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INDEX TO BENET WEAPONS LABORATORY (LCWSL)
TECHNICAL REPORTS - 1981

R. D. Neifeld
Technical Publications and Editing Unit

April 1982



US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
LARGE CALIBER WEAPON SYSTEMS LABORATORY
BENET WEAPONS LABORATORY
WATERVLIET, N. Y. 12189

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ARLCB-TR-81008	A099396
ARLCB-SP-81009	--
ARLCB-TR-81010	A099112
ARLCB-TR-81011	B058199L
ARLCB-TR-81012	A099736
ARLCB-TR-81013	B058434L
ARLCB-MR-81014	A102056
ARLCB-TR-81015	B058435L
ARLCB-TR-81016	A101358
ARLCB-TR-81017	A101900
ARLCB-TR-81018	A101408
ARLCB-TR-81019	A101901
ARLCB-TR-81020	A101265
ARLCB-MR-81021	A101219
ARLCB-TR-81022	A101268
ARLCB-TR-81023	B059207L
ARLCB-TR-81024	A102792

AD NUMBERS--1981 (CONT.)

<u>REPORT NUMBER</u>	<u>AD NUMBER</u>
ARLCB-TR-81025	A101722
ARLCB-TR-81026	B058745L
ARLCB-TR-81027	A103208
ARLCB-TR-81028	A103475
ARLCB-TR-81029	A103386
ARLCB-SP-81030	A103774
ARLCB-TR-81031	A103387
ARLCB-TR-81032	B059758L
ARLCB-TR-81033	B061949L
ARLCB-TR-81034	A104184
ARLCB-TR-81035	A104313
ARLCB-TR-81036	B060283L
ARLCB-TR-81037	B060489L
ARLCB-TR-81038	A105243
ARLCB-TR-81039	B060490L
ARLCB-TR-81040	A105228
ARLCB-TR-81041	B061378L
ARLCB-TR-81042	B061132L
ARLCB-TR-81043	A109482
ARLCB-TR-81044	A109320
ARLCB-TR-81045	A110133
ARLCB-TR-81046	B062871L

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81001	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) THE MICROSTRUCTURAL AND PROPERTY CHANGES OF LASER TREATED ELECTRODEPOSITS		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) V. P. Greco		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Benet Weapons Laboratory Watervliet Arsenal, Watervliet, NY 12189 DRDAR-LCB-TL		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 32970672130 PRON No. 1A924411A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE January 1981
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 24
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Presented at the 67th Annual AES Conference & Exhibit of Industrial Finishing, Milwaukee, WI, 22-26 June 1980.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Electrodeposits LASER Surface Heating Chromium Surface Diffusion		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The use of the LASER as a tool to improve the properties of electrodeposits for wear and erosion resistance is introduced. The microstructures and micro-hardness of LASER treated electrodeposits of chromium (Cr) and duplex coatings of chromium over cobalt (Co) onto steel are shown. Cobalt as an underlay is shown to produce superior structures compared to chromium directly on steel which suffers from the formation of brittle phases at the chromium-steel interface.		

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81002	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) COMPUTATION SCHEMES FOR SENSITIVITY COEFFICIENT OF EXTERIOR BALLISTICS WITH VELOCITY SQUARE DAMPING		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) C. N. Shen and Julian J. Wu		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Benet Weapons Laboratory Watervliet Arsenal, Watervliet, NY 12189 DRDAR-LCB-TL		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 36KA7000204 DA Project No. 1564018136GRN PRON No. 1A0215641A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE January 1981
		13. NUMBER OF PAGES 36
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Presented at the 1980 Army Numerical Analysis and Computer Conference, NASA Ames Research Center, Moffett Field, California, 20-21 February 1980.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Ballistics with Drag Sensitivity Coefficients Target Hitting Initial Velocity and Elevation Angle Correction Computational Scheme Iteration Procedure		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The principal equation of exterior ballistics with velocity square damping term has been integrated analytically in obtaining the solution for tangential velocity in terms of the elevation angle and other parameters. Using the variational method, four equations are obtained. The first one is derived from consideration of terrain slope and the second one is determined by hitting the target. The third and fourth equations are variations of the range and (CONT'D ON REVERSE)		

20. Abstract (Cont'd)

elevation drag functions, respectively.

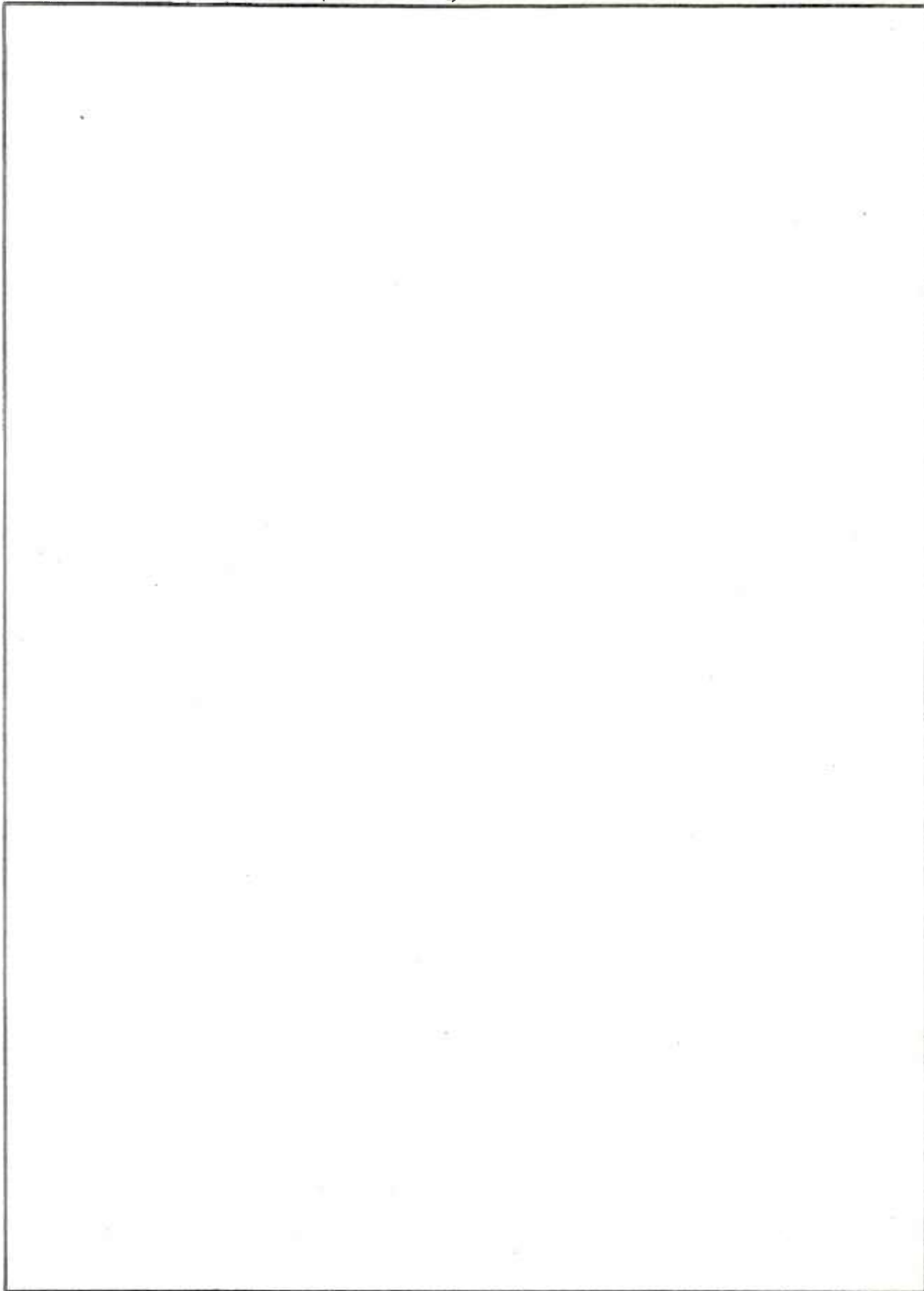
The computation involves integrals which can be evaluated analytically if the drag coefficient is relatively small. In simplifying the computational procedure we can assign the launch and impact slopes and then compute the drag functions and the terrain slope. However, this procedure is in reverse order because physically the terrain slope is known a priori the rounds are fired. If the terrain slopes and launch slopes are given first, an iteration procedure in computation is required to solve for the impact slopes. The sensitivity coefficients and the range ratios are then computed and plotted for various terrain slopes and launch slopes as the drag coefficients are varied.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81003	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) REINFORCEMENT OF FeCrAlY WITH SILICON CARBIDE (CARBON CORE) FILAMENT		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) I. Ahmad, D. N. Hill, J. Barranco, R. Warchak, and W. Heffernan		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, N.Y. 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 612105.H840011 DA Project No. 1L162105AM84 PRON No. AW-9-R0003-01-AW-M2
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, New Jersey 07801		12. REPORT DATE January 1981
		13. NUMBER OF PAGES 19
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Published in <u>Advanced Fibers and Composites for Elevated Temperatures</u> edited by I. Ahmad and B. R. Noton, pp. 156-174; proceedings of symposium held at 108th AIME Annual Meeting, New Orleans, Louisiana, 20-21 February 1979.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Chemical Vapor Deposition Diffusion Bonding FeCrAlY Alloy High Temperature Mechanical Properties Metal Matrix Composites Silicon Carbide Filament Stress-to-Rupture Tungsten Coating		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) In view of its high temperature stability (100 hr stress-to-rupture of 280 ksi at 2000°F), low density (0.115 lb.in. ³) and high elastic modulus (60x10 ⁴ psi) silicon carbide filament (carbon core) is an attractive candi- date as a reinforcement for high temperature matrix alloys. However, it reacts with most metals at elevated temperatures and must be protected with a suitable barrier coating. For FeCrAlY, tungsten was found to be a good barrier material. Therefore, 0.0005 in. thick coating of tungsten was (CONT'D ON REVERSE)		

20. Abstract (Cont'd)

applied to the filament by a continuous chemical vapor deposition process. The coated filament had 100 hr 2000°F rupture strength of 110-130 ksi. Composites of FeCrAlY containing about 30 v/o of the coated filament were fabricated using the diffusion bonding process and their tensile and stress-to-rupture properties were determined in the 1800°F - 2000°F range. While at room temperature the tensile strength of the composite was low, at elevated temperatures it approached values predicted by the rule of mixtures. At 1800°F, the 100 hr stress-to-rupture was 35 ksi. At higher temperatures, excessive coating-matrix interaction resulted in the degradation of the composite properties.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-SP-81004	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Computer User Guide for IBM 4341		5. TYPE OF REPORT & PERIOD COVERED
7. AUTHOR(s) J. Pascale R. Romano		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, N.Y. 12189		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon System Laboratory Dover, New Jersey 07801		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. DA Project. PRON No.
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE 15 January 1981
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) IBM 4341 Computer Central Processor		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This guide provides an introduction to the IBM 4341 Computer, and associated operating system and describes in detail the facilities, services, procedures, and policies relating to its use.		

