



673 7313 SIMULATOR FOR PRODUCTION TESTS OF WEAPONS

Development of Improved Rifling Procedures and Equipment	676 7402	Mr. Charles H. LaRoss Project Leader, Machine Processes DRDAR-LCB-SE Advanced Engineering Div. Watervliet Arsenal Watervliet, NY 12189	AV 974-5590 (518) 266-5590

Contractors: Ross Valve Mfg. Co.
Troy, NY

Watervliet Iron & Brass Co.
Watervliet, NY 12189

ACCOMPLISHMENTS:

The results of the application of dual rifling to the 105mm M68 gun tube showed a reduction of machining time of approximately 40% through the efforts applied in rifling the 40 gun tubes. The process also will reduce manpower requirements in that only one operator will be necessary to produce two rifled gun tubes at the same time. In addition, the floor space requirement for rifling machines will be reduced significantly as one machine will now replace two. Many improvements were added to duplex rifler WV-6695 as a result of the previous tests in rifling 105mm M2A2 gun tubes. The refinements have added to the value of the duplex process of gun tube rifling.

The results of the efforts expended in dual rifling of 105mm M68 gun tubes confirm previous conclusions that the process is highly adaptable to production line quantities and to larger caliber gun tubes and it is recommended that all necessary action be initiated to expedite the extended use of the process.

The Dual Rifler (WV-6695) was transferred to Building 134 where it is used in the production line.

AD-A059 656 ARMY INDUSTRIAL BASE ENGINEERING ACTIVITY ROCK ISLAND IL F/G 13/8
MANUFACTURING METHODS AND TECHNOLOGY PROGRAM ACCOMPLISHMENTS.(U)
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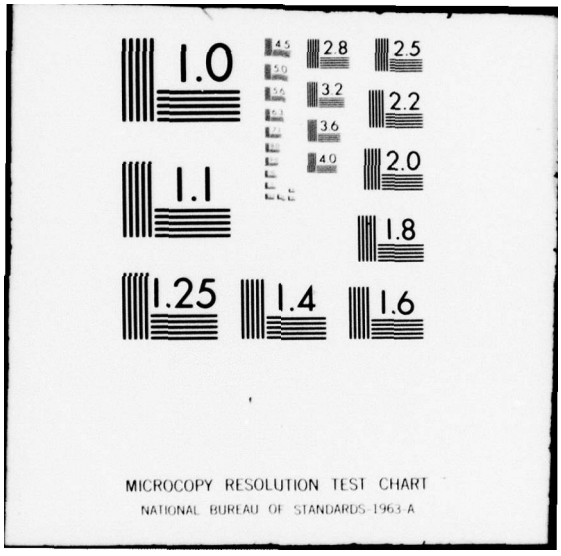
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4.5
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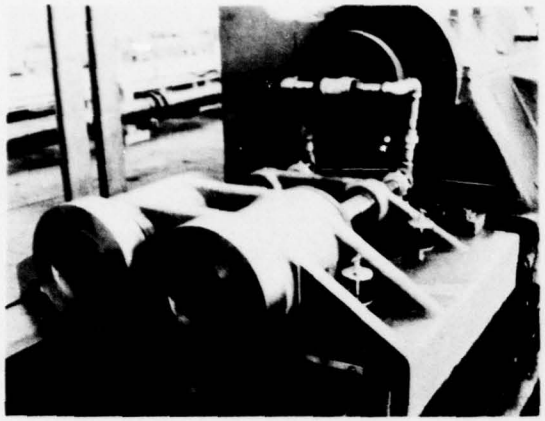
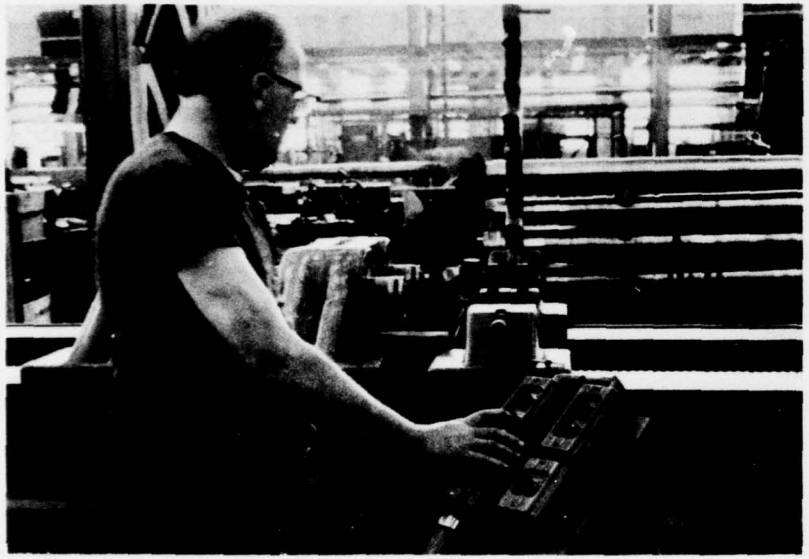
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

GUN TUBES



RIFLING BAR DRIVE CARRIAGE



DUAL RIFLING HEADS
AND CONTROL STATION

PROJECT NO: 674767402

TITLE: MM&T -- DEVELOPMENT OF IMPROVED RIFLING PROCEDURES AND EQUIPMENT.

COST: $120,000; $46,000

BENEFITS

Watervliet developed a heavy duty duplex rifling system for large gun tubes. The system broaches two tubes in the place of one and saves $28 per M68 105mm gun tube, and $15 per M2A2 105mm gun tube.

A complete set of drawings is available from Watervliet Arsenal. Report WVT-TR-77002 illustrates the system and is available.

Fine Blanking of Precision Small Caliber Weapon Parts	674 7410	Mr. Virgil Dillon Rock Island Arsenal Rock Island, IL 61299	AV 793-4135 (309) 794-5235

Contractor: Forming and Fabricating Equipment Co.

Contract: DAAA08-76-C-0119

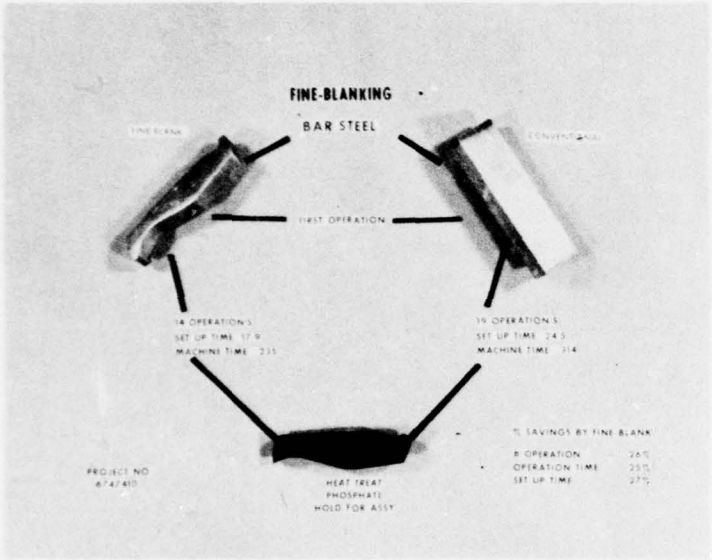
ACCOMPLISHMENTS:

The present conventional machining process with 19 operations has been reduced to 14 operations. Previously, blanks were cut from bars, then straddle and profile milled, ground for thickness, drilled, reamed, deburred and inspected.

The "fine-blanked" part had most of its contour developed in the "as-blanked" condition. Parts were then ground for thickness, straddle and profile milled, drilled, reamed, deburred and inspected.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

SMALL ARMS



EXAMPLE OF FINE BLANKING

PROJECT NO: 6747410

TITLE: MM&T -- FINE BLANKING OF PRECISION SMALL CALIBER WEAPON PARTS.

COST: $100,000

BENEFITS

Eight sets of fine blanking dies were built by forming and fabricating equipment company and used to form M85 machine gun parts.

Average savings were 54% compared to conventional blanking and secondary operations.

Other savings: 25% fewer operations,
26% less machining time,
27% less setup time.

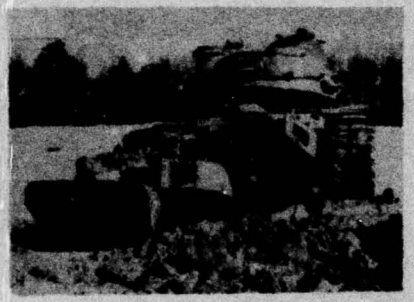
TROOP SUPPORT

POWER

BRIDGING

ENVIRONMENT

MINE DETECTION/
NEUTRALIZATION



TROOP SUPPORT AND AVIATION MATERIEL READINESS COMMAND (TSARCOM)

TSARCOM

M&T Representative:	Mr. Donald G. Doll US Army Troop Support and Aviation Readiness Command ATTN: DRSTS-PLE 4300 Goodfellow Blvd. St. Louis, MO 63120	AV 693-3040 (314) 263-3040

TSARCOM

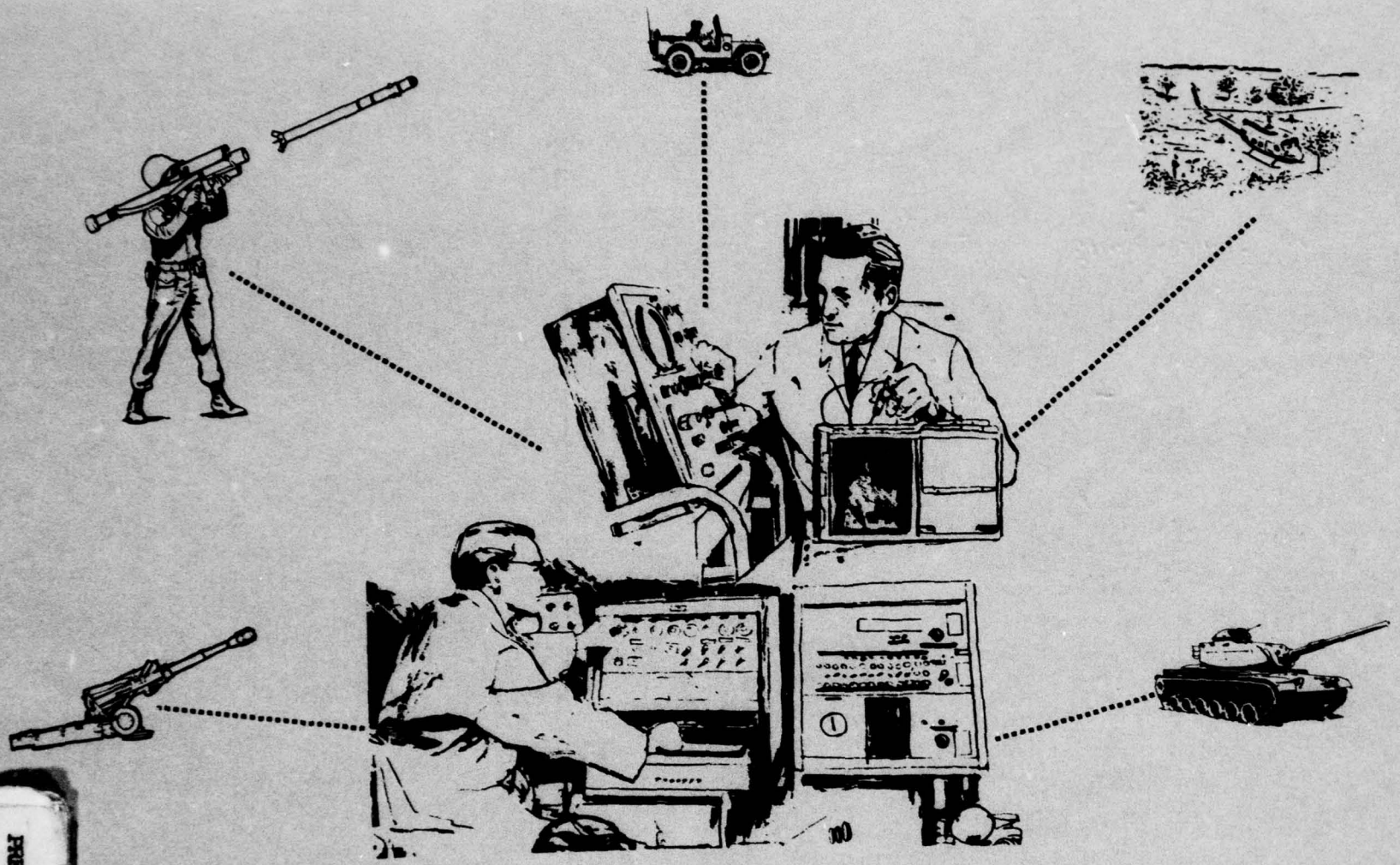
THE EMERGENCY REPAIR Shelter was developed by the US Army Natick Laboratories and is used to provide protection from the weather for maintenance personnel making minor field repairs on the CH-47 helicopter. It is (may also be) used in the performance of normal maintenance and inspections when fixed or semi-permanent facilities are not adequate to accommodate the helicopter. The shelter consists of a collapsible, six-sided, umbrella type aluminum frame with a fabric top, three sidewalls and two fuselage walls made of ten-ounce Dynel and fits over the forward or aft rotors.

TOW CAP

Gunners who operate TOW (Tube-launched, Optically-tracked, Wire-guided) missiles now have added protection against artillery fragments. A TOW CAP (Cover, Artillery, Protection), developed by NARADCOM is a canopy of ballistic nylon that can be set up on the ground or erected over the roof hatch of an armored personnel carrier.

KITCHEN TRAILER CONSTRUCTION

The Mobile Field Kitchen Trailer is an expandable, self-contained unit designed to feed about 200 soldiers per meal. It's a complete food system under one hard-shell roof, with room for preparation counters, cooking areas and serving line. Mounted on a standard 1½ ton trailer chassis, the kitchen can be towed by a standard 2½ ton tactical vehicle either on or off the highway. Four soldiers can set up the trainer or take it down in 20 minutes.



TEST AND EVALUATION COMMAND
(TECOM)

TECOM

MM&T Representative:	Mr. Benjamin Champion US Army Test and Evaluation Command ATTN: DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170/3677 (301) 278-2170/3677

T E C O M

INDEX

IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

FRAGMENTATION SYSTEM

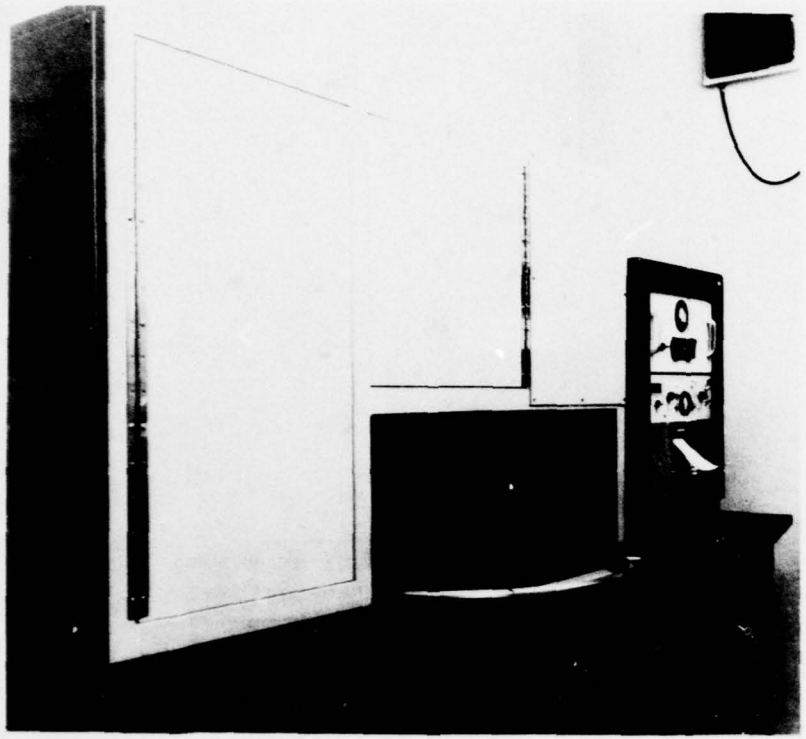
Improvement of TECOM Production Test Methodology	069 5071	Mr. Benjamin Champion U.S. Army Test and Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170 (301) 272-2170

Subproject: Automating the Measurement of the Projected Area of Shell Fragments

An instrument was developed for automatically measuring the projected area of shell fragments. The instrument reduces area measurement times by a factor of 20 without compromise in accuracy. Upwards of 150 fragments from a given shell burst may be measured. Annual savings are conservatively estimated at $20,000.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

FRAGMENTATION MEASUREMENT



AUTOMATED FRAGMENT MEASURING DEVICE

PROJECT NO: 0695071

TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: $40K

BENEFITS

TECOM AUTOMATED THE MEASUREMENT OF PROJECTED AREA OF SHELL FRAGMENTS.

THE INSTRUMENT REDUCES AREA MEASUREMENT TIME BY A FACTOR OF 20.

MEASURES UP TO 150 FRAGMENTS FROM ONE BURST WITH GOOD ACCURACY.

SAVINGS IS APPROX. $20,000 ANNUALLY.

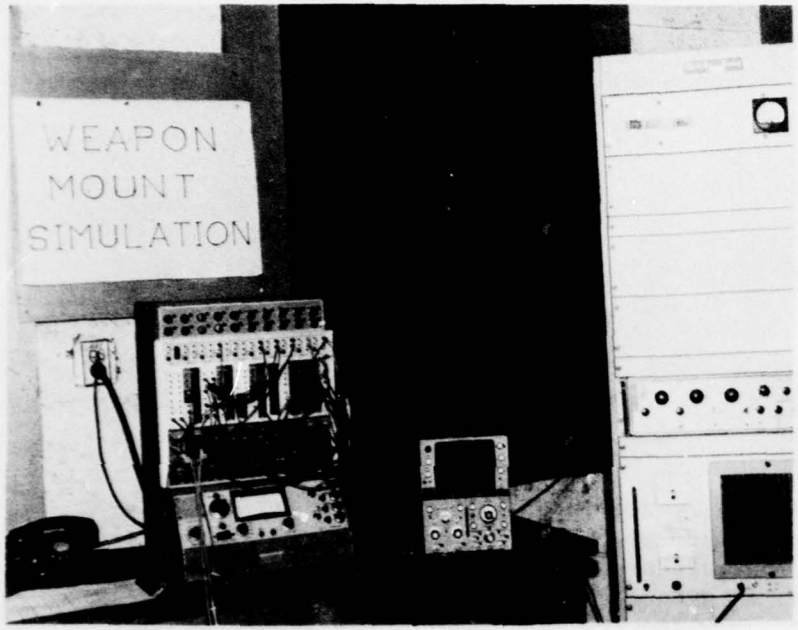
Improvement of TECOM Production Test Methodology	073 5071	Mr. Benjamin Champion U.S. Army Test and Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170 (301) 272-2170

Subproject: Weapon Mount Simulation and Compatibility Testing

Weapon mount simulation was accomplished by use of a direct-coupled electrodynamic shaker and an analog computer for mounting structures on automatic weapons. This was demonstrated with the breadboard simulator shown here. Nearly all dynamic mount functions can be assessed including feeding, chambering, locking, firing, recoil forces, power, ejection, and accuracy. Laboratory model is yet to be constructed. Savings in test conduct are indicated but not yet determined.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TEST SIMULATION



WEAPON MOUNT SIMULATOR

PROJECT NO: 0735071

TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: $35.4K

BENEFITS

ABERDEEN COUPLED AN ANALOG COMPUTER TO AN ELECTRO DYNAMIC SHAKER TO SIMULATE WEAPON FORCES.

THIS SETUP CAN SIMULATE DYNAMIC FORCES OF FEEDING, CHAMBERING, LOCKING, FIRING, RECOIL, POWER & EJECTION.

SIMPLIFIES TESTING OF FIRE CONTROL OR OTHER STRUCTURES MOUNTED ON THE GUN.

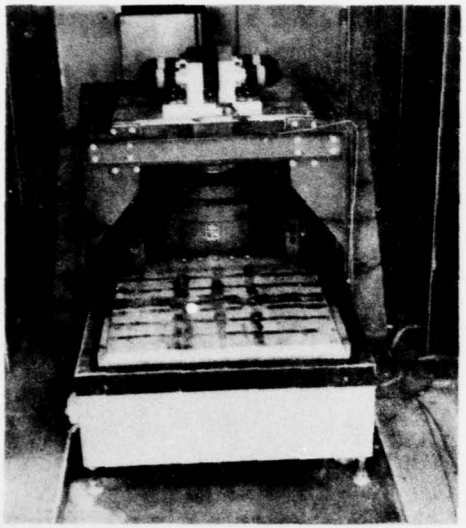
Improvement of TECOM Production Test Methodology	073 5071	Mr. Benjamin Champion U.S. Army Test and Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2701 (301) 272-2701

Subproject: Updating and Developing Laboratory Test Schedules

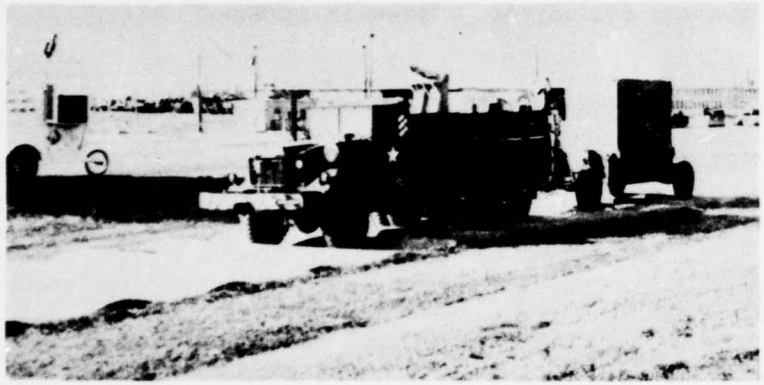
Use of laboratory vibration techniques (top photo) in lieu of instrumented test course (bottom photo) to simulate transportation shocks in transport of loosely stowed or secured cargo results in significant savings of time and equipment. Vibration schedules of an hour or so duration replace hundreds of miles of vehicle operation. A vehicle test costing $22,000 is accomplished at an estimated cost of $12,000; for 30 tests annually, savings are estimated at $300,000.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TRANSPORTATION TEST



CARGO ON VIBRATION TABLE



VEHICLE & CARGO ON TEST COURSE

PROJECT NO: 0735071

TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: $44K

BENEFITS

ABERDEEN DEVELOPED A TEST TABLE THAT REPLACES AN INSTRUMENTED TEST COURSE TO SIMULATE TRANSPORTATION SHOCK.

ONE HOUR OF VIBRATION REPLACES HUNDREDS OF MILES OF VEHICLE OPERATION. A $12,000 TEST REPLACES A $22,000 VEHICLE TEST. SAVINGS ON 30 TESTS ANNUALLY IS $300,000.