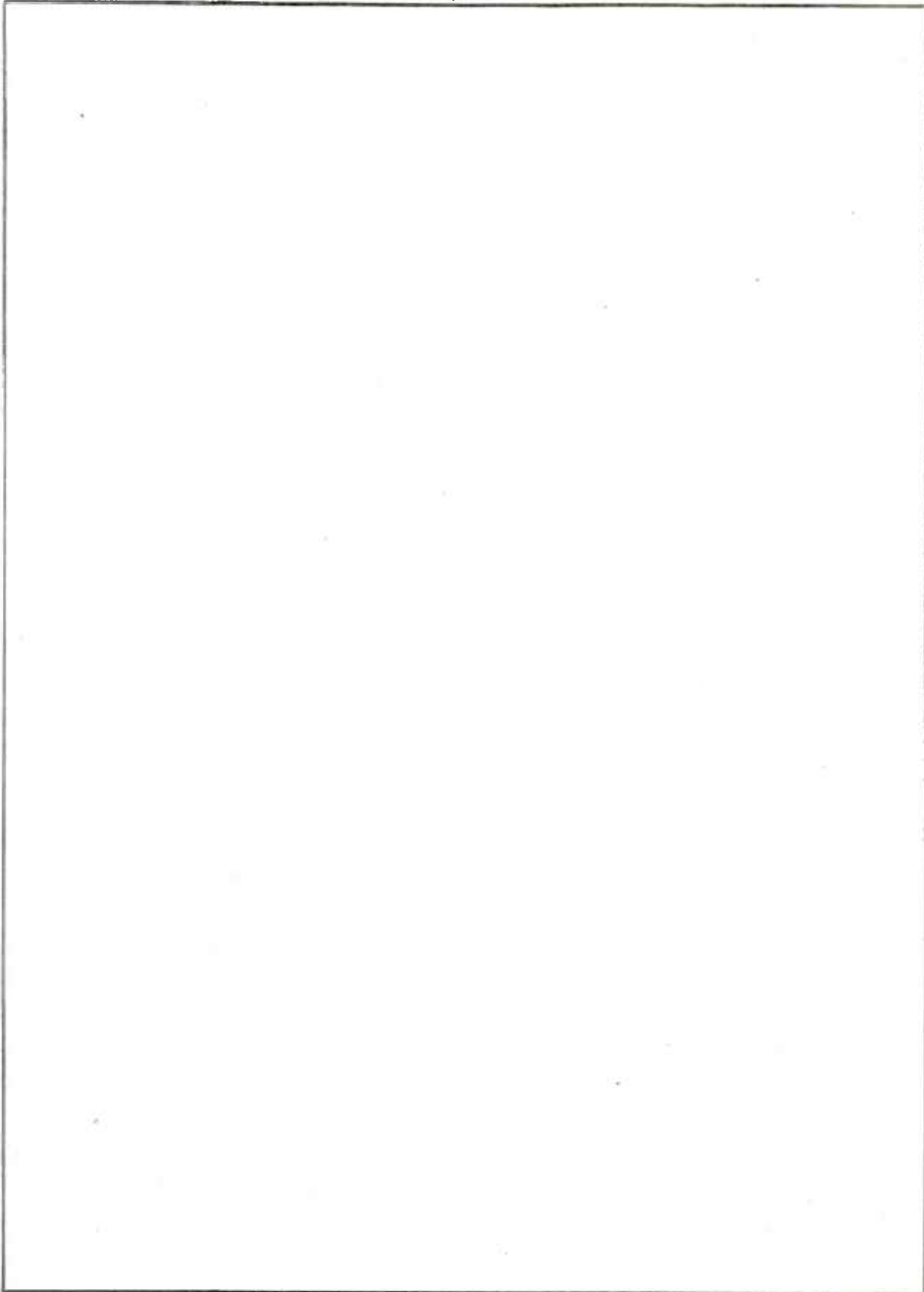


REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81005	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) RESIDUAL STRESS REDISTRIBUTION CAUSED BY NOTCHES AND CRACKS IN A PARTIALLY AUTOFRETTAGED TUBE		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) S. L. Pu and M. A. Hussain		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Benet Weapons Laboratory Watervliet Arsenal, Watervliet, NY 12189 DRDAR-LCB-TL		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H600011 DA Project No. 1L161102AH60 PRON No. 1A0215601A1A
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE January 1981
		13. NUMBER OF PAGES 21
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES To be published in Journal of Pressure Vessel Technology.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Stress Intensity Residual Stress Stress Redistribution Autofrettaged Tube Fracture Mechanics		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A simple method is provided for the computation of the redistribution of residual stresses and the stress intensity factors due to the introduction of notches and cracks in a partially autofrettaged tube. Numerical results of several crack and notch problems are obtained by the method of thermal simulation. These results are shown to be in excellent agreement with those obtained from the classical method of superposition. The new method based on thermal simulation (CONT'D ON REVERSE)		

20. Abstract (Cont'd)

is easier to apply and it avoids the singular stresses near the crack tip when the distributed crack face loading is used in the method of superposition.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81006	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A CRITICAL REVIEW OF THE DRY FRICTION AND COMPRESSIBLE FLUID RECOIL/COUNTER-RECOIL CONCEPTS		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) H. J. Sneck		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, N.Y. 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 612603H181011 DA Project No. TL162603AH18 PRON No. 1A1AZC07NMLC
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, New Jersey 07801		12. REPORT DATE February 1981
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14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Recoil Mechanism Dry-Friction Recoil System Compressible Fluid Recoil System		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report reviews two new recoil systems as possible replacements for the conventional mechanisms currently in use on medium and large size cannon. One uses compressible fluid to dissipate energy in viscous friction and store elastic energy for counter recoil. The other uses coulomb or dry friction for dissipation of the recoil energy.		



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81007	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) SERVICE SIMULATION TEST SYSTEM FOR KINETIC ENERGY PENETRATOR PROJECTILES		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) M. A. Scavullo and J. H. Underwood		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 41111629916 PRON No. 1A9289511A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE February 1981
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 18
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE		
16. DISTRIBUTION STATEMENT (of this Report) Distribution limited to US Government Agencies only because of test and evaluation; February 1981. Other requests for this document must be referred to Commander, ARRADCOM, ATTN: Benet Weapons Laboratory, DRDAR-LCB-RA, Watervliet Arsenal, Watervliet, N. Y. 12189.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Presented at Second Charlottesville Conference on High Density Penetrator Materials, Foreign Science Technology Center, Charlottesville, Virginia, October 1980.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Simulation Projector Launch Fracture Tensile Tests Failure		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) During the launch of a high density penetrator round the sabot pulls the penetrator through the gun tube with a given acceleration. This causes a tensile stress in the penetrator which is proportional to the mass of the unsupported rear end of the penetrator times the acceleration. This tensile stress is a maximum at the rear of the sabot near the location of the rearmost (CONT'D ON REVERSE)		

20. .Abstract (Cont'd)

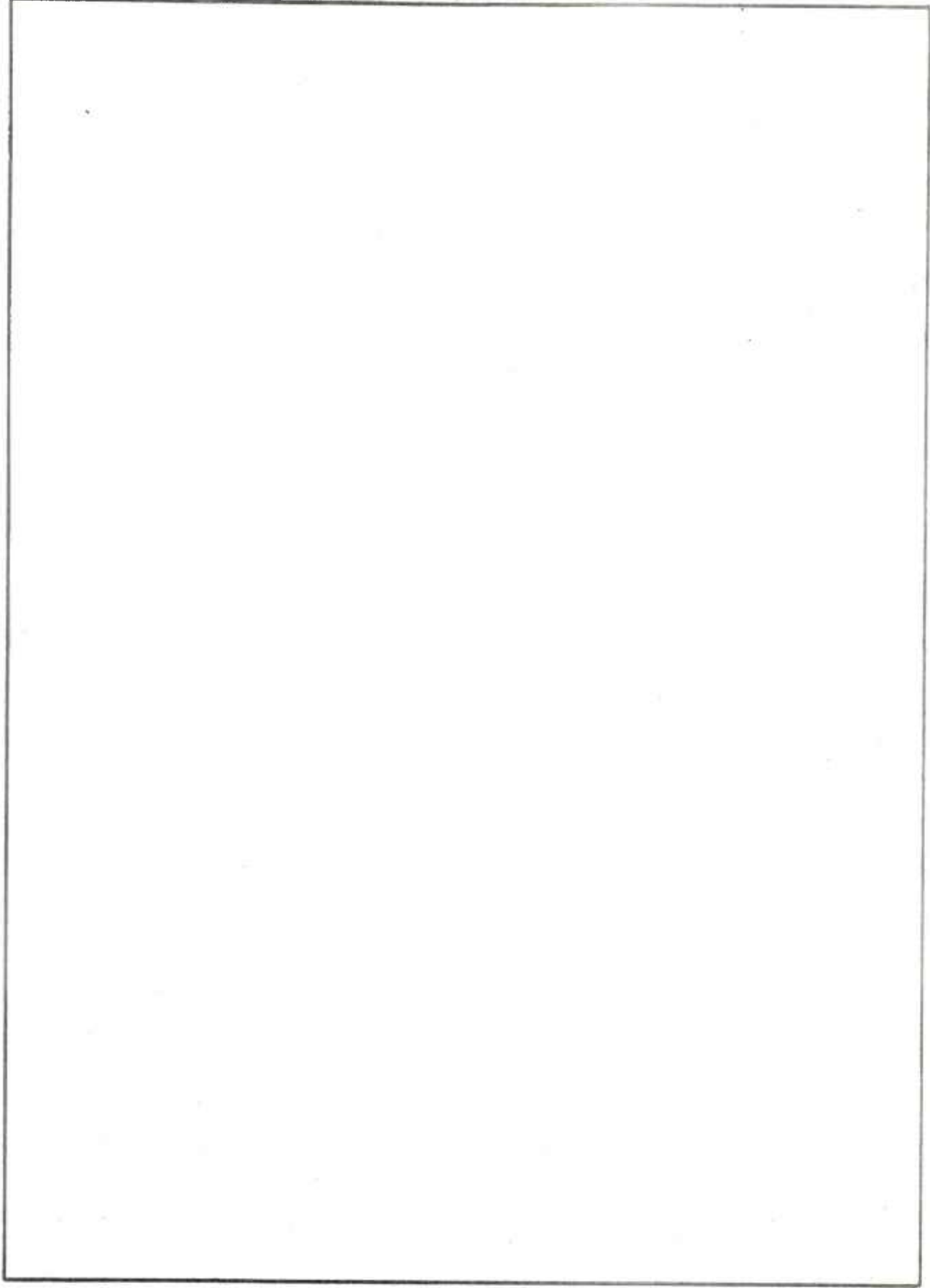
groove which interconnects the sabot and penetrator. A simulation of this loading can be achieved by a tensile test in which the penetrator is loaded through its grooves. In this paper we will discuss the design of the tensile test apparatus and the preliminary results achieved. The test system can be used for comparisons of various designs, materials, coatings, and environmental effects.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81008	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A PHOTOELASTIC STUDY OF STRESSES IN SINGLE-GROOVE CONNECTIONS OF THE SAME MATERIAL		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Y. F. Cheng		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 6111.01.91A0 PRON No. 1A1281501A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE February 1981
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14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Groove Connections Photoelasticity Maximum Fillet Stresses Contact Stresses Stress Concentrations		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report describes a three-dimensional photoelastic study on stresses in single-groove connections of the same material. Two groove profiles were investigated; namely, the British standard buttress and the new profile. Boundary stresses, interior stresses, and contact stresses were determined. Shear-difference method was used and the procedure of the method was outlined. (CONT'D ON REVERSE)		

20. Abstract (Cont'd)

Appropriate checks for the accuracy of the results were made. Heywood's empirical equation for calculating maximum fillet stress in loaded projections was reviewed. It was found that the British standard buttress is stronger than the new profile and that the Heywood's equation is not applicable in our problem. Further work on multi-groove connection is in progress.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-SP-81009	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) POSTURE REPORT - FY 1980		5. TYPE OF REPORT & PERIOD COVERED Final 1 Oct 79 thru 30 Sept 80
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Coordinated by: Plans and Resources Section Benet Weapons Laboratory		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, N.Y. 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. N/A DA Project. N/A PRON No. N/A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, New Jersey 07801		12. REPORT DATE March 1981
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 75
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents an overview of the most important technical contributions and programs in research technology, weapons development, and engineering support for cannon technology.		