WEAPON MOUNT SIMULATION

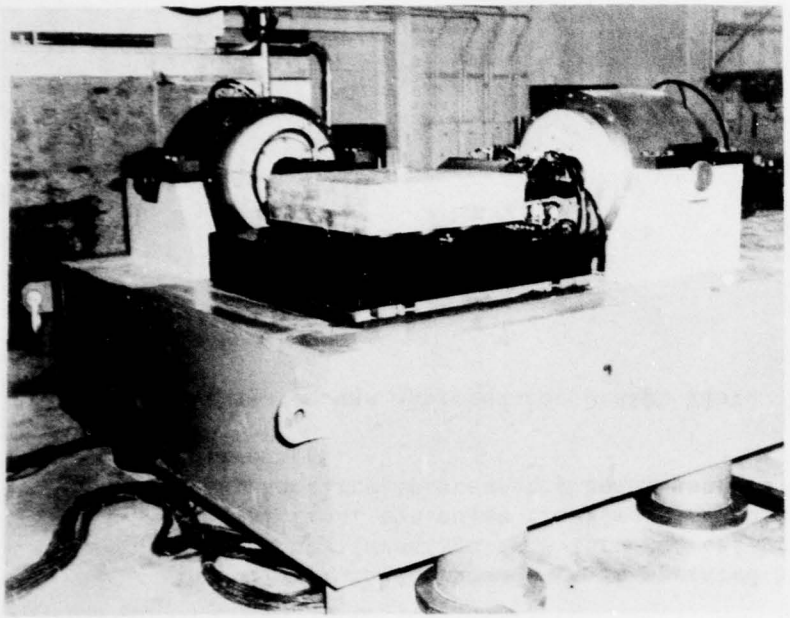
Improvement of TECOM Production Test Methodology	073 5071	Mr. Benjamin Champion U.S. Army Test & Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170

Subproject: Three-Dimensional Vibration Systems

The "one-axis-at-a-time" philosophy for vibration testing of equipment is too slow, expensive, and unrealistic for modern complex weapon systems. The multiaxial vibration system developed under this MMT program is fast, economical, and simulates a realistic vibration environment. It is useful for testing complex missile systems, ground support equipment, avionics gear, and other related defense equipment. The system is suitable for design, realiability, suitability, and qualification testing.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

WEAPON MOUNT SIMULATION



TEST TABLE

PROJECT NO: 0735071

TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: $35.4K

BENEFITS

DEVELOPED A MULTI-AXIS VIBRATION TABLE FOR TESTING MISSILE SYSTEMS, GROUND SUPPORT EQUIPMENT, AVIONICS EQUIPMENT.

REPLACES TESTERS THAT CHECK ONE AXIS AT A TIME AND CUTS TEST TIME BY 1/2 OR 1/3.

SUITABLE FOR DESIGN, RELIABILITY OR QUALIFICATION TESTING.

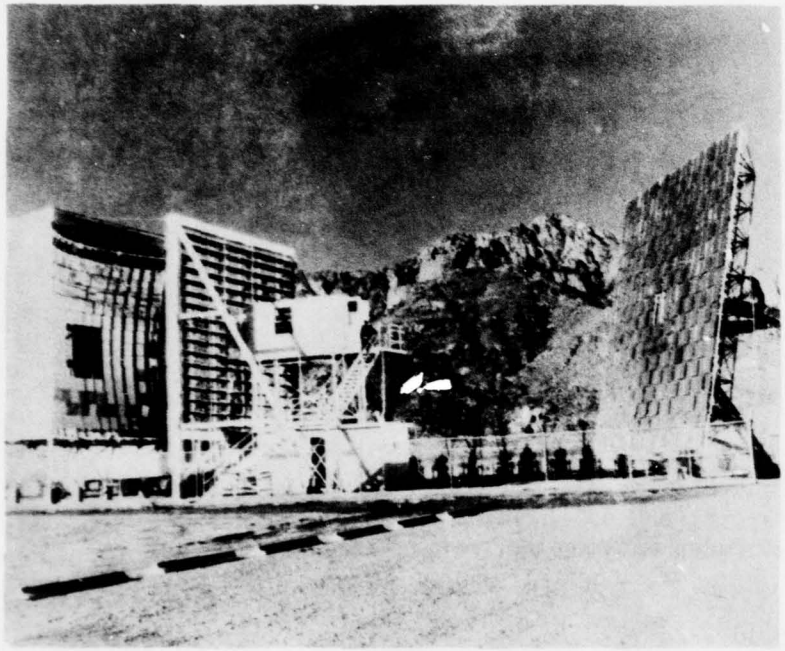
Improvement of TECOM Production Test Methodology	074 5071	Mr. Benjamin Champion U.S. Army Test & Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170

Subproject: White Sands Solar Furnace

The Solar Furnace shown here is operated by the Nuclear Weapons Effects Branch of ARMTE. Methodology investigations into the calibration techniques needed for measurement of the total thermal flux, the pulse risetime, and pulse shape were initiated under the MMT program. The solar facility is presently being used to test and evaluate Army weapons in a nuclear thermal environment.

The system was approved for Design Test. DT III Test on Nuclear Effects for hardening.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT
TESTING



SOLAR FURNACE

PROJECT NO: 0745071

TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: $12K (FACILITY PROVIDED BY R&D FUNDING)

BENEFITS

PROJECT DEVELOPED A METHOD FOR USING A SOLAR FURNACE TO SIMULATE NUCLEAR HEAT FLUX IN TESTING OF FUZES, MISSILE AND AMMUNITION COMPONENTS.

CALIBRATED THE FURNACE FOR TOTAL THERMAL FLUX, PULSE RISE TIME AND PULSE SHAPE.

TESTS MISSILES AND STORED AMMO COMPONENTS IN A SIMULATED NUCLEAR THERMAL ENVIRONMENT. SYSTEM WAS OK'D FOR DESIGN TEST III ON NUCLEAR EFFECTS FOR HARDENING PURPOSES.

INERT FILLER

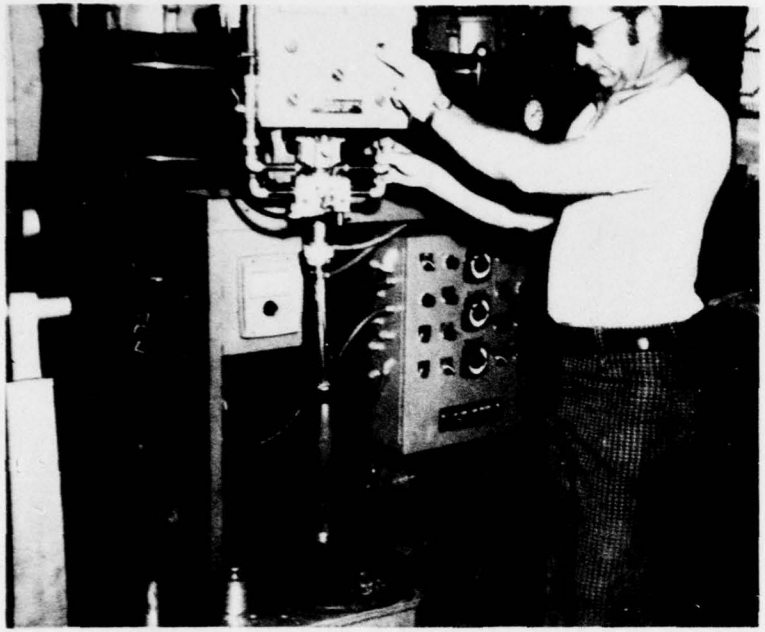
Improvement of TECOM Production Test Methodology	075 5071	Mr. Benjamin Champion U.S. Army Test & Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170 (301) 272-2170

Jefferson Proving Ground developed a new polyurethane filler material which simulates the physical characteristics of several widely used explosives. With new semi-automatic filler equipment the time needed for filling a projectile is also reduced. This in turn reduces cost of labor.

The polyurethane filler has uniform density and good weight tolerance. It also has a short setting time. Since shinkage is negligible, only a one-pass filling operation is needed. Shown here is the prototype filling equipment.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

INERT FILLER



SEMI-AUTOMATIC FILLER OPERATION

PROJECT NO: 0755071

TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: $14K OF $645,000

BENEFITS

JEFFERSON PROVING GROUND DEVELOPED A POLYURETHANE INERT FILLER MATERIAL THAT:

1. BETTER SIMULATES THE PHYSICAL CHARACTERISTICS OF VARIOUS EXPLOSIVES
2. REDUCES TIME NEEDED FOR INERT FILLING
3. REDUCES COST OF MATERIAL AND LABOR
4. HAS UNIFORM DENSITY AND CLOSE WEIGHT TOLERANCE
5. PERMITS EASY MOLDING OF FUZE CAVITIES
6. HAS A SHORT SETTING TIME
7. PERMITS A ONE-PASS OPERATIONS AND CUTS LABOR COST

IMPROVED BORESCOPE

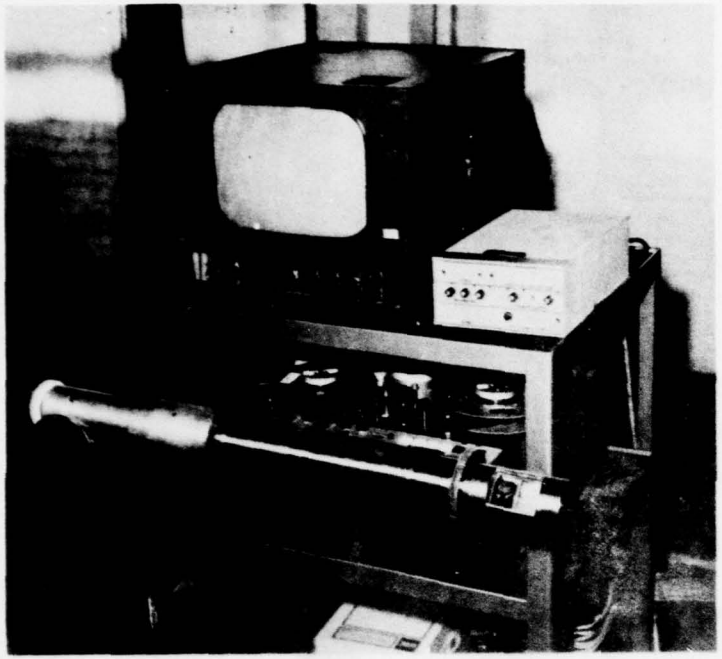
Improvement of TECOM Production Test Methodology	075 5071	Mr. Benjamin Champion US Army Test & Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170

Subproject: Evaluation of Improved Borescope Techniques

A method using closed-circuit television (top photo) to replace optical technique (bottom photo) provided a more reliable and accurate method for inspection of cannon tubes, resulting in estimated annual savings of $20,000.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

IMPROVED BORESCOPE



CLOSED CIRCUIT TV SYSTEM

PROJECT NO: 0755071

TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: $13.5K

BENEFITS

USED CLOSED-CIRCUIT TV TO REPLACE THE OPTICAL SYSTEM SHOWN BELOW.

TV IS A MORE ACCURATE AND RELIABLE METHOD FOR INSPECTING GUN TUBE BORES.

SAVES $20,000 PER YEAR IN TESTING TIME.