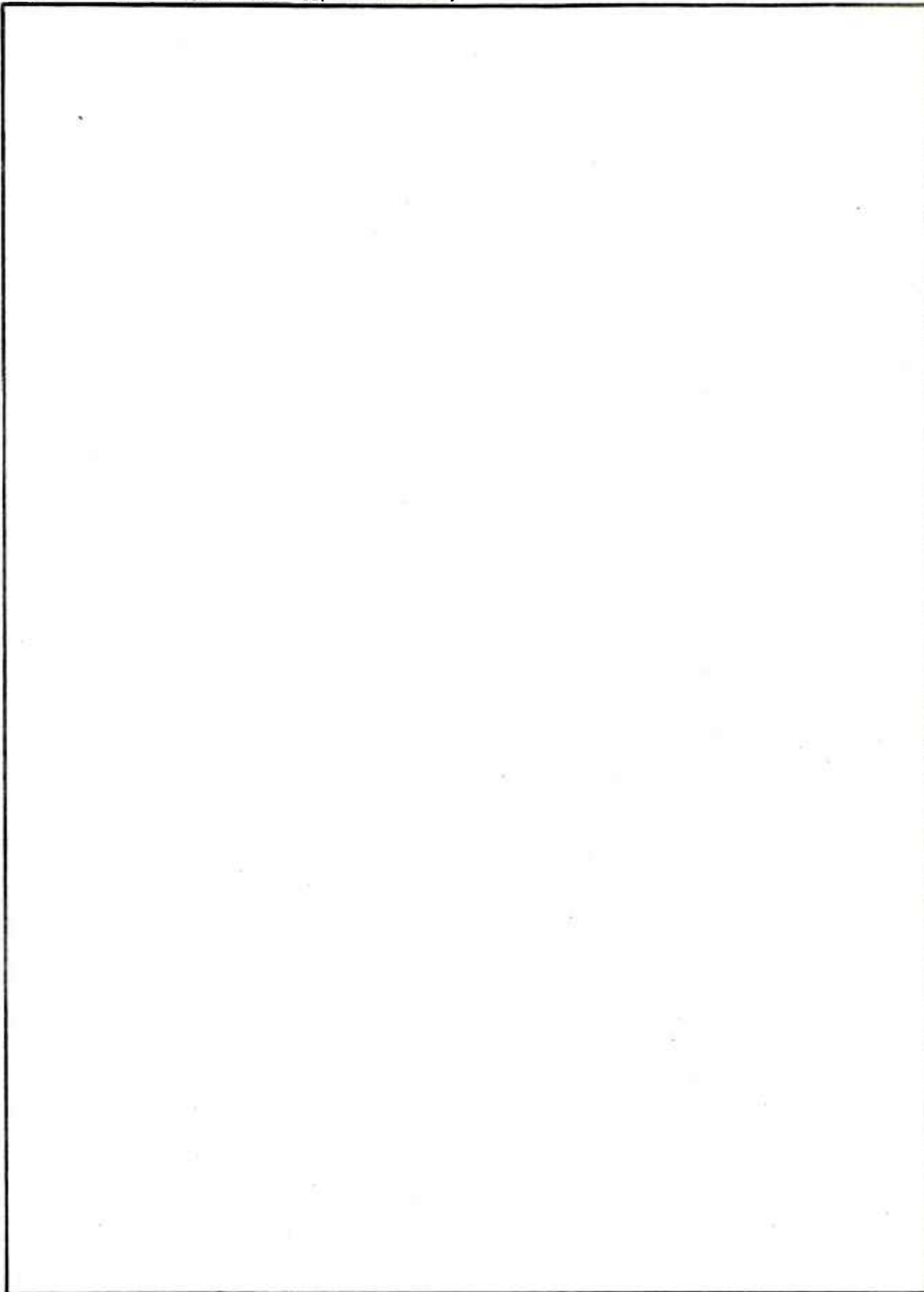
REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81010	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) THERMAL AND STRUCTURAL ANALYSIS OF THE EFFECTS OF CHLORINE IMPURITIES ON PRESSURIZED CADMIUM SULFIDE		5. TYPE OF REPORT & PERIOD COVERED Final
7. AUTHOR(s) P. J. Cote, G. P. Capsimalis, and C. G. Homan		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H600011 DA Project No. 1L161102AH60 PRON No. 1A0215601A1A
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE March 1981
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Submitted for publication to Applied Physics Letters.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Differential Scanning Calorimetry X-Ray Diffraction Temperature Effects Cadmium Sulfide Pressure Effects		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Anomalous large diamagnetism ($\chi \sim 0.25/4\pi$ cgs units) and large positive magnetism ($\chi_v \sim +10^{-4}$ cgs units) have recently been reported in pressure quenched CdS polycrystalline samples by Homan and MacCrone. These effects were shown to be sample material source dependent, and as a first step toward characterizing these samples, we compared the thermal and structural properties of various CdS samples before and after pressurization. Samples (CONT'D ON REVERSE)		

20. Abstract (Cont'd)
containing up to 6 wt % Cl were prepared by precipitation from a chloride containing aqueous bath. We find that (i) Cl impurities are probably present in the form of a complex which can decompose on heating to $\text{CdS} + \text{CdCl}_2$, (ii) melting of a portion of the samples containing high levels of Cl occurs at 535°C and is attributed to the eutectic temperature of the $\text{CdS} + \text{CdCl}_2$ mixture, and (iii) heating beyond 535°C produces complete volatilization of the CdCl_2 component. The results on samples prepared by mixing of CdS and $\text{CdCl}_2 \cdot \text{H}_2\text{O}$ were examined and found to have similar thermal behavior. The cadmium sulfide used in the previous magnetization study was examined and, based on the similarities in the thermal and structural properties, we conclude that the samples which exhibit the anomalous magnetic effects were also prepared by precipitation. In agreement with earlier studies, metastable phases are observed after various pressurizations to above 4.0 GPa.

20. Abstract (Cont'd)

coated steel liners to reduce excessive bore erosion. Firing tests conducted in the 20 mm M24A1 gun system compare the Ta/steel with steel and chromium plated steel liners subjected to the same test conditions. Preliminary results indicate that the Ta/steel combination reduces erosion in the 20 mm gun system. Future work calls for adapting the Ta/steel liner concept to large caliber gun tubes.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81012	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) THE CORRELATION OF FRACTURE TOUGHNESS WITH CHARPY V-NOTCH IMPACT TEST DATA		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) S. Tauscher		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, N.Y. 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 3297.06.7588 PRON No. M1-7-P2913-M11A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, New Jersey 07801		12. REPORT DATE March 1981
		13. NUMBER OF PAGES 72
14. MONITORING AGENCY NAME & ADDRESS (If different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Barsom-Rolfe Correlation Charpy Impact Test Correlation Linear Regression Plain-Strain Fracture Toughness		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Fracture toughness data is compared with the Charpy V-notch impact data. The applicability of various regression models for showing the relationship of K_{Ic} with other mechanical properties is examined for gun steel. The types of material were classified by steel maker, type of forging, and location within the tube. It was concluded that, of the models examined, $K_{Ic}^2 = 5 \text{ CVN } \sigma_{ys} - .25 \sigma_{ys}^2$, the Barsom-Rolfe correlation, provided the best correlation of K_{Ic} with mechanical property data. However, even then, the prediction of K_{Ic} was only within 6 - 18 percent of the measured value.		



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81013	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) MAIN ARMAMENT CONCEPTS FOR A NEAR TERM FUTURE MAIN BATTLE TANK		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) John K. Jorczak		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Benet Weapons Laboratory Watervliet Arsenal, Watervliet, N.Y. 12189 DRDAR-LCB-TL		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 612603.H1.80111 DA Project No. 1L162603AH18 PRON No. 1A-0-2ZB01-0-NMLC
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, N.J. 07801		12. REPORT DATE March 1981
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 43
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE		
16. DISTRIBUTION STATEMENT (of this Report) Distribution limited to US Government Agencies only because of test and evaluation; March 1981. Other requests for this document must be referred to Commander, ARRADCOM, ATTN: Benet Weapons Laboratory, DRDAR-LCB-DC, Watervliet Arsenal, Watervliet, N.Y. 12189.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Integral Weapon Feeder Telescoped Round		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This study was undertaken to develop various armament concepts and to define envelope configurations for near term future combat fighting vehicles (primarily the XM-1 successor). Ammunition, weapon and vehicle interface were main con- siderations from a broad spectrum in assessing concept growth potential.		

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

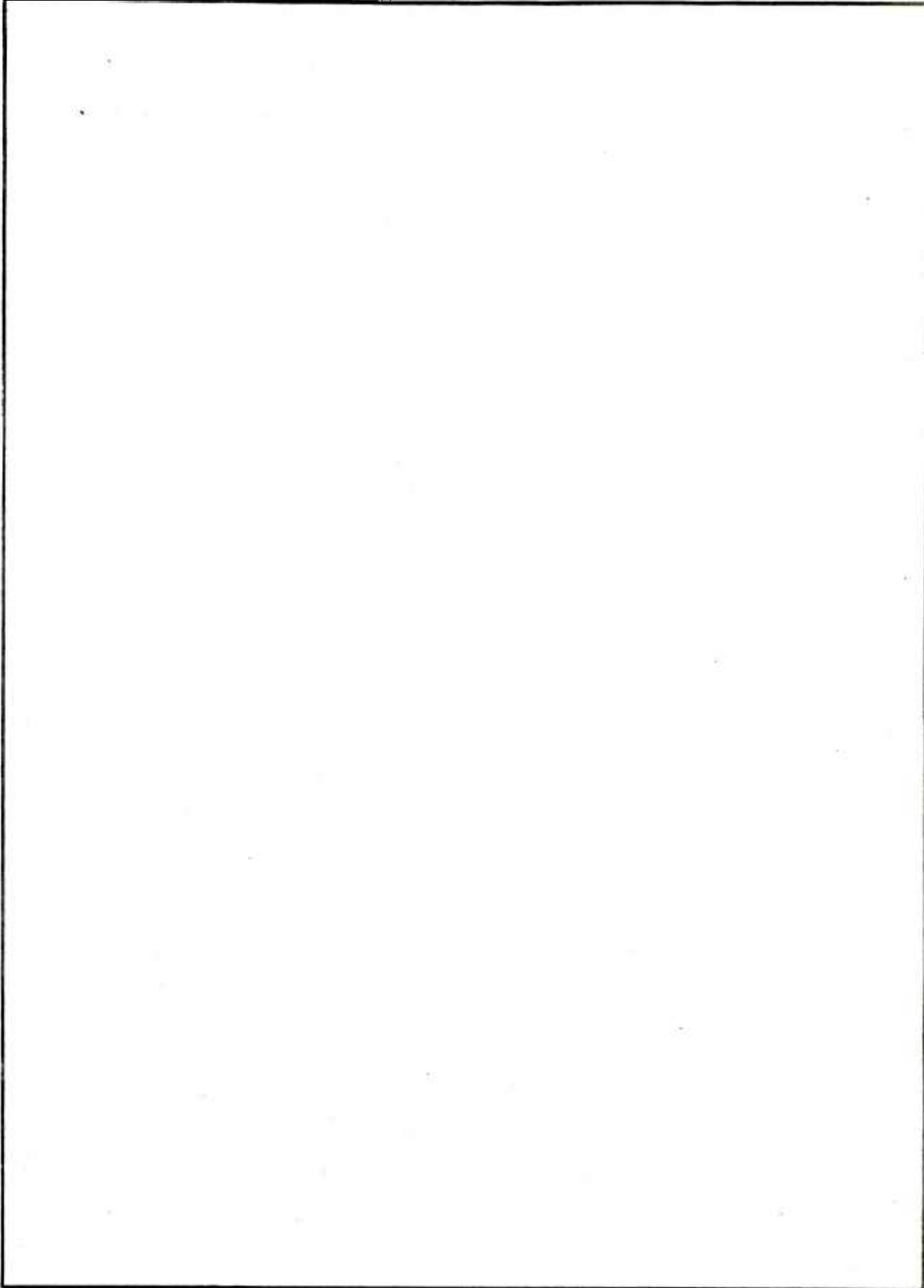
REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-MR-81014	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) AN IN-PROCESS THICKNESS DETERMINATION DURING ELECTROPLATING OR ELECTROPOLISHING BY THE ULTRASONIC PULSE-ECHO TECHNIQUE		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) J. Frankel W. J. Korman G. C. Capsimalis		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, N.Y. 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H600011 DA Project No. 1L161102AH60 PRON No. 1A0215601A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, New Jersey 07801		12. REPORT DATE April 1981
		13. NUMBER OF PAGES 3
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Published in 1980 Ultrasonics Symposium Proceedings, November 1980.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Electroplated Thickness Electroplating Electropolished Thickness Time Measurement Ultrasonics		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The transit time change of an echo of an ultrasonic echo train is used to determine the thickness of electroplated chromium on a steel substrate and the change of thickness of the steel substrate during the electropolishing or surface removal operation.		