OPTICAL BORESCOPE SYSTEM

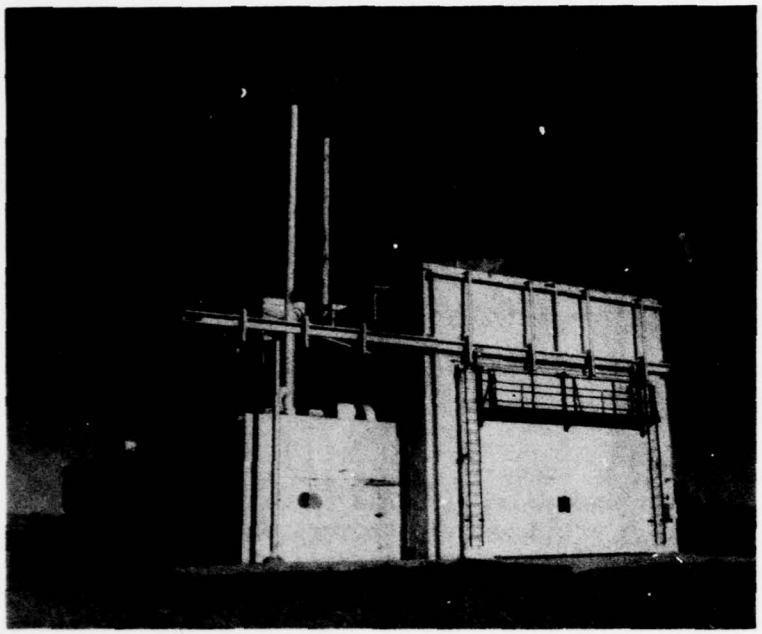
Improvement of TECOM Production Test Methodology	075 5071	Mr. Benjamin Champion US Army Test & Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170

Subproject: Defensive Test Chamber

The Defensive Test Chamber at Dugway Proving Ground is a facility in which chemical warfare and biological defensive material is challenged with chemical and biological agents in an enclosed environment with no release of agent to the atmosphere. The MM&T Program has contributed to the development of procedures for the use of the chamber.

The Test Chamber was constructed with funds from other than MM&T or MTT projects.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT



DEFENSIVE TEST CHAMBER

PROJECT NO: 0755071

TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: SMALL PART OF $645,000

BENEFITS

TECOM DEVELOPED A FACILITY AT DUGWAY PROVING GROUND IN WHICH CHEMICAL AND BIOLOGICAL DEFENSIVE MATERIAL CAN BE CHALLENGED WITH CHEMICAL AND BIOLOGICAL AGENTS IN AN ENCLOSED ENVIRONMENT.

NO AGENT IS RELEASED TO ATMOSPHERE.

MM&T PROGRAM CONTRIBUTED TO DEVELOPMENT OF PROCEDURES FOR USE OF THE CHAMBER.

AMMUNITION TESTING

--SPOILER PLATE--

Improvement of TECOM Production Test Methodology	076 5071	Mr. Benjamin Champion US Army Test & Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170

Subproject: Artillery Projectile Spoiler Plate Design and Evaluation

Design and evaluation tests for a new spoiler plate were initiated because of reported failures of the old plate. The new plate is one inch smaller in diameter and 50 percent thicker, and contains a better grade of steel. The new plate is shown placed on an 8-Inch M106 projectile with inert M78 fuze. Closeups of the plates with a M78 fuze are shown in the lower photo.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

AMMUNITION TESTING

--SPOILER PLATE--

SPOILER ON 8" PROJECTILE

PROJECT NO: 0765071

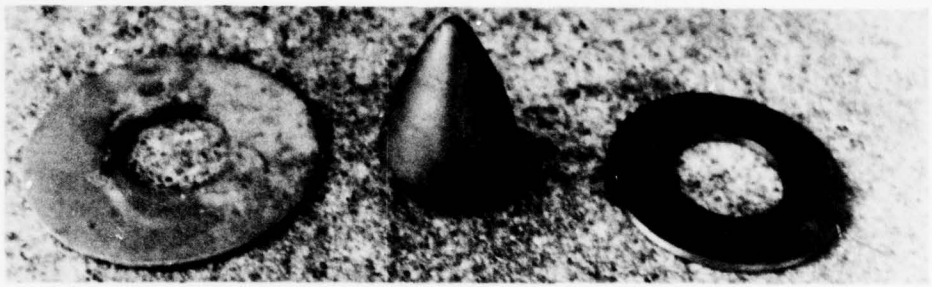
TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: $29.2K

BENEFITS

TECOM DEVELOPED A TEST FOR A NEW, SMALLER SPOILER PLATE FOR THE 8" PROJECTILE , M106.

SPOILER PLATES REDUCE THE RANGE OF INERT ROUNDS AND REDUCE TEST RESERVATION BOUNDARIES.



OLD FUZE NEW

TEST RESERVATION -- SAFETY FAN

Improvement of TECOM Production Test Methodology	076 5071	Mr. Benjamin Champion US Army Test & Evaluation Command DRSTE-ME Aberdeen Proving Ground, MD 21005	AV 283-2170

Subproject: Safety Fan

Old safety fans required range limits at 10° to 15° gun elevation. Study and tests revealed that danger area was less than previously used, especially for the APDS and APFSDS high velocity, low drag projectiles. Safety fan for the M735 was reduced from 27,000 meters to 8,000 meters; for the M392 from 19,000 to 15,000 meters. As a result, no marine patrol is needed for the M735 (5 boats usually required), and for the M392 is reduced from 5 to 3. Reduction of boat requirements permits firing to begin earlier and end later, adding at least 1 hr per day (5 hours per week) for 12 personnel (5 gun crew, 2 photographers, 2 velocity monitors, 2 field instrumentation personnel, 1 test director). Computed savings amount to $97,040 on boats for each of the projectiles and $13,920 for test crews for a total of $208,000 annually. Greater savings are anticipated as investigations for other projectiles are completed.

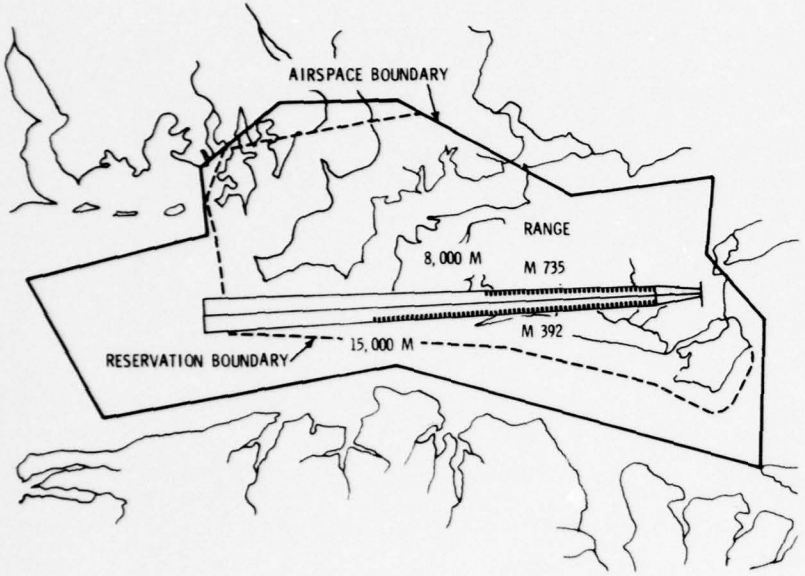
DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TEST RESERVATION - SAFETY FAN

PROJECT NO: 0765071

TITLE: MM&T - IMPROVEMENT OF TECOM PRODUCTION TEST METHODOLOGY

COST: $18.5 OF $706,000



BENEFITS

TESTS SHOWED THAT DANGER AREA WAS LESS THAN PREVIOUSLY USED AND THUS THE RANGE LIMITS WERE REDUCED.

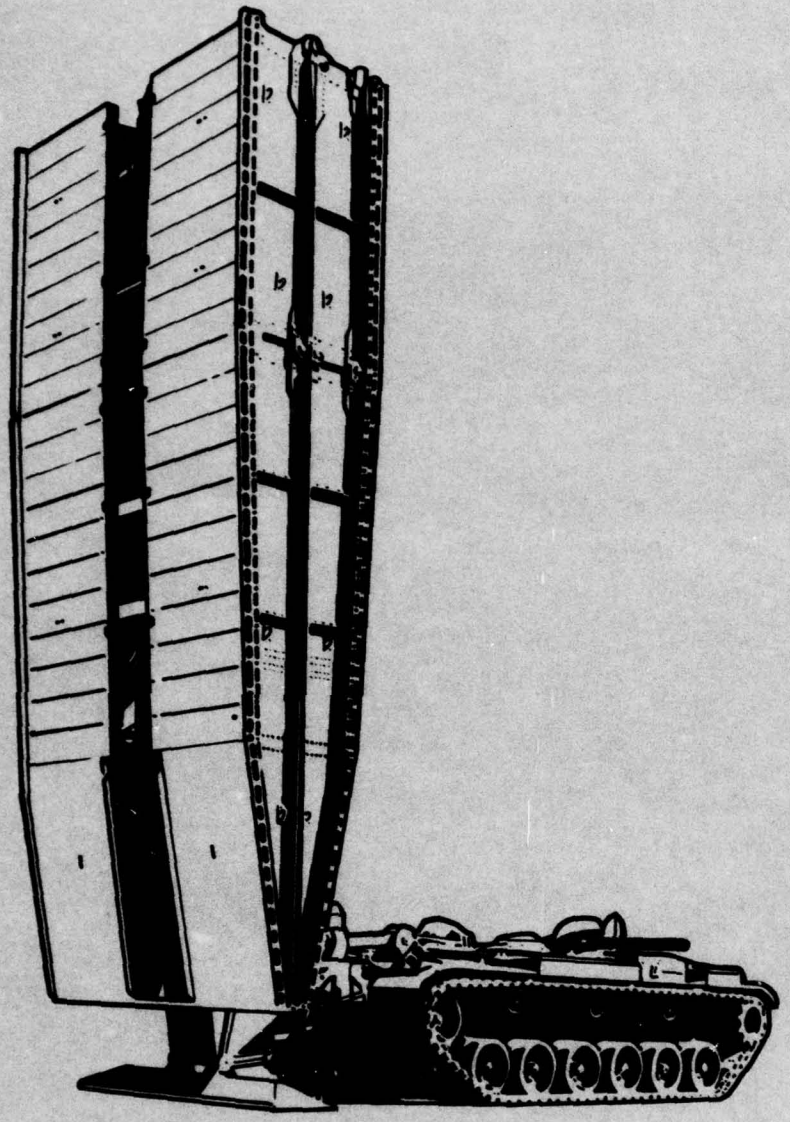
SAFETY FAN FOR M735 WAS CUT FROM 27,000 METERS TO 8,000 METERS, ELIMINATING NEED FOR THE 5 BOAT MARINE PATROL.

SAFETY FAN FOR M392 WAS CUT FROM 19,000 METERS TO 15,000, REDUCING THE MARINE PATROL FROM 5 BOATS TO 3.

WITHOUT THE PATROL, FIRING CAN START 1/2 HOUR EARLIER AND RUN 1/2 HOUR LATER, ADDING 5 HRS/WEEK

SAVINGS ON PATROLS IS $97,000 AND ON GUN CREWS IS $14,000, PER PROJECTILE.

ANNUAL SAVINGS IS $208,000.