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81015	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) COMPUTER CONTROLLED ULTRASONIC INSPECTION OF CANNON TUBES		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Mark Johnson		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 53970M63500 PRON No. 1A925155GGGG
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE April 1981
		13. NUMBER OF PAGES 28
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Distribution limited to US Government Agencies only because of test and evaluation; April 1981. Other requests for this document must be referred to Commander, ARRADCOM, ATTN: Benet Weapons Laboratory, DRDAR-LCB-RC, Watervliet Arsenal, Watervliet, N. Y. 12189.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Ultrasonics Minicomputer Nondestructive Testing Fatigue Cracks Cannon		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) An automated system for ultrasonically inspecting cannon tubes during fatigue testing has been developed. The tubes are inspected for cracks growing inward from the outer surface toward the tube center, measuring the depth, length, and angular position of each crack detected. The system uses a minicomputer to control the test equipment and process the results. The computer is (CONT'D ON REVERSE)		

20. ABSTRACT (Cont'd)

interfaced with a device that mechanically positions an ultrasonic probe and with an ultrasonic flaw detector capable of supplying it with inspection data upon request. The computer directs the probe inside the breech end of a cannon and collects the data for immediate analysis. The results of the inspection, including plots of crack location and crack growth, are printed on a teletype.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81016	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) BASIC MECHANICS OF DE BANGE OBTURATOR SPLIT RING PRESTRESSING		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) D. F. Finlayson		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Benet Weapons Laboratory, ARRADCOM Watervliet Arsenal, Watervliet, NY 12189 DRDAR-LCB-TL		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 738017.C30Q70191CG PRON No. M179Q761M11A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE April 1981
		13. NUMBER OF PAGES 23
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) De Bange Obturator Split Ring Prestress Elastic-Plastic Deformation		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) An analysis is presented to show the relationship between the maximum obtainable residual shear force in a split ring preform and the prestressing parameters (included angle between fixture grips and total angle of twist). Also included is an analysis of the section depth of the ring that is required to provide sufficient material for the finish machining operation. Application of the formulas derived would require the quantification of certain parameters by either experimental or numerical methods.		

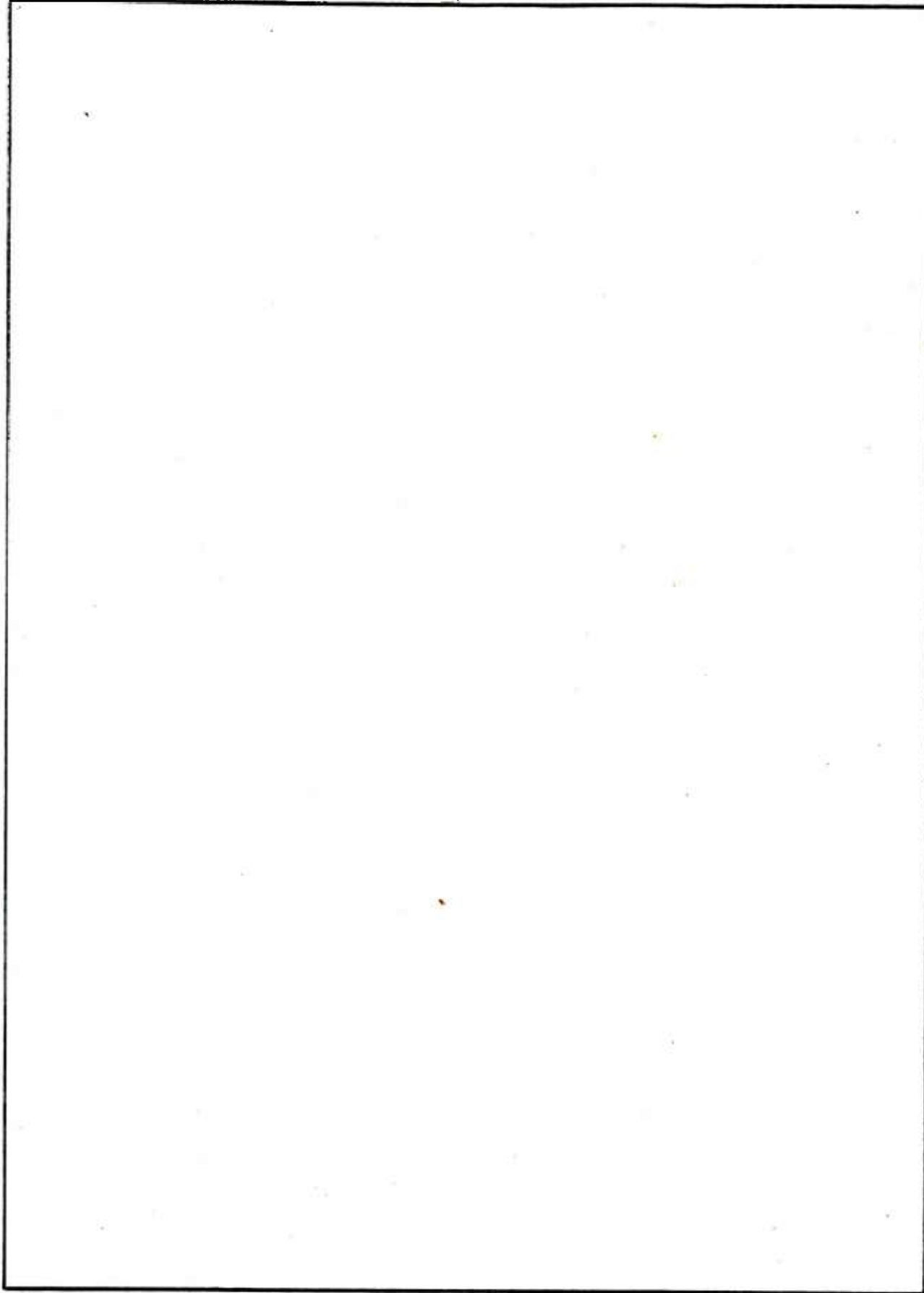


REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81017	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) EVALUATION OF MODIFIED BORE EROSION GAGE		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) G. Capsimalis, R. Williams, and G. D'Andrea		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 53970M63500 PRON No. 1A9241561A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE May 1981
		13. NUMBER OF PAGES 25
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Bore Erosion Gage Rifling Profile Plotting 105 mm M68 Gun Tube		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A bore erosion gage developed earlier (Krupski and Audino, WVT QA-7701 (1977)) for monitoring the coating thickness and erosion of the 105 mm M68 in the region up to 40 inches from the origin of rifling has been modified, and the problem of the lack of responsibility of radius measurements along the bore circumference has been successfully eliminated. Test data and statistical analysis of the results have demonstrated that the modified gage can measure (CONT'D ON REVERSE)		

20. ABSTRACT (CONT'D)

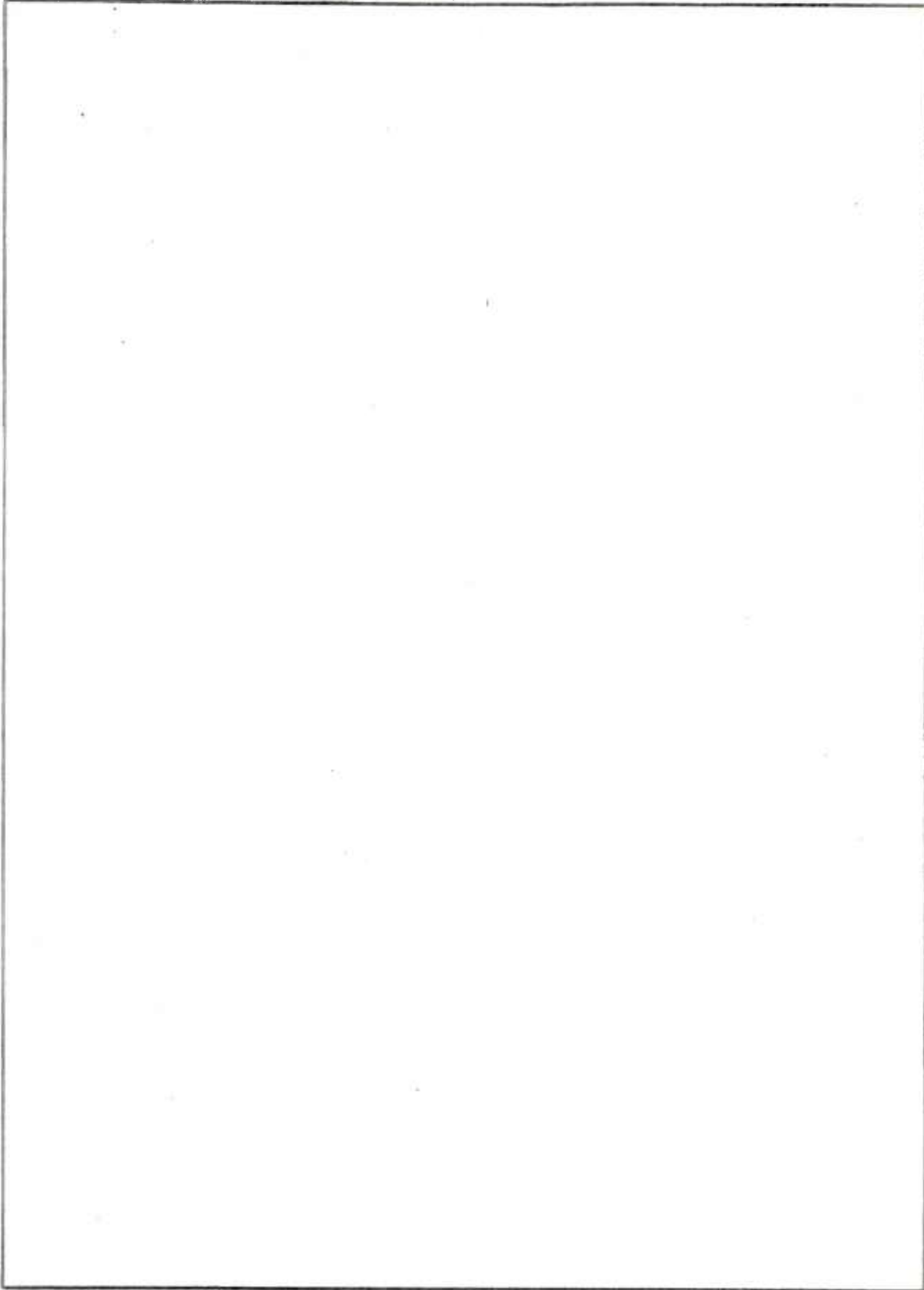
the relative change in the bore radius with an accuracy of ± 0.005 inch. The statistical accuracy can be further improved by increasing the number of data points.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81018	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) FATIGUE AND FRACTURE TESTS OF GAS BOTTLE MATERIAL		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) J. H. Underwood and J. J. Zalinka		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 691000H180021 PRON No. 1A0271951A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE May 1981
		13. NUMBER OF PAGES 24
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) NASA Langley Research Center Research Facilities Engineering Division Hampton, VA 23665		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Prepared by Benet Weapons Laboratory, US Army ARRADCOM, under contract to NASA Langley Research Center.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Fracture Fatigue Fatigue Life Cylinder		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A program of nondestructive inspection, mechanical tests, and fracture mechanics tests was performed on a high pressure air storage bottle. The tests were planned to provide the basis of fracture mechanics life analysis of gas bottles in their service environment. This report describes the procedures and results and gives a preliminary analysis of the results.		



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
ARLCB-TR-81019		
4. TITLE (and Subtitle) NUMERICAL PREDICTION OF RESIDUAL STRESSES IN AN AUTOFRETTAGED TUBE OF COMPRESSIBLE MATERIAL		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) P. C. T. Chen		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 6111.01.91A0.0 DA Project No. 1T161101A91A PRON No. 1A1281501A1A
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE May 1981
		13. NUMBER OF PAGES 16
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Presented at 1981 Army Numerical Analysis and Computer Conference, Huntsville, Alabama, 26-27 February 1981. Published in proceedings of the conference.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Elastic-Plastic Deformation Residual Stress Autofrettaged Tube Finite-Difference Method		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The residual stresses in an autofrettaged tube of compressible material are obtained by a new finite-difference approach. The tube is assumed to obey the von Mises' yield criterion, the Prandtl-Reuss flow theory and the isotropic- hardening rule. In order to test the accuracy of the computer program, a convergence study for a nearly incompressible tube has been made and compared with the exact solution as well as the simulated results for residual stresses in an incompressible tube.		

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81020	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) SUPERCONDUCTIVITY IN PRESSURE QUENCHED CADMIUM SULFIDE AT 77 K		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) C. G. Homan (BWL), K. Laojindapun (RPI), and R. K. MacCrone (RPI).		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H600011 PRON No. 1A1283121A1A
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE May 1981
		13. NUMBER OF PAGES 15
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES To be presented at XVI International Conference on Low Temperature Physics, 19-25 August 1981, Los Angeles, CA. To be published in Journal of Physical Review Letters.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Cadmium Sulfide Diamagnetism Pressure Quenched Superconductivity		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Observations of magnetic field induced collapse of Meissner sized diamagnetism with a coincident decrease in electrical conductivity in pressure quenched CdS material at 77 K are reported. These results are consistent with the existence of superconducting regions in the specimens at this temperature.		