MOBILITY EQUIPMENT R&D COMMAND
(MERADCOM)

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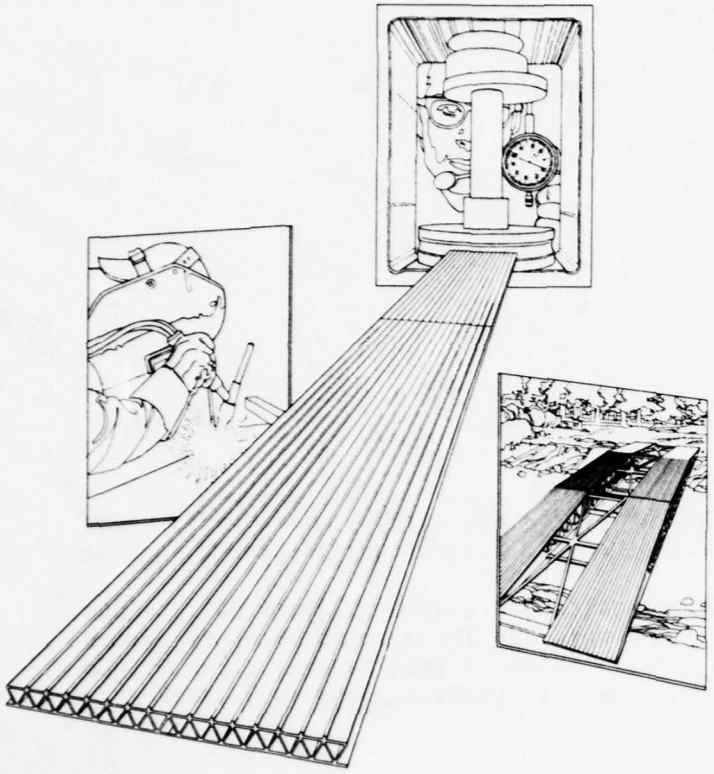
MERADCOM

INDEX

Develop Extrusion Technology for 7005-T53 High Strength Aluminum Bridge Deck Components	772 3500	Mr. Emerson Asher US Army Mobility Equipment R&D Command DRXFB-VB Ft. Belvoir, VA 22060	AV 354-5146 (703) 664-5126

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

BRIDGING



EXTRUDED ALUMINUM BRIDGE DECKING

PROJECT NO: 772 3500

TITLE: DEVELOP EXTRUSION TECHNOLOGY FOR 7005-T53 HIGH STRENGTH ALUMINUM BRIDGE DECK COMPONENTS.

COST: $185,000

BENEFITS

Alcoa extruded high strength aluminum bridge decking for the:

- Ribbon Bridge
- Mobile Assult Bridge
- Medium Girder Bridge
- Armored Vehicle Launched Bridge

7005 Alloy is field weldable.

Cuts weight by 50% over riveted aluminum bridges.

Panels are 2½″ thick and 60′ long.

APRIL 78

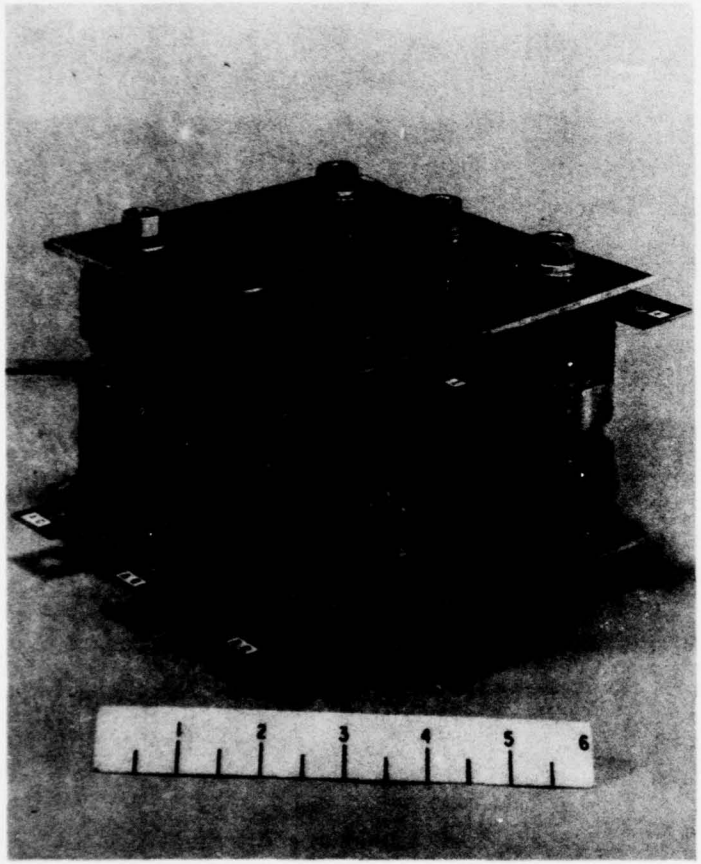
Transcalent (High Power) Rectifier	E78 3606	Dr. Russell Eaton Power Services Division Army Mobility Equipment Research & Development Cmd MERADCOM, DRDME-EA Ft. Belvior, VA 22060	AV 354-5531 (703) 664-5531

This project at RCA Electronic Products Division, Lancaster, PA, is developing methods for making and attaching heat pipes to silicon wafers to form high power rectifiers. It is also productionizing methods for applying a variable thickness metallization over both sides of the silicon wafer to thereby equalize current flow and heat transfer.

It uses heat pipe fabrication methods developed on project 276 9732 and will establish a batch type pilot line for low volume production - 20 units per day.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

HIGH POWER RECTIFIERS



6 RECTIFIERS WITH HEAT PIPES

PROJECT NO: E 78 3606

TITLE: MM&T - TRANSCALENT (HIGH POWER) RECTIFIER.

COST: $360K + 75K IN FY 79

BENEFITS

MANUFACTURED AND ATTACHED HEAT PIPES TO BOTH SIDES OF A SILICON RECTIFIER WAFER.

PERMITS HIGH HEAT DISSIPATION IN A SMALL AREA. SAVES SPACE IN USE.

FOUND A METHOD FOR APPLYING A VARIABLE THICKNESS METALLIZATION TO THE SILICON WAFER.

REDUCED COST FROM $350 TO $80 EACH.

USED IN POWER CONDITIONERS AND WELDERS.

Improvement of Surface Finish of Ceramic Materials for Bearings	7 74 5506	Mr. Emil York US Army Mobility Equipment R&D Command Materials Engineering Div. DRDME-V Ft. Belvoir, VA 22060	AV 354-5872 (703) 664-5872
		Mr. George M. Harris Army Materials & Mechanics Research Center DRXMR-EO Arsenal Street Watertown, MA 02172	AV 955-3258 (617) 923-3258)

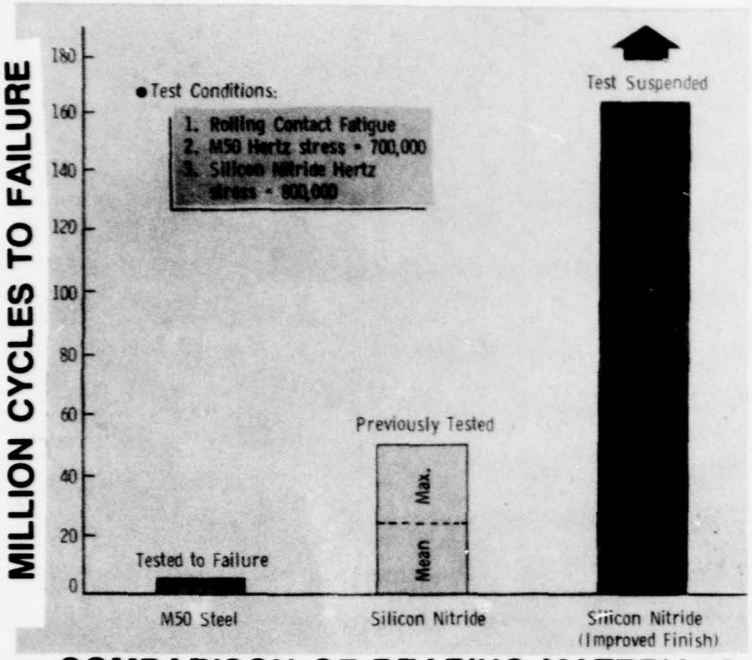
Contractors: Norton Company
Industrial Ceramics Division
ATTN: Mr. H. R. Baumgartner
1 New Bond Street
Worcester, MA 01606

Federal Mogul Corporation
ATTN: Mr. Paul E. Cowley
Ann Arbor, MI 48104

Contract: DAAG46-74-C-0055

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

BEARINGS



COMPARISON OF BEARING MATERIALS

PROJECT NO: 774 5506

TITLE: MM&T - IMPROVEMENT OF SURFACE FINISH OF CERAMIC MATERIALS FOR BEARINGS

COST: $75,000

BENEFITS

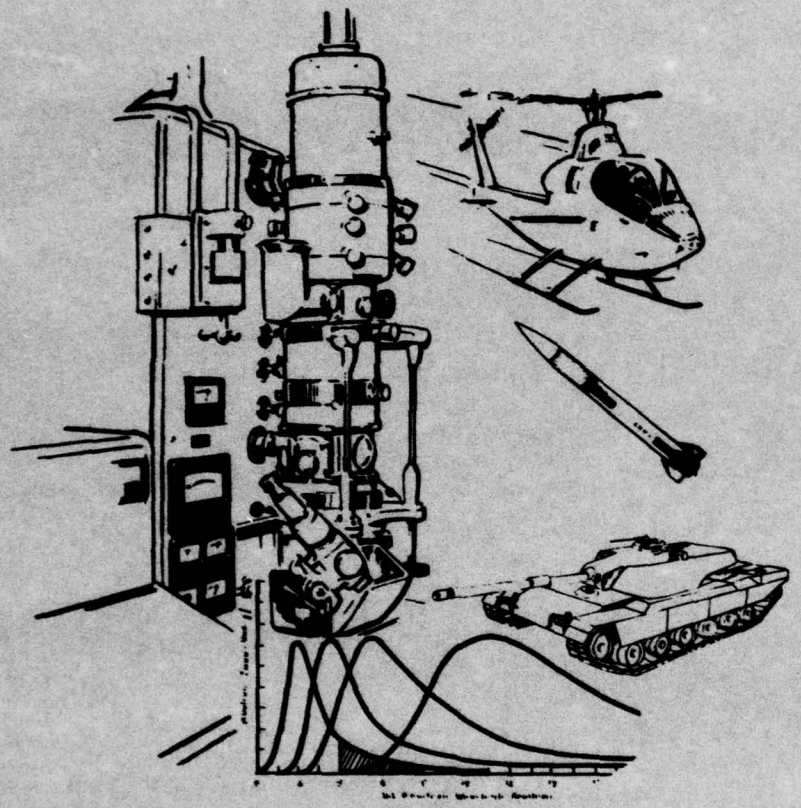
The Norton Company and Federal-Mogul Corp. showed the importance of surface finish on ceramic bearing life.

Life was increased 2x over silicon nitride bearings and 10x M50 steel bearings.

FUTURE IMPLEMENTATION

MERADCOM is working with solar on ceramic bearings for 10kw generators.

AVSLABS is working with Bell Helicopter on ceramic bearings for the main rotor.



MATERIALS & MECHANICS RESEARCH CENTER

(AMMRC)

AMMRC

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(617) 923-3555

Mr. Paul Ralston
MTT Project Engineer
US Army Material & Mechanics
Research Center
DRXMR-MQ
Watertown, MA 02172

MM&T - Nondestructive Testing of Tire Casings	M73, 74 6350	Mr. Paul Ralston MTT Project Engineer U.S. Army Material and Mechanics Research Center DRXMR-MQ Watertown, MA 02172	AV 955-3555 (617) 923-3555

PROBLEM:

The Army has established a goal to reduce tire acquisition cost by supplying 75 percent of all tire needs with retreads. However, not all tire casings are suitable for retreading due to hidden defects such as ply separation and weak cords.