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-MR-81021	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A FOUR POINT BENDING EXPERIMENT		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) R. V. Milligan and V. J. Olmstead		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 32111600116 PRON No. T196935802NMAE
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE June 1981
		13. NUMBER OF PAGES 21
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Straightening Deflections Strains Gun Tubes		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents data obtained in a four point bend experiment on a 105 mm M68 rotary forged gun tube. The four point bending was accomplished using a standard hydraulic straightening press fitted with a two point loading device designed and fabricated by the Benet Weapons Laboratory Engineering Support Branch. Strains were measured at several points on the surface in a circumferential plane using standard foil type resistance gages and standard strain (CONT'D ON REVERSE)		

20. ABSTRACT (CONT'D)

readout equipment. Deflections at mid-span were measured with a rotary ten turn potentiometer. Load strain and load deflection curves are presented and compared with theory. The agreement is quite good. The difference between theory and experiment probably can be attributed to the larger diameter of the tube nearer the breech end which could contribute to greater stiffness. Maximum strains were less than 1.4 percent and are quite low compared to those expected in three point bending. The experiment shows a good possibility of using four point bending to eliminate the need for hot straightening.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81022	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A RATIONAL FUNCTION APPROXIMATION FOR THE INTEGRATION POINT IN EXPONENTIALLY WEIGHTED FINITE ELEMENT METHODS		5. TYPE OF REPORT & PERIOD COVERED
7. AUTHOR(s) Joseph E. Flaherty		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		8. CONTRACT OR GRANT NUMBER(s) Grant No. AFOSR 80-0192.
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H5710011 DA Project No. 1L161102BH57 PRON No. 1A1235821A1A
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE June 1981
		13. NUMBER OF PAGES 18
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES To be published in the International Journal for Numerical Methods in Engineering. This research was partially sponsored by the U.S. Air Force Office of Scientific Research, Air Force Systems Command, U.S.A.F. The U.S. (CONT'D ON REVERSE)		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Convection-Diffusion Problems Exponential-Weights Finite Element Method Rational Approximations		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A rational function is presented for approximating the function $f(z) = \coth z - 1/z$ that appears in several exponentially fitted or weighted finite difference and finite element methods for convection-diffusion problems. The approximation is less expensive to evaluate than $f(z)$ and provides greater accuracy than the doubly asymptotic approximation when $z = O(1)$.		

18. SUPPLEMENTARY NOTES (Cont'D)

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM								
1. REPORT NUMBER ARLCB-TR-81023	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER								
4. TITLE (and Subtitle) THE EFFECT OF PREBORE QUENCH TIME ON THE DEPTH AND UNIFORMITY OF HARDENING IN 105mm M68 GUN TUBE FORGING		5. TYPE OF REPORT & PERIOD COVERED								
7. AUTHOR(s) J. Passmore D. G. Baldrey		6. PERFORMING ORG. REPORT NUMBER								
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, N.Y. 12189		8. CONTRACT OR GRANT NUMBER(s)								
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, New Jersey 07801		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 3297.06.7588 PRON M1-7-P2913-(01)-M1-1A								
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE July 1981								
		13. NUMBER OF PAGES 45								
		15. SECURITY CLASS. (of this report) UNCLASSIFIED								
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16. DISTRIBUTION STATEMENT (of this Report) Distribution limited to US Government Agencies only because of proprietary information; July 1981. Other requests for this document must be referred to Commander, ARRADCOM, ATTN: Benet Weapons Laboratory, DRDAR-LCB-S, Watervliet Arsenal, Watervliet, N. Y. 12189.										
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)										
18. SUPPLEMENTARY NOTES										
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) <table border="0"> <tr> <td>Quench</td> <td>Hardenability</td> </tr> <tr> <td>Spray Quench</td> <td>8620 Steel</td> </tr> <tr> <td>Bore Quench</td> <td>High Strength Steel</td> </tr> <tr> <td>Hollow Tube Forging</td> <td></td> </tr> </table>			Quench	Hardenability	Spray Quench	8620 Steel	Bore Quench	High Strength Steel	Hollow Tube Forging	
Quench	Hardenability									
Spray Quench	8620 Steel									
Bore Quench	High Strength Steel									
Hollow Tube Forging										
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) At Watervliet Arsenal, the quenching of hollow steel gun tube forgings from the austenitizing temperature has commonly involved a combination of bore quenching (I.D.) and spray quenching (O.D.). The bore quench is generally initiated prior to the start of the O.D. spray quench. This is called a prebore quench. This work evaluated the effect of quench time on the depth and uniformity of hardening in 105mm M68 gun tube forgings. (The prebore quench times were varied from 0 to 150 sec. in this investigation.) (CONT'D ON REVERSE)										

20. ABSTRACT (Cont'd)

Cooling rates in the tube wall for various prebore quench times were determined by welding sections of AISI 8620 steel to the breech and muzzle ends of the tube. The hardness gradient through the tube wall was used to determine cooling rates at 1300°F from the known relationships between end-quench hardenability curves and Jominy test bar cooling rates. The minimum cooling rates, at 1300°F, varied from 4°F/sec. to 10°F/sec. at the muzzle end of the tube. The point of minimum hardness (slowest cooling rate) moved toward the O.D. of the tube as the prebore quench time increased.

The minimum cooling rates resulting from the prebore quench times used in this experiment are sufficient to exceed the critical cooling rate for gun steel. As a result, the prebore quench time in the range of 0-150 seconds has no effect on the depth of uniformity of hardening in 105mm M68 gun tube forgings.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81024	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A COMPARISON OF THREE POINT AND FOUR POINT LOADING IN ELASTIC-PLASTIC BENDING OF BEAMS		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) R. Vincent Milligan		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 612105H840011 DA Project No. 1L162105AH84 PRON No. 1A0217131A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE June 1981
		13. NUMBER OF PAGES 22
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Beams Straightening Bending Elastic-Plastic Analysis		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A comparison between the maximum deflections resulting from beams symmetrically loaded into the elastic-plastic region is presented for the case of three and four point bending. The results indicate that significantly larger deflections can be obtained for the case of four point bending while keeping the maximum fiber strains approximately the same. It appears that using the four point bending approach holds certain advantages in straightening operations for the (CONT'D ON REVERSE)		

20. ABSTRACT (CONT'D)

removal of permanent deflections with the possible elimination of hot straightening in some instances. The concept of distribution of plastic deformation is put forth as a possible explanation of the advantage of one method over the other.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81025	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) MOMENT-STRAIN RELATIONSHIPS IN ELASTIC-PLASTIC BENDING OF BEAMS		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) R. V. Milligan		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 612105H840011 DA Project No. 1L162105AH84 PRON No. 1A0217131A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE June 1981
		13. NUMBER OF PAGES 23
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Bending Strain Elastic-Plastic Deformation Beams		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Theoretical expressions for bending moment versus depth of elastic-plastic interface for both rectangular, tubular, and solid circular beams are developed. Theoretical expressions for strain as a function of geometry and depth of elastic-plastic interface for each type of cross section are derived. The possibility of a strain singularity occurring as the elastic-plastic interface approaches the neutral axis is pointed out. The assumption that "planes remain (CONT'D ON REVERSE)		

20. Abstract (Cont'd)

plane" is examined. Experimental data is presented which supports the assumption. The basis for determining residual or permanent strains and expressions for their calculation are given. Finally a brief section of strain-curvature relationships is presented.

20. ABSTRACT (CONT'D)

reproducibility of RLPG's in a 40 mm caliber.

A description of the fixture hardware, operation, and testing is provided. Critical areas which were identified and dealt with included material compatibility of sliding parts, projectile shot start pressure, ignition delay, combustion instability, and piston damping.

Considerable effort was expended in identifying and dealing with an acoustic combustion instability in the first tangential mode. The remedial approach which attenuated the instability was to machine five circumferential grooves on the face of the regenerative piston in the region of the injectors. This had the effect of simultaneously providing baffles and altering the injection "spray". The results show that although combustion instability is possible in an RLPG environment, it can be dealt with simply by using mechanical devices which are a direct extension of existing liquid propellant rocket technology.

Recommendations for future testing using this fixture are included.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81027	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) STRESS INTENSITY FACTORS FOR RADIAL CRACKS IN A PARTIALLY AUTOFRETTAGED THICK-WALL CYLINDER		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) S. L. Pu and M. A. Hussain		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H600011 DA Project No. 1L161102AH60 PRON No. 1A0215601A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE July 1981
		13. NUMBER OF PAGES 33
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Presented at Fourteenth National Symposium on Fracture Mechanics, UCLA, Los Angeles, CA, 29 June - 1 July 1981. To be published in ASTM Special Technical Publication.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Stress Intensity Factors Weight Function Multiple Cracks Load Relief Factor Thick-Wall Cylinder Fracture Mechanics Quadrilateral Isoparametric Element		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Using a finite element method and thermal simulation, stress intensity factors are determined for a uniform array of equal depth radial cracks emanating from the internal boundary of a pressurized, autofrettaged thick-wall cylinder. Computations of the stress intensity factors by methods of load relief and weight function are also examined. The combination of finite elements and (CONT'D ON REVERSE)		

20. ABSTRACT (CONT'D)

weight functions is found very effective and is used in this report for multiple-radial cracks in a partially autofrettaged tube.

Extensive numerical results are presented for a cylinder having an external diameter twice that of the internal diameter. It is shown that the autofrettaged tube with two diametrically opposed cracks remains, in general, the weakest configuration. For more than two cracks, the higher the number of cracks is, the smaller the stress intensity factor will be.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81028	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) STRUCTURAL ANALYSIS OF A KINETIC ENERGY PROJECTILE DURING LAUNCH		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) G. A. Pflegl, J. H. Underwood, and G. P. O'Hara		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 4111.16.2991.0 PRON No. 1A-9-39362-0
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE July 1981
		13. NUMBER OF PAGES 18
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Penetrator Sabot Stress Fracture		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This paper presents the results of a three phase effort to quantify the structural integrity of a long rod kinetic energy penetrator projectile during launch. The first phase used the finite element method to investigate the two body problem of penetrator and sabot during peak launch loads. This portion of the analysis considered the effect of pressure loading, body forces, and different moduli to determine an estimate of the stresses present in the (CONT'D ON REVERSE)		

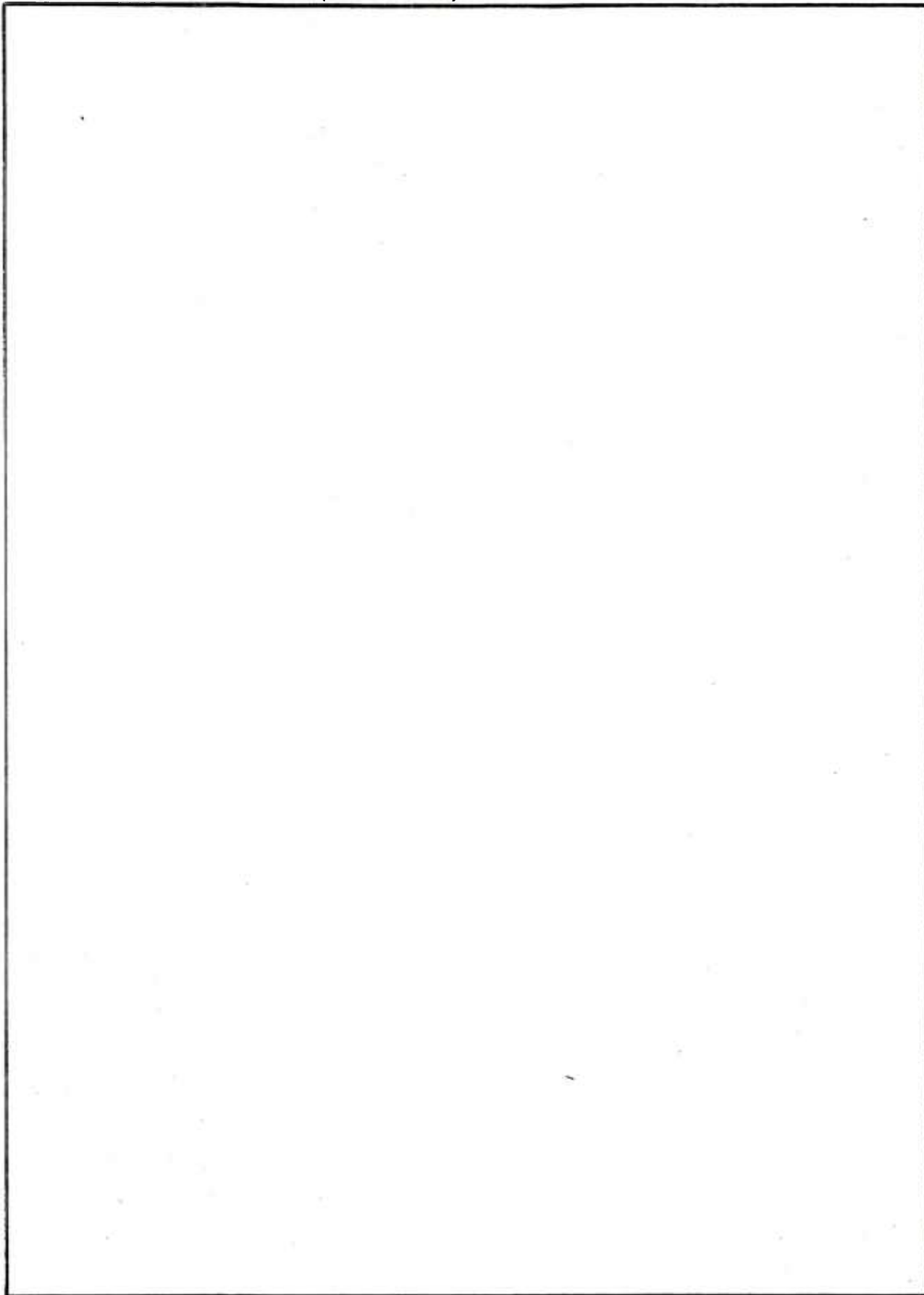
20. ABSTRACT (CONT'D)

penetrator and sabot - particularly along the intersection between the two. These stresses were then used to determine the load transfer between the penetrator and sabot.

The second phase of the effort applied the load transfer from phase one to a detailed finite element model of the thread-like lugs of the penetrator in order to determine the stress concentrations in the notch root area between the lugs. This portion of the work took into account the geometry, material properties, and load transfer of the lugs. The resulting stresses due to the shearing and bending loads and contact friction were analyzed to determine the location and magnitude of the largest tensile stresses at the surface of the lug root.

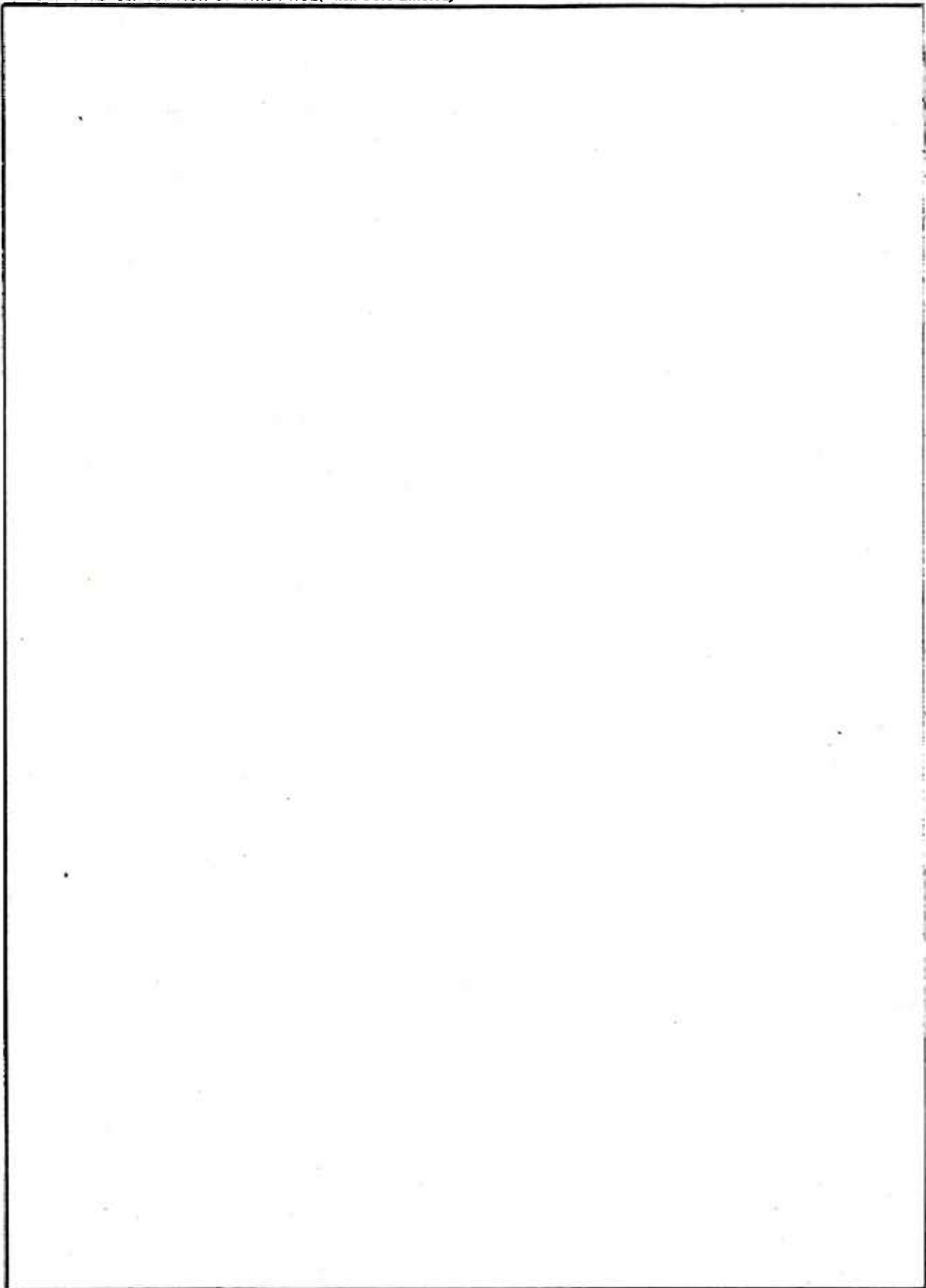
The value of maximum tensile stress in the root of the penetrator lugs was then used in a fracture mechanics analysis to determine a critical flaw size which would cause brittle fracture. Using fracture toughness measurements from depleted uranium penetrator materials, critical flaw sizes were calculated and used to determine the likelihood of failure during launch and to formulate NDT inspection standards.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81029	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) LOW FREQUENCY INDUCTION HEATING OF LARGE DIAMETER STEEL PREFORMS FOR ROTARY FORGING		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) David Concordia		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 3291.06.7328 PRON No. M7-4-P4727-M7-1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE July 1981
		13. NUMBER OF PAGES 42
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Induction Heating Magnetic Field Magnetic Flux Preforms Rotary Forge		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Part I of this report surveys the basic theory of induction heating and heat flow in an inductively heated steel cylinder. Part II describes an induction heating system now in use at the Watervliet Arsenal, and applies the theory of Part I to this system.		



REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-SP-81030	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) INDEX TO BENET WEAPONS LABORATORY (LCWSL) TECHNICAL REPORTS - 1980		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) R. D. Neifeld		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE July 1981
		13. NUMBER OF PAGES 113
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Benet Weapons Laboratory Technical Publications Bibliography Abstracts Document Control Data		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This is a compilation of Benet Weapons Laboratory technical reports published during 1980.		

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

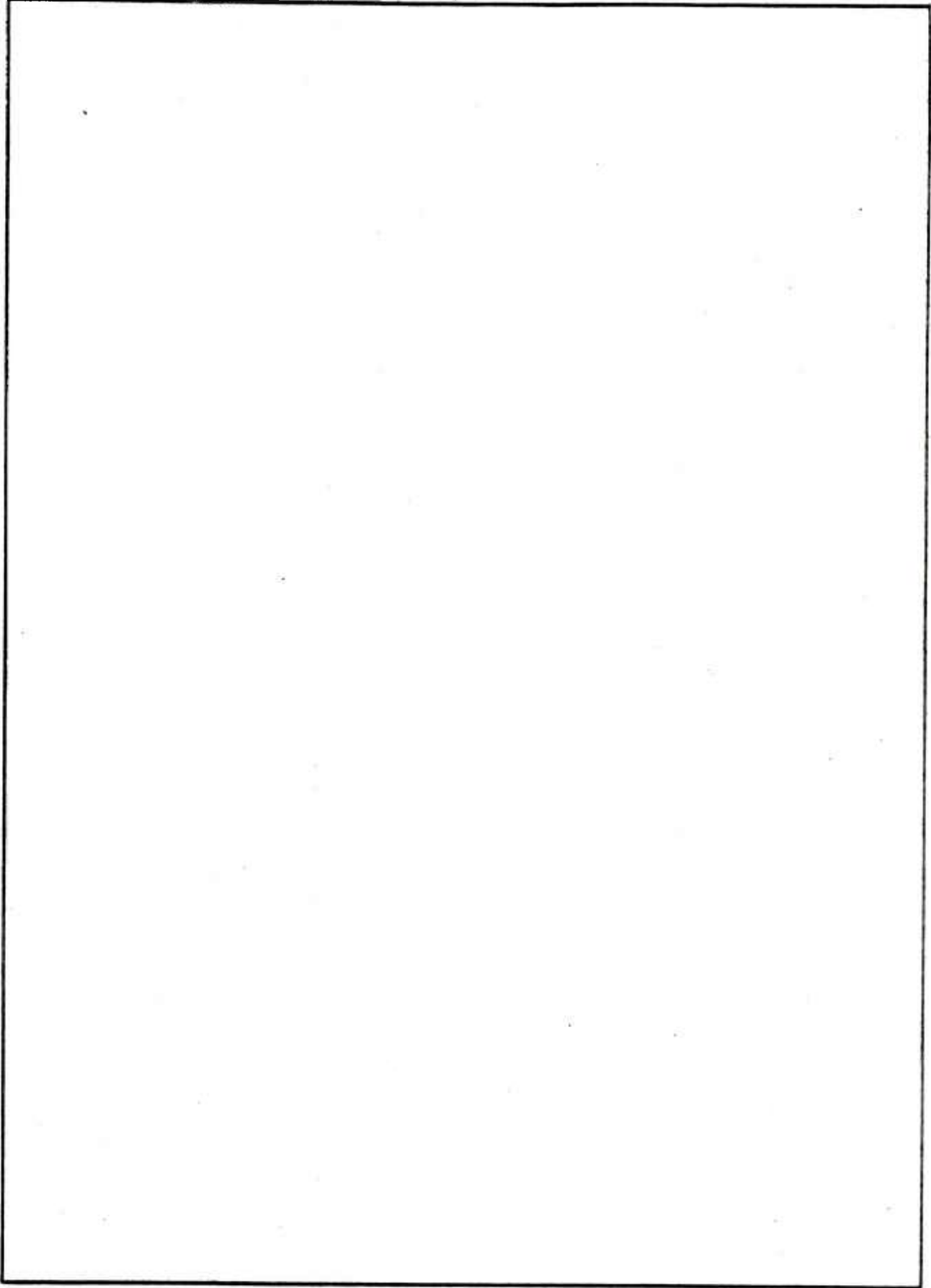


REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81031	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) NUMERICAL SOLUTION TO BEAM VIBRATIONS UNDER A MOVING COUPLE		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) J. J. WU		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H600011 PRON No. 1A1283121A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE August 1981
		13. NUMBER OF PAGES 29
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Presented at the U.S. Army Numerical Analysis and Computer Conference, Huntsville, AL, 26-27 Feb 81.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Moving Load Beam Vibrations Finite Element Gun Dynamics Projectile Eccentricity		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The finite element solution formulation in time- and space-coordinates is extended to beam vibrations effected by a moving couple. This problem has direct application to gun motions analysis with an unbalanced moving projectile. The moving load, instead of being a time-dependent Dirac delta function as for the case of a moving concentrated force, is now the derivative of this Dirac delta function. This singular function does not present any difficulty due to (CONT'D ON REVERSE)		

20. ABSTRACT (CONT'D)

the variational process employed. This solution procedure is described together with results of beam motions subjected to a couple moving with various speeds.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM															
1. REPORT NUMBER ARLCB-TR-81032	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER															
4. TITLE (and Subtitle) SAFE SERVICE LIFE TESTING OF THE 155 MM M185 HOWITZER BARREL WITH M203 PROPELLING CHARGE		5. TYPE OF REPORT & PERIOD COVERED															
7. AUTHOR(s) Bruce B. Brown and Howard D. McAlonie		6. PERFORMING ORG. REPORT NUMBER															
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		8. CONTRACT OR GRANT NUMBER(s)															
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 3111162223 PRON No. 1A0204811A1A															
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE August 1981															
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)																	
18. SUPPLEMENTARY NOTES																	
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) <table border="0"> <tr> <td>Howitzer</td> <td>Fatigue Test</td> <td>Fracture Toughness</td> </tr> <tr> <td>155 MM M185</td> <td>Fatigue Life</td> <td>Fatigue Failure</td> </tr> <tr> <td>Cannon</td> <td>Safe Service Life</td> <td></td> </tr> <tr> <td>Barrel</td> <td>Fatigue Crack</td> <td></td> </tr> <tr> <td>Tube</td> <td>Propelling Charge 155 mm M203</td> <td></td> </tr> </table>			Howitzer	Fatigue Test	Fracture Toughness	155 MM M185	Fatigue Life	Fatigue Failure	Cannon	Safe Service Life		Barrel	Fatigue Crack		Tube	Propelling Charge 155 mm M203	
Howitzer	Fatigue Test	Fracture Toughness															
155 MM M185	Fatigue Life	Fatigue Failure															
Cannon	Safe Service Life																
Barrel	Fatigue Crack																
Tube	Propelling Charge 155 mm M203																
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A fatigue study has been made of the 155 mm M185 barrel operating at M203 propelling charge pressure to assess the safe fatigue life and determine failure locations and modes. Two regions were tested: the origin of rifling which proved critical, and the bore evacuator. Reliability factors were determined and a safe service life recommended.																	