SOLUTION:

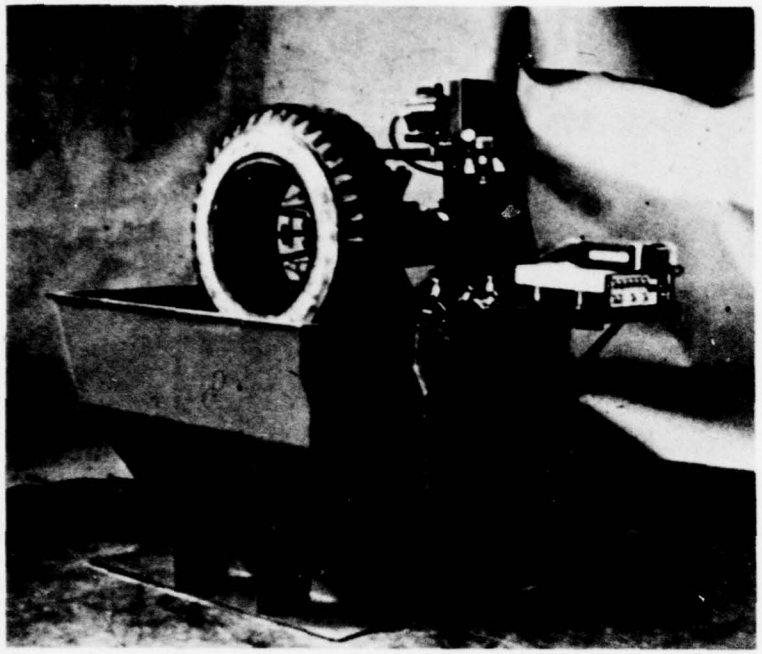
The ultrasonic inspection system shown on the first viewgraph was designed and constructed for use at depots involved in recapping tires. The portable unit shown in the next viewgraph is a residual life indicator. This test can be applied in the field on mounted tires to determine the amount of internal degradation and, therefore, can estimate the amount of remaining life.

STATUS:

Depot level model is in use at Red River. An FY77 MTT project is underway to improve the portable residual life monitor.

DARCOM PRIOR YEAR MM&T ACCOMLISHMENT

TESTING



DEPOT-LEVEL ULTRASONIC TIRE INSPECTION EQUIPMENT

PROJECT NO: M 73, 74 6350

TITLE MTT - NONDESTRUCTIVE TESTING OF TIRE CASINGS

COST: $88,000; $52,000

BENEFITS

Gatx developed two ultrasonic tire inspection systems, one for depot use and the other for field use.

The depot-level tester includes a submersion tank for close coupling of the ultrasonic sensor. It detects cord disbonds and carcass integrity for retreadability with 95% accuracy.

The field unit indicates residual life of tires on or off a vehicle.

AIDS ARMY'S GOAL OF SUPPLYING 75% OF ITS TIRE NEEDS FROM RETREADS.

Interface Techniques for Coordinate Measuring System	M 74 6350	Mr. Paul Ralston MTT Project Engineer U.S. Army Material and Mechanics Research Center DRXMR-MQ Watertown, MA 02172	AV 955-3555 (617) 923-3555

PROBLEM:

The previous inspection method for determining the acceptability for component parts for cannons relied on the use of a variety of standard tools and individual special gages requiring multiple handling and individual set-ups. The measurement data obtained was subject to interpretation and dependent on operator skill and judgment. As a result, errors were quite common.

SOLUTION:

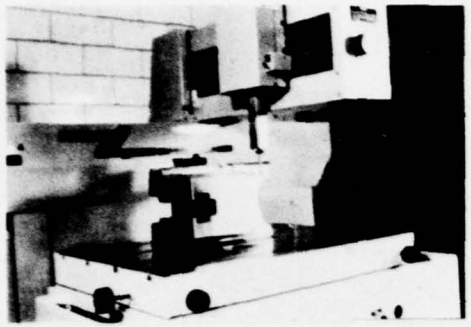
A Computerized Coordinate Measuring System was built which is capable of defining geometric shapes, areas, diameters, and contours.

STATUS:

The Computerized Coordinate Measuring System, shown inspecting the breech block from a 105mm Howitzer, has significantly reduced inoperation time and cost. As an example, for a prototype breech block, inspection time has been reduced from 16 hours to 45 minutes. For production breech blocks, inspection with gages takes 15 minutes while the CCM machine can perform the inspection in 11 minutes. However, the real savings in production inspection comes from the elimination of the special gages and the time necessary to procure them. Costs have been reduced 60 percent and procurement time 50 percent.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TESTING



MEASURING HEAD

COORDINATE MEASURING MACHINE

PROJECT NO: M 74 6350

TITLE: MTT - INTERFACE TECHNIQUES FOR COORDINATE MEASURING SYSTEM

COST: $75,000

BENEFITS

The project procured a coordinate measuring machine and developed fixturing and programs for inspecting complex machined component parts.

Inspection time for a 155MM Breechblock was cut from 45 minutes to 18 minutes. Cost of fixtures was reduced from $31,000 to $12,000, and lead time from 8 months to 4 months.

Eliminates many special gages, and multiple handling and setup.

Is in use at WVLT.

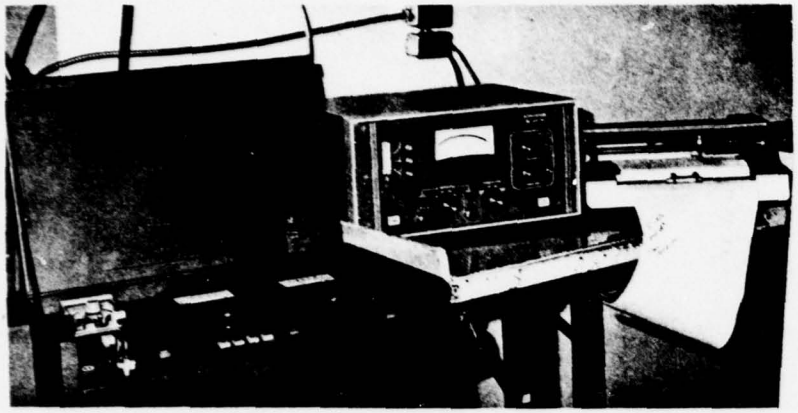
Radiographic Evaluation of Potting Voids for Electronic Fuzes	M73, 75 6350	Mr. Paul Ralston MTT Project Engineer Army Material & Mechanics Research Center AMMRC, DRXMR-MQ Watertown, MA 02172	AV 955-3555 (617) 923-3555

The new technology of dynamic x-ray scintallography has been demonstrated to possess superior sensitivity. Response times are compatible with projected full-scale fuze production rates. The significant feature of this technology is in the preparation of a continuous trace (on a linear recorder chart) whose ordinate is clearly proportional to the density of the foamed potting and whose abscissa possesses a one-to-one correspondence with the transverse scan of the conical fuze. It is this feature which permits a rapid, reliable, and permanent visual inspection record of the trace and positive identification of defects, which until now, has escaped detection.

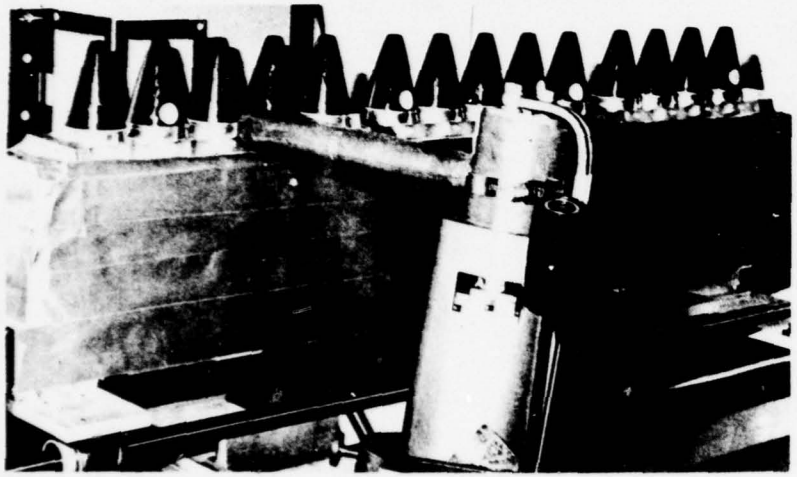
It now appears to be feasible and practicable to extend the automation of the testing procedure by simultaneously introducing the input voltages to the recorder into a set of decision circuits in such a way that the non-conforming fuze can be automatically rejected.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TESTING



VOID PLOTTING SYSTEM



X-RAY SCANNING EQUIPMENT

PROJECT NO: M 73, 75 6350

TITLE: MTT - RADIOGRAPHIC EVALUATION OF POTTING VOIDS IN ELECTRONIC FUZES.

COST: $67,100; $52,000

BENEFITS

Raytheon developed an x-ray scintillographic scanning system that uses a print-out rather than wet processed x-ray film.

The system permits real time on-line examination of fuzes coming off an assembly line at full-scale production rates.

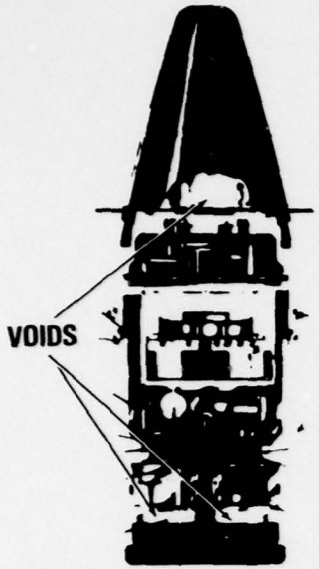
Permits detection of 0.1 inch voids in 1.5 inches of foam thru ¼ inch of steel.

The new technology is specified by procurement and has been installed in the production line for M728 proximity fuzes at Raytheon, Bristol, TN.

Radiographic Evaluation of Potting Voids for Electronic Fuzes	M75 6350 Task 1630	Mr. Paul Ralston MTT Project Engineer Army Material & Mechanics Research Center AMMRC, DRXMR-MQ Watertown, MA. 02172	AV 995-3555 (617) 923-3555