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1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
ARLCB-TR-81033		
4. TITLE (and Subtitle)		5. TYPE OF REPORT & PERIOD COVERED
PROCESS AND PROCEDURE GUIDE FOR THE "PUMP THRU" METHOD OF CHROMIUM PLATING 120 MM XM256 GUN BORES		
7. AUTHOR(s)		6. PERFORMING ORG. REPORT NUMBER
G. D'Andrea, V. P. Greco, and J. Walden		
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		AMCMS No. 32970672130 PRON No. 1A9241411A1A
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE
US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		October 1981
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
Plating	Guns	
Chromium	"Pump Thru"	
Controller	Computer	
Process	Large Caliber	
	Microprocessor	
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
The "pump thru" plating system to chromium plate large caliber guns is described. Included in this report are: a detailed explanation of the "pump thru" prototype plating facility, process equipment used, related specification requirements, and the process procedure for chromium plating the 120 mm cannon tube and chamber.		

(CONT'D ON REVERSE)

20. ABSTRACT (CONT'D)

This computerized facility shows the ready availability of program substitution, accommodation of complex plating processes and removal of manual restraints through automation.

Typical chromium plating results of several 120 mm XM256 gun barrels are presented to show the capability of the automated "pump thru" facility. These results have arisen from increased monitoring and control capabilities, which are essential needs for the automated factory.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81034	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A NEW VARIATIONAL METHOD FOR INITIAL VALUE PROBLEMS, USING PIECEWISE HERMITE POLYNOMIAL SPLINE FUNCTIONS		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) C. N. Shen Julian J. Wu		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H600011 PRON No. 1A1283121A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE August 1981
		13. NUMBER OF PAGES 19
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Presented at the US Army Numerical Analysis & Computers Conference, Huntsville, AL, 26-27 Feb 81.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Variational Principle Initial Value Problems Bilinear Concomitant Adjoint System Far End Value Spline Function Finite Element Recursive Solutions		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A variational principle for a functional can be found which satisfies both the original system and its adjoint system. The variations of this functional give no boundary terms if the bilinear concomitant of the systems vanishes. For a second order time varying initial value problem, one can adjust the boundary conditions of the adjoint system in terms of the boundary conditions of the original system so that the bilinear concomitant is identically zero. (CONT'D ON REVERSE)		

20. ABSTRACT (Cont'd)

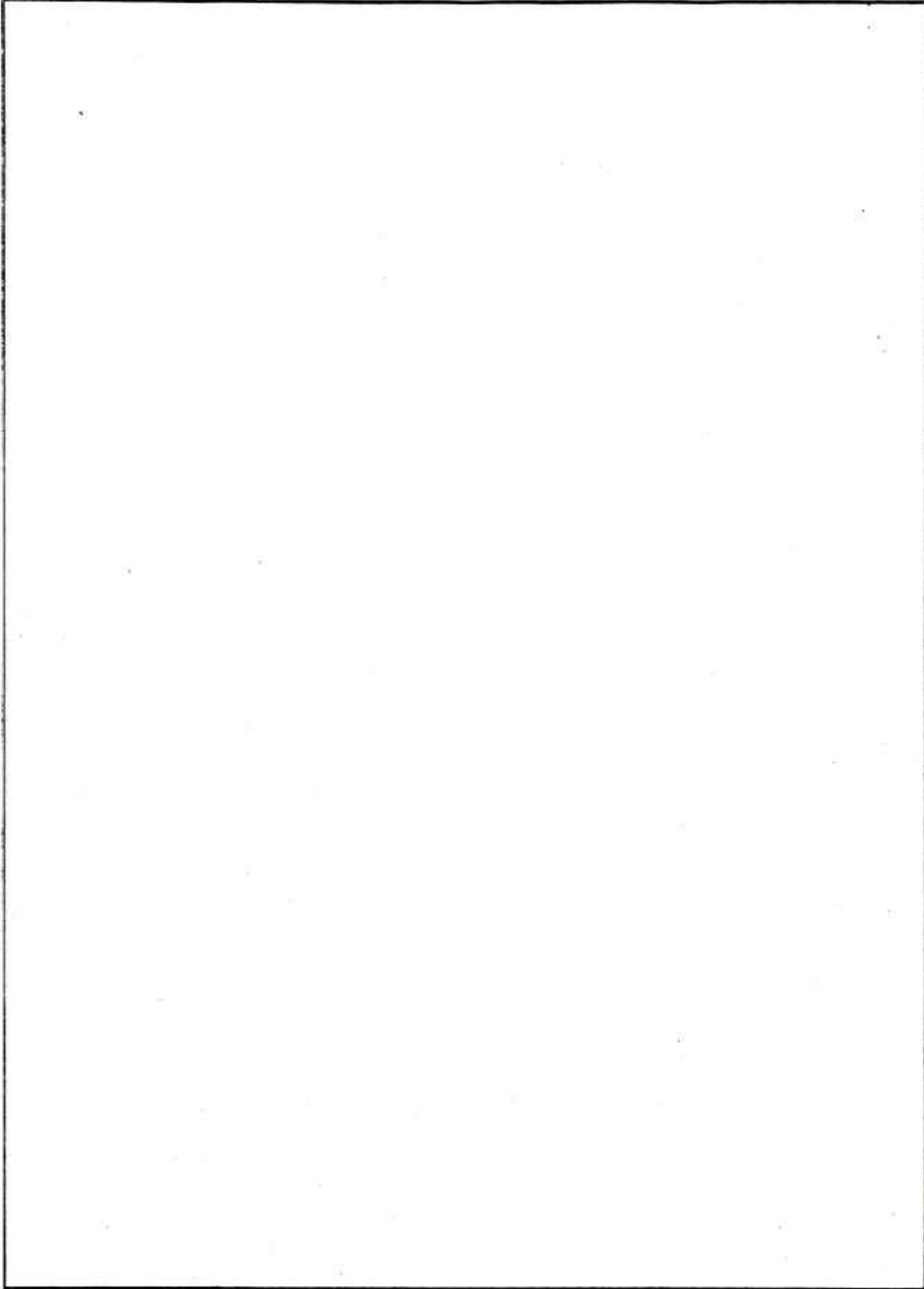
An expression for the variation of the functional is derived which contains only the terms involving the variations of the adjoint variable and its derivative, but no variation of its second derivative. The variations of the adjoint variable and its derivative are found to be zeroes at the final conditions, just as the variations of the original variable and its derivative are zero at the starting (initial) conditions. This implies that we are able to solve the problem in one direction without worrying about the conditions at the other end as the initial value problem should be. The algorithm is much more simplified than in the past. An example is given to show the procedures of this new variational method.

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER ARLCB-TR-81035	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ACTIVATION OF SUPERALLOYS AND STAINLESS STEELS FOR CHROMIUM PLATING		5. TYPE OF REPORT & PERIOD COVERED FINAL
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) W. Baldauf E. S. Chen		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102T1600011 DA Project No. 1L161102AH60 PRON No. 1A0215601A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE August 1981
		13. NUMBER OF PAGES 13
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES Presented at Symposium on Plating on Difficult to Plate Metals, New Orleans, LA, 30-31 October 1980. Published in proceedings of the symposium.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Activation Electrodeposition Adhesion Stainless Steel Chromium Plating Superalloys		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The adhesion of electrodeposited chromium on cobalt, nickel and iron-nickel based superalloys such as CG-27, Haynes alloy 25, and Udimet 700, as well as stainless steels was investigated. A number of pretreatments were used to activate these alloys. The results show that a hydrofluoric-sulfuric acid pretreatment used anodically produces excellent adhesion. A qualitative adhesion test, named the "Groove Test" was developed to evaluate the adhesion of thick deposits of chromium on metallic substrates. The development of this test is described.		

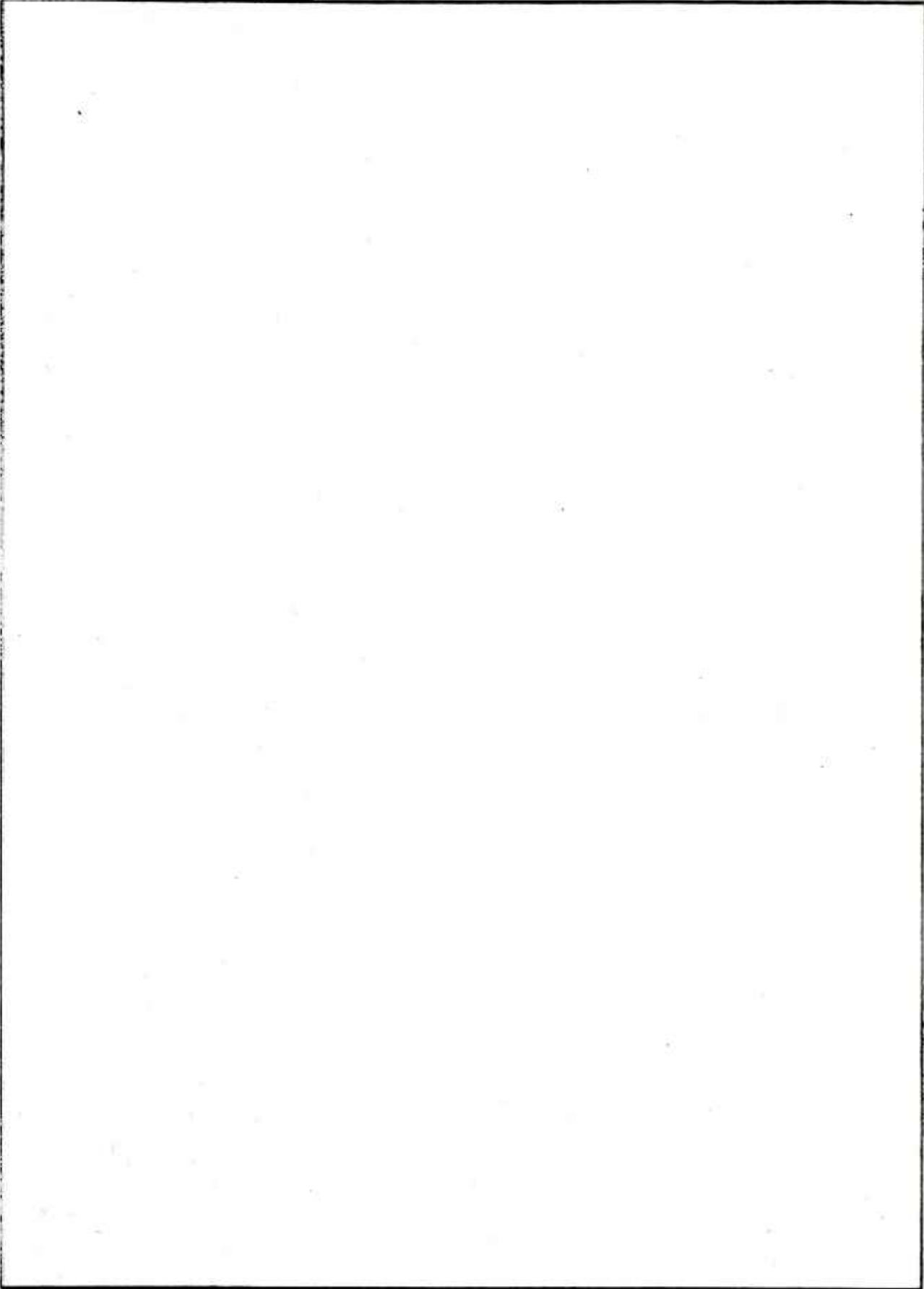
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1. REPORT NUMBER ARLCB-TR-81036	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) AUTOMATED PLATING OF LARGE CALIBER GUNS - APPLICATION OF COMPUTER CONTROL TO "PUMP THRU" PLATING SYSTEMS		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Joseph A. Walden		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 32970672130 PRON No. 1A9241411A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE September 1981
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Plating "Pump Thru" Chromium Computer Controller Large Caliber Process Microprocessor Guns		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Computerized control of the "pump thru" plating system to chromium plate large caliber guns is described. Included in this report are: circuit diagrams of interfacing electrical hardware; ladder diagrams and memory address records; a detailed explanation of program operation, and a software stepper switch whose function can be automatically or manually controlled. (CONT'd ON REVERSE)		

20. ABSTRACT (Cont'd)

The study shows the ready availability of program substitution, accommodation of complex plating processes, and removal of manual restraints through automation. Typical chromium plating results of several 120 mm XM256 gun barrels are presented to show the capability of the automated "pump thru" facility. These results have arisen from increased monitoring and control capabilities, essential needs for the automated factory.