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

FUZE INSPECTION



PARTIALLY FILLED FUZE ASSEMBLY

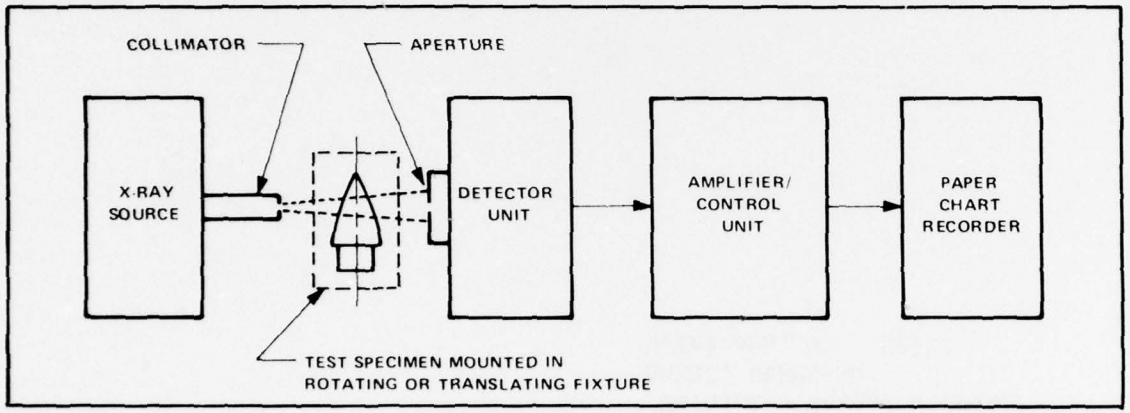
PROJECT NO: CODE 1630 OF M75 6350

TITLE: MTT: RADIOGRAPHIC EVALUATION OF POTTING VOIDS FOR ELECTRONIC FUZES

COST: $52,000

BENEFITS

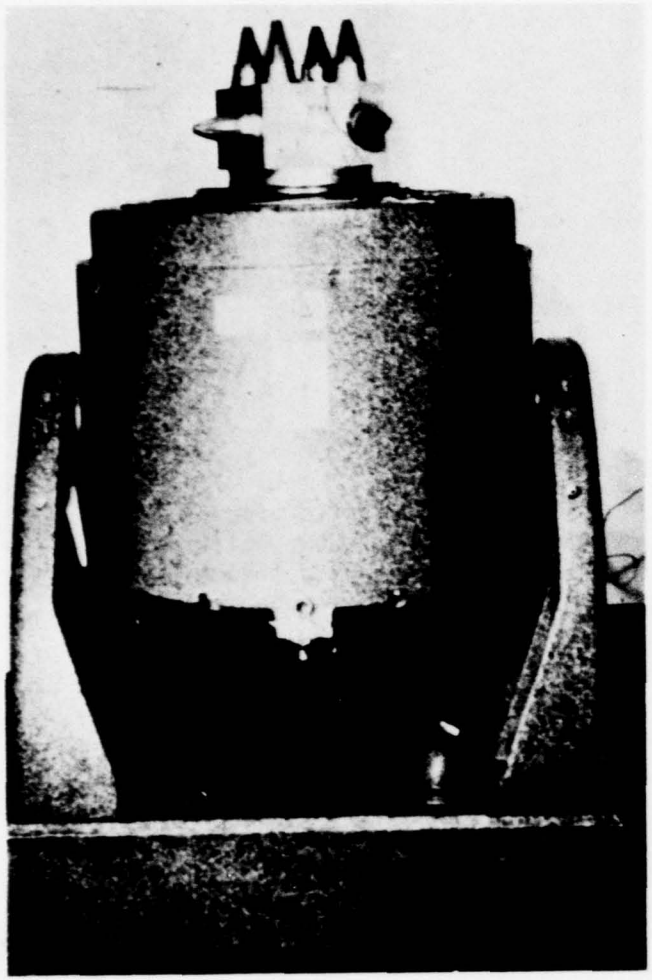
- HDL AND AMMRC DEVELOPED AN X-RAY RECORDING UNIT FOR DETECTING VOIDS IN THE POTTING MATERIAL IN THE OGIVE CAVITY.
- FUZES MOVE THRU RAPIDLY ON A BELT AND ROTATE WHILE EXPOSURE IS MADE AUTOMATICALLY.
- EXPOSURE CAN BE MADE THRU 1/8 INCH OF STEEL.
- SYSTEM USES A DISPLAY; NEEDS NO X-RAY FILM.



SCINTILLOGRAPH SYSTEM

Direct Digital Control of Sinerandom Vibration Systems	M73, 75, 76 6350	Mr. Paul Ralston MMT Project Engineer Army Material & Mechanics Research Center AMMRC, DRXMR-MQ Watertown, MA 02172	AV 955-3555 (617) 923-3555

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT



SHAKE TABLE TESTING FUZES

DIGITAL METHOD IS SUPERIOR TO OLDER ANALOG METHOD.

TESTING

PROJECT: M 73, 75, 76 6350

TITLE: MMT -- DIRECT DIGITAL CONTROL OF SINE RANDOM VIBRATION SYSTEMS.

COST: $80,200; $69,500; $69,500

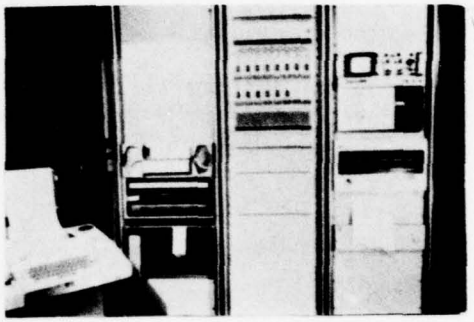
BENEFITS

Digital Vibration Testing simulates transit and firing conditions.

Direct digital computer control of the shake table provides a more realistic environment of shake frequencies between 50 and 2,000 cycles per second.

A Random-Sinusoidal envelope of frequencies is provided by the computer.

System is in use at Harry Diamond Labs on preproduction fuzes.



COMPUTER CONTROL EQUIPMENT

Automatic Inspection Device for Explosive Charge in Shell (AIDECS)	M75, 76 6350	Mr. Paul Ralston MMT Project Engineer Army Material & Mechanics Research Center AMMRC, DRXMR-MQ Watertown, MA 02172	AV 955-3555 (617) 923-3555

PROBLEM:

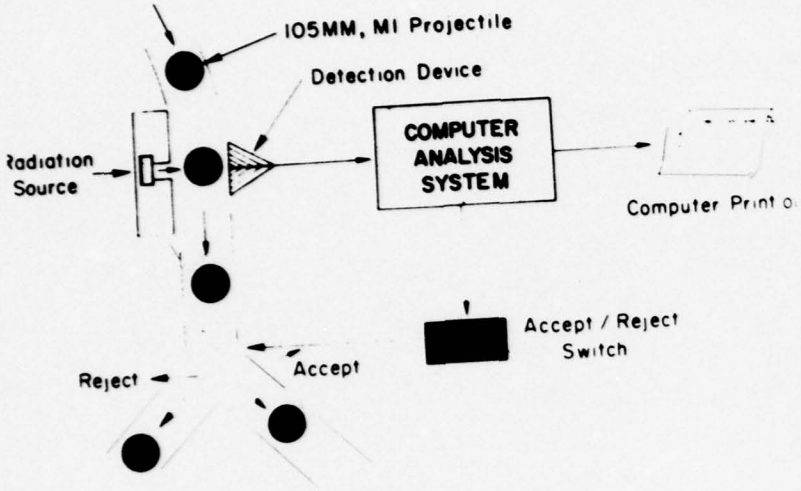
A new hot melt pour line for the 105mm M1 artillery shell is being installed at the Lone Star Ammunition Plant. The new production process will be capable of producing 44 rounds/minute which will require 100 percent inspection.

SOLUTION:

The conceptual idea for the inspection system is to utilize a combination of through transmission and back scatter gamma gaging. From the information received, a computer will construct a digitized image and automatically evaluate the quality of the loaded shell, resulting in its acceptance or rejection.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TESTING



FLOW DIAGRAM OF AUTOMATIC INSPECTION SYSTEM

PROJECT NO: M 75, 76 6350

TITLE: MTT -- AUTOMATIC INSPECTION DEVICE FOR EXPLOSIVE CHARGE IN SHELL (AIDECS)

COST $517,000; $649,000

BENEFITS

Automatic on-line inspection of projectiles for hazardous cavities in the explosive will improve safety, cut cost, and enhance Shell reliability.

The continuous spiral scan method is being developed into an engineering model by Irt. Corp. for delivery in 1978.

The filmless method saves manpower and x-ray developing and interpreting cost. Could result in $3.25 million per plant per year when in use.

Will permit 100% inspection of 44 rounds per minute. of 105MM ammunition.

Testing of Conformal Coated Printed Circuit Boards	M73, 76, 77 6350	Mr. Paul Ralston MMT Project Engineer Army Material & Mechanics Research Center AMMRC, DRXMR-MQ Watertown, MA 02172	AV 955-3555 (617) 923-3555

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TESTING

THERMOMECHANICAL TESTING

PROJECT NO: M 73, 76, 77 6350

TITLE: MTT - TESTING OF CONFORMAL COATED PRINTED CIRCUIT BOARDS.

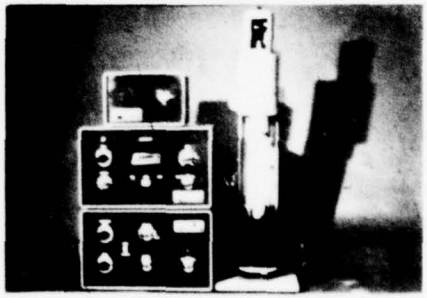
COST: $50,000; $50,000; $40,000

BENEFITS

Contractor found that "Glass Transition Temperature," TG, as obtained from Thermomechanical Testing, is much more sensitive than the shore hardness test.

Glass Transition Temperature -- TG -- indicates whether the coating will be soft, glass-like, or a hard crystalline solid.

Method is used at Miradcom to check coatings on boards for Dragon, Redeye, and LCSS Missiles.



MIL-I-46058 WILL BE UPDATED.

Portable Neutron Radiographic System-Engineering Model	M 77 6350	Mr. Paul Ralston MMT Project Engineer Army Material & Mechanics Research Center AMMRC, DRXMR-MQ Watertown, MA 02172	AV 955-3555 (617) 923-3555

PROBLEM:

Honeycomb, composite and adhesively bonded primary structures offer great weight and cost savings in the design and manufacture of structural system, i.e., helicopters. However, these materials have not been fully utilized due to the present inability to assure their serviceability after initial installation.

SOLUTION:

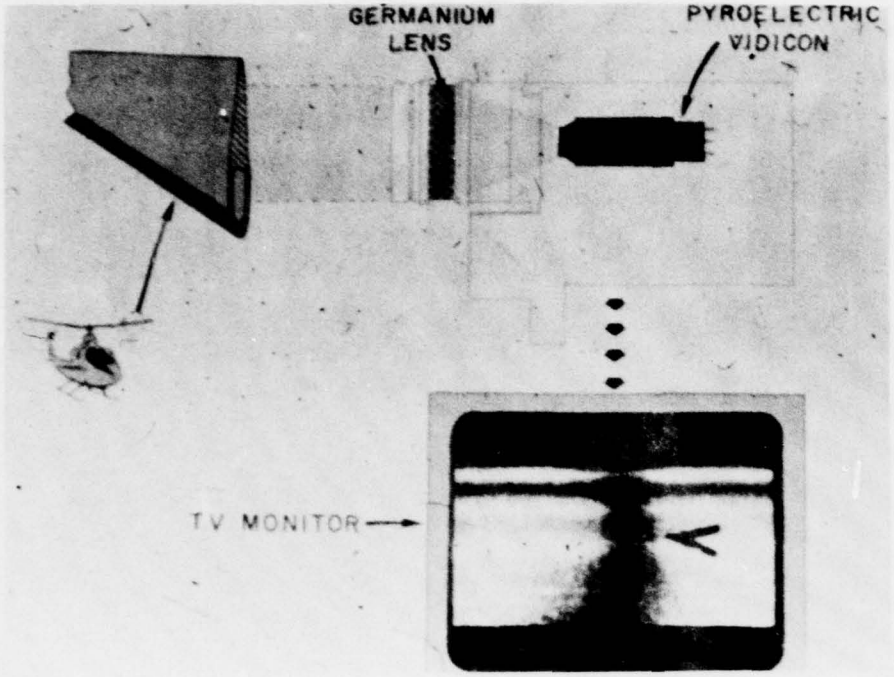
A portable neutron radiographic system is being constructed for on-site inspection use.

STATUS:

A contract for the development of the system has been let with Vought Corporation with delivery scheduled for 1979.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

TESTING



COMPOSITE TESTING SYSTEM

PROJECT NO: M 77 6350

TITLE: MTT - PORTABLE NEUTRON RADIOGRAPHIC SYSTEM -- ENGINEERING MODEL.

COST: $525,000

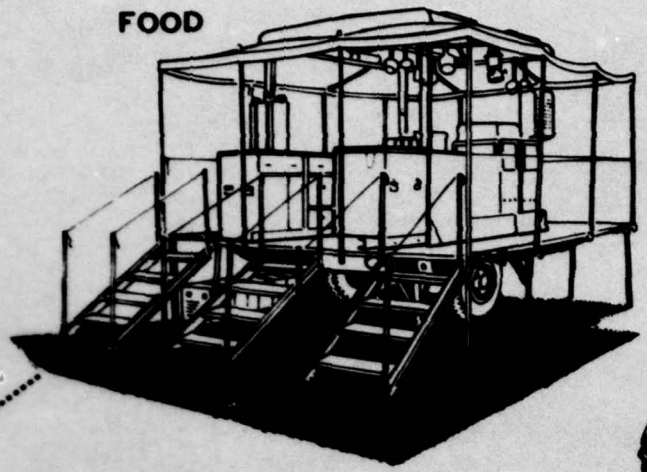
BENEFITS

A portable neutron radiographic system is being constructed for on-site inspection use.