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1. REPORT NUMBER ARLCB-TR-81038	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ELASTIC-PLASTIC THICK-WALLED TUBES SUBJECTED TO INTERNAL PRESSURE AND TEMPERATURE GRADIENT		5. TYPE OF REPORT & PERIOD COVERED Final
7. AUTHOR(s) P. C. T. Chen		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H5710011 DA Project No. 1L161102BH57 PRON No. 1A1235821A1A
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE September 1981
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18. SUPPLEMENTARY NOTES Presented at 27th Conference of Army Mathematicians, US Military Academy, West Point, NY, 10-12 June 1981. Published in proceedings of the conference.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Elastic-Plastic Thick-Walled Tube Finite-Difference Method Internal Pressure Temperature Gradient		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Using von Mises' criterion and the Prandtl-Reuss flow theory, numerical solutions are obtained for the stresses, strains, and displacements in an elastic-plastic thick-walled tube subjected to internal pressure and temper- ature gradient. The material is based on the incremental finite-difference method in conjunction with a scaled loading approach. All incremental quantities are determined in the program and no iteration is needed. The approach is simpler than others yet quite general and accurate.		



7. AUTHORS (Cont'd)

R. J. Fiorentino
Battelle Memorial Institute
Columbus, OH

J. Mescall, G. Bishop
US Army Materials and Mechanics Research Center
Watertown, MA

E. Roecker
US Army Armament Research and Development Command
Ballistics Research Laboratory
Aberdeen, MD

20. ABSTRACT (Cont'd)

Metallurgical examination of the transverse sections of the extruded specimens showed no detectable porosity or filament-matrix interaction. Mechanical property including Taylor test data are presented along with a discussion of the failure modes observed in these various tests.

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1. REPORT NUMBER ARLCB-TR-81040	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ON ELASTIC-PLASTIC ANALYSIS OF AN OVERLOADED BREECH RING USING NASTRAN		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) P. C. T. Chen		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 611102H5710011 DA Project No. 1L161102BH57 PRON No. 1A1235821A1A
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES To be presented at Tenth NASTRAN Users' Colloquium, NASA/Jet Propulsion Lab, Pasadena, California, 7-9 October 1981. To be published in proceedings of the colloquium.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Elastic-Plastic Breech Ring Finite Element NASTRAN Code		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The piece-wise linear analysis option of the NASTRAN code was used to analyze a photoplastic model for sliding breech mechanism. A two-dimensional finite element representation for the breech ring was chosen and the material was made of polycarbonate resin. The aluminum block was regarded as rigid and the width of contact was assumed to remain unchanged during loading. The displacements and stresses in the breech ring were obtained for loading in (CONT'D ON REVERSE)		

20. ABSTRACT (CONT'D)

the elastic as well as plastic range. The maximum tensile stresses before and after complete unloading were obtained and compared with numerical and experimental results.

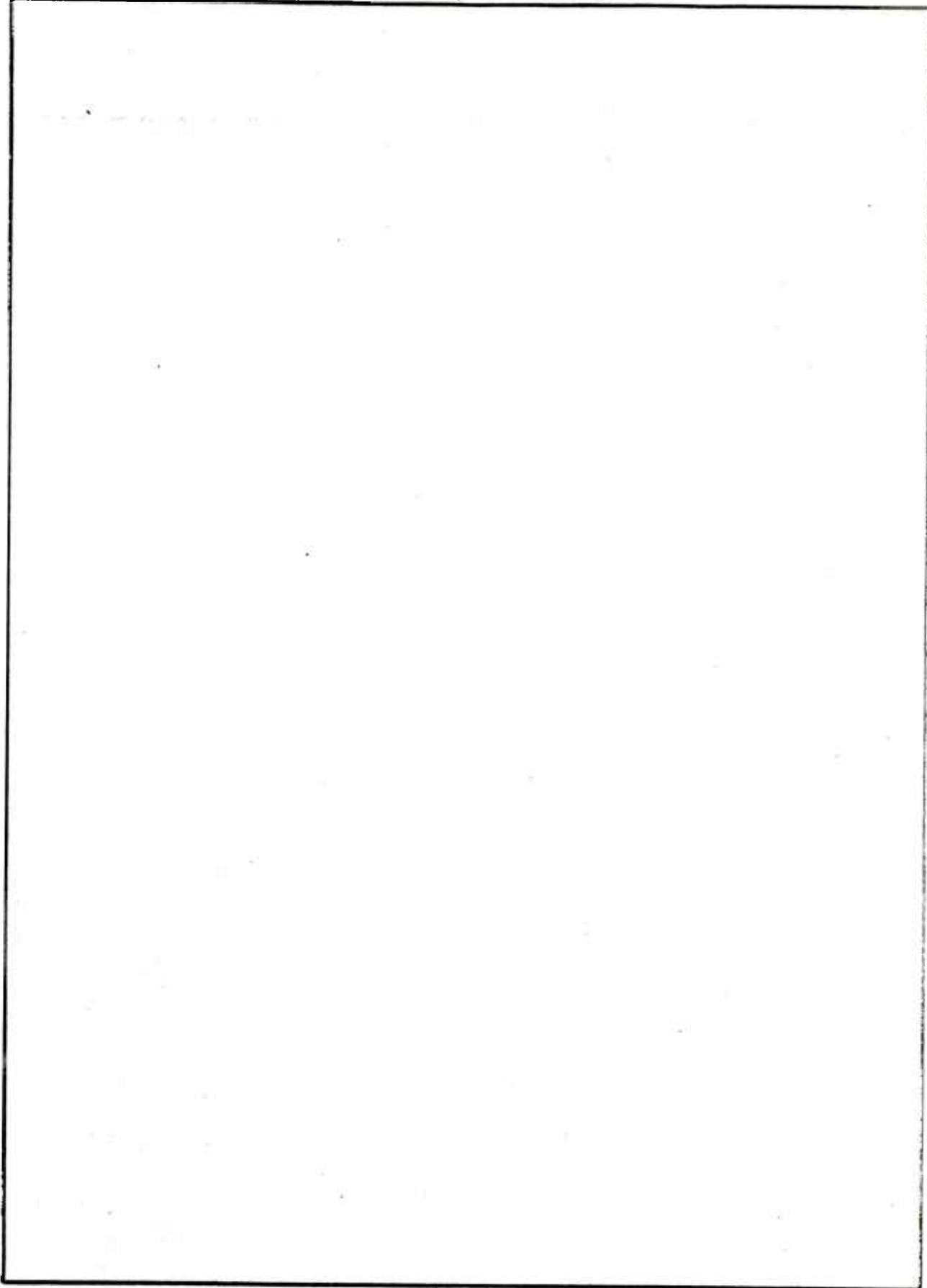
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1. REPORT NUMBER ARLCB-TR-81041	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) FRACTURE TOUGHNESS OF 105mm M68 TUBES		5. TYPE OF REPORT & PERIOD COVERED Final
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) F. A. Heiser		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 3211.16.0011.6 PRON No. 1A-9-39347-NMLC
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Electro Slag Refining Fracture Toughness 105mm M68 Rotary Forging		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Since fracture toughness is not usually measured, a program was initiated to measure K_{Ic} of 105mm M68 cannon tube forgings produced by various combinations of steel producer, steel making technique, and forging technique. The data show that, regardless of the techniques used to produce the forging, the fracture toughness is consistently higher at the breech end than at the muzzle end, a pattern which is consistent with the Charpy V-Notch (CVN) energy which is measured as part of the acceptance testing of tube forgings. (CONT'D ON REVERSE)		

20. ABSTRACT (CONT'D)

This is interpreted as a manifestation of the increased forging reduction seen at the muzzle end.

It is also shown that fracture toughness is greatly influenced by the steel making practice and by the steel supplier, but it is not greatly affected by the forging process used. Specifically, the fracture toughness of rotary forged tubes is similar to that of conventionally press forged tubes, when the steel making practice is the same, and the forging reduction is similar. Of the mechanical properties usually measured, only CVN shows a relationship to fracture toughness. Even then, there is sufficient scatter to preclude using CVN as a predictor.

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1. REPORT NUMBER ARLCB-TR-81042	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) 155mm M199 FIRING TRAIN TEST		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) R. Fiscella R. Carroll		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research and Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 32111600156 PRON No. 1A9280051A1A
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research and Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE October 1981
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES 13
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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Energy Firing Mechanism Firing Pin Misfire Primer		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Due to misfire problems during the Follow-on Evaluation (FOE) of the 155mm M198 Howitzer, an investigation was initiated to determine what extent increasing the energy supplied by the M199 firing train would have on improving the system performance with marginal M82 primer lots (or with marginal M35 firing mechanisms). It was concluded that increasing the amount of energy transferred to the primer has a significant effect in lowering the misfire rate.		



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4. TITLE (and Subtitle) METHOD OF SOLUTION FOR VARIATIONAL PRINCIPLE USING BICUBIC HERMITE POLYNOMIAL		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) C. N. Shen		8. CONTRACT OR GRANT NUMBER(s)
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18. SUPPLEMENTARY NOTES Presented at 27th Conference of Army Mathematicians, US Military Academy, West Point, NY, 10-12 June 1981. Published in proceedings of the conference.		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Variational Principle Initial-Boundary Value Problem Bilinear Concomitant Adjoint System Spline Function Recursive Solution Bicubic Hermite Polynomial		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) In solving mixed boundary and initial value problems of a second order partial differential equation using spline functions, the computation may be simplified considerably if the variable in time can be truncated into arbitrary sections. Each section may have several node points for the spline functions in the time domain. This is true because we found from a previous paper that the initial value problem can be solved in one direction using variational principle and (CONT'D ON REVERSE)		

20. ABSTRACT (CONT'D)

cubic Hermite Polynomials, without worrying about the conditions at the other end.

The end conditions of the adjoint system can be adjusted according to the end conditions of the original system so that the bilinear concomitant is identically zero. This satisfies the variational principle. A bilinear form of the original and adjoint variables is employed in determining the coefficients of the variations of the functions and their first derivatives. There is no term involving the variations of any higher derivatives. A bicubic Hermite Polynomial spline function is used which gives continuity in the function and first partial derivatives in space or time, together with the mixed first partial derivative in space and time. Algorithm and procedure of computation are given.

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4. TITLE (and Subtitle) THERMO-ELASTIC-PLASTIC STRESSES IN MULTI-LAYERED CYLINDERS		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) John D. Vasilakis		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS No. 6111.01.91A0.0 DA Project No. 1T161101A91A PRON No. 1A1281501A1A
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Thermo-Elastic-Plastic Response Multi-Layered Cylinders Thermal Loads Pressure Loads		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) One of the many efforts undertaken to increase the life of gun tubes and/or increase their resistance to erosion involves the use of liners fabricated from different materials. A finite difference computer code for investigating the thermo-elastic-plastic response of gun tubes has been expanded to include multi-layered cylinder response to time dependent boundary conditions. Considered are both cyclic heat input and cyclic stress input. Response (CONT'D ON REVERSE)		

20. ABSTRACT (Cont