System is expected to be delivered by Vought Corp. in FY 79.

Neutron Radiography enables viewing hydrogen-containing materials such as epoxies thru thick metal sections.

Can also detect corrosion in honeycomb and metallic structures.



FOOD

CLOTHING

SHELTER

NATICK R&D COMMAND
(NARADCOM)

NARADCOM

MM&T Representatives:	Mr. Edward F. Levell US Army Natick R&D Command Attn: DRDNA-Z Natick, MA 01760	AV 955-2793 (617) 653-1000, ext 2793
	Mr. Irving Tarlow US Army Natick R&D Command Attn: DRDNA-EM Methodology Res. Branch Natick, MA 01760	AV 955-2349 (617) 653-1000, ext 2349
	Mr. Frank Civilikas US Army Natick R&D Command Attn: DRDNA-EM Natick, MA 01760	AV 955-2349 (617) 653-1000, ext 2349

Computer-Aided Pattern Fabrication Techniques	A74 202N	Mr. Irving Tarlow US Army Natick R&D Command Attn: DRDNA-EM Methodology Res. Branch Natick, MA 01760	AV 955-2349

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

UNIFORM DESIGN

BENEFITS

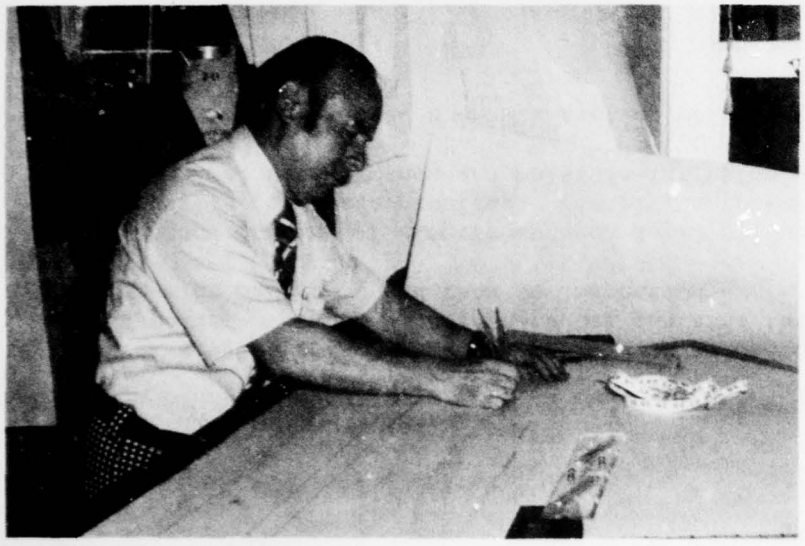
Hughes Aircraft Corp. set up a computerized pattern processing system that improves Natick's design capability, reduces cost of pattern fabrication, and improves storage and recall.

It also established a standard pattern design procedure and improves master patterns.

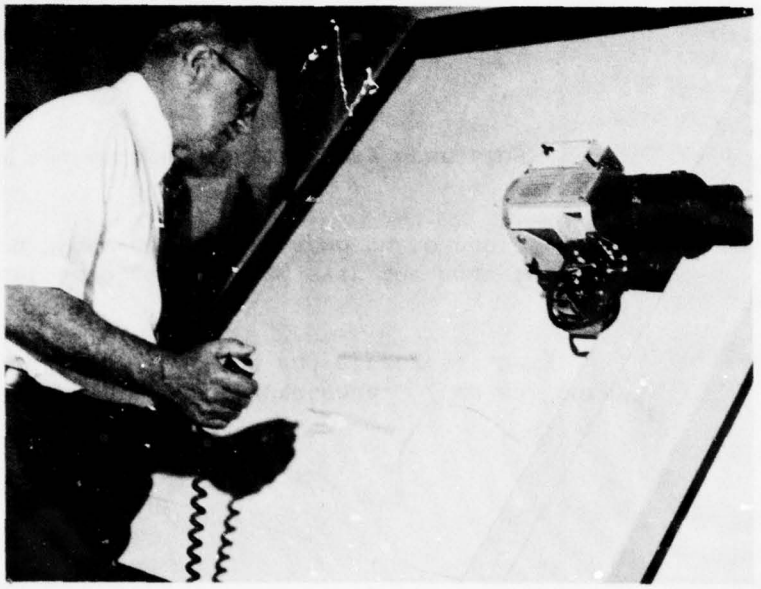
PROJECT NO: A74 202N

TITLE: COMPUTER AIDED PATTERN FABRICATION TECHNIQUES

COST: $300,000



PRIOR HAND LAYOUT METHOD



NEW COMPUTERIZED METHOD

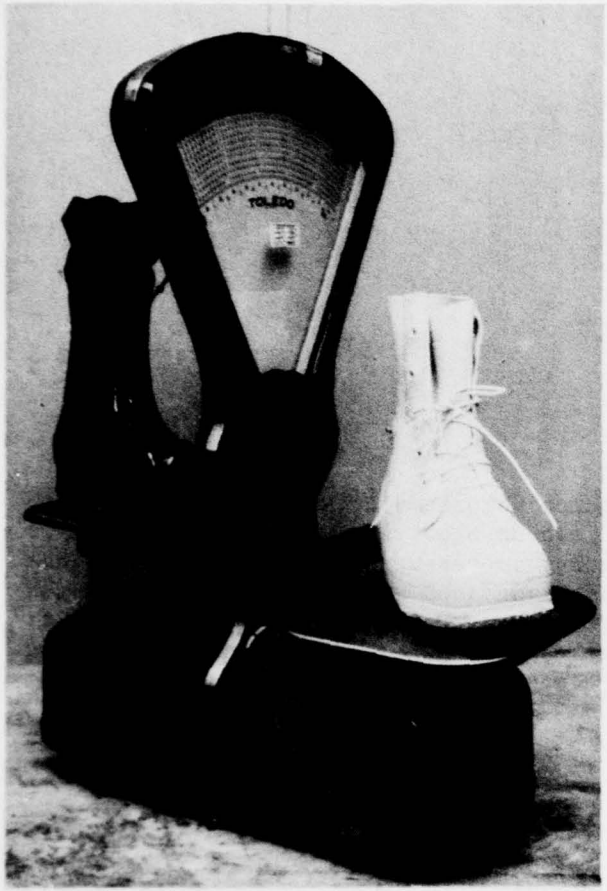
Automated Production of Insulated Footwear	Q75 8035 Q76 8035	Mr. Joseph Assaf U.S. Army Natick Research and Development Command Natick, MA 01760	AV 955-2471 (617) 653-1000 x2471

Over a nylon sock lining the "upper" is molded of expanded ether type polyurethane. Then an "outer" is molded over the upper; the outer contains the tread system for traction and strength. Next comes an oven cure and then an inspection.

A second coating of electro-sprayed solid polyurethane, unfoamed, is applied over the boot for durability and waterproofing. Finally, a three-inch nylon "snow collar" is sewn on to protect the wearer against snow and moisture intrusion.

The project developed a 4-unit station which automates or mechanizes most of these operations.

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT
FOOTWEAR PRODUCTION



NEW BLACK BOOT WEIGHS LESS THAN CURRENT ARCTIC BOOT

BOOTS KEEP WARM AND DRY AT - 40°F

PROJECT NO: Q 75 76 8035

TITLE: MM&T--AUTOMATED PRODUCTION OF INSULATED FOOTWEAR.

COST: $310,000; $350,000

BENEFITS

UNIROYAL ESTABLISHED A 4-UNIT STATION FOR:

- INJECTION MOLDING EXPANDED POLYURETHANE TO FORM THE UPPER PORTION OF THE BOOT,
- INJECTION MOLDING THE OUTER PORTION OVER THE UPPER,
- OVEN CURING THE BOOT,
- ELECTRO-SPRAYING SOLID POLYURETHANE OVER THE ENTIRE BOOT TO FORM A DURABLE, PROTECTIVE COAT,
- SEWING ON A 3 INCH SNOW COLLAR.

THE NEW SYSTEM REPLACES HAND LAYUP AND PROVIDES A SUPERIOR PRODUCT.

Numerically Controlled Helmet Die Sinking (CAM)	Q76 8036	Mr. Abraham L. Lastnik Engineering Program Mgmt Office Army Natick Research and Development Command DRDNA-VCA Natick, MA 01760	AV 955-2102 (617) 653-1000 X2102

ACCOMPLISHMENTS:

Comfort, fit, and improved protection highlight the new style helmet for combat soldiers. Developed at NARADCOM as part of the Personnel Armor System for Ground Troops, the helmet is molded of Kevlar [R]. Molds were machined on a numerically controlled milling machine using tapes developed on a contouring program written by engineers at Boeing after computer specialists at the Army Management Engineering Training Agency, AMETA, found there was no contouring program available in the public domain. Software is available from Boeing or McDonnell Douglas for smoothing complex sculptured surfaces other than helmets.

[R] DuPont Trademark

DARCOM PRIOR YEAR MM&T ACCOMPLISHMENT

DIE SINKING

NEW HELMET DESIGN

PROJECT NO. Q 76 77 8036

TITLE: MM&T--NUMERICALLY CONTROLLED HELMET DIE SINKING (CAM)

COST: $70,000; $75,000

BENEFITS

AMETA DEVELOPED SOFTWARE FOR CONTROLLING A NUMERICALLY CONTROLLED MILLING MACHINE FOR MACHINING HELMET FORMING DIES.

PICATINNY ARSENAL FABRICATED MATCHED METAL PRODUCTION TYPE MOLDS USING THE SOFTWARE DEVELOPED ABOVE.

THREE SIZES OF WOODEN PLUGS FOR THERMOFORMING OF HELMET SHAPES WERE ALSO MACHINED ON NC EQUIPMENT.

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REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER	2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER: NONE	
4. TITLE (and Subtitle): MANUFACTURING METHODS AND TECHNOLOGY PROGRAM ACCOMPLISHMENTS	5. TYPE OF REPORT & PERIOD COVERED: Rept. Annual 1977-1978
	6. PERFORMING ORG. REPORT NUMBER: NONE
7. AUTHOR(s): Charles E. McBurney	8. CONTRACT OR GRANT NUMBER(s): N/A
9. PERFORMING ORGANIZATION NAME AND ADDRESS: US Army Industrial Base Engineering Activity, ATTN: DRXIB-MT, Rock Island, IL 61299	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: N/A
11. CONTROLLING OFFICE NAME AND ADDRESS: US Army Industrial Base Engineering Activity, ATTN: DRXIB-MT, Rock Island, IL 61299	12. REPORT DATE: July 1978
	13. NUMBER OF PAGES: 278
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): US Army Materiel Development & Readiness Command, ATTN: DRCMT, Office of Manufacturing Technology, 5001 Eisenhower Avenue, Alexandria, VA 22333	15. SECURITY CLASS. (of this report): Non-classified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE: N/A

16. DISTRIBUTION STATEMENT (of this Report)

DISTRIBUTION UNLIMITED

242p.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

DISTRIBUTION UNLIMITED

18. SUPPLEMENTARY NOTES

N/A

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Manufacturing methods	Technology utilization
Manufacturing technology	MM&T Accomplishments
Manufacturing methods and technology	Technology transfer

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, benefits of the work, results obtained, and illustrates the process, equipment, or end item supported. An accompanying page gives project engineer's name, address, phone number, and contract number and report designation.

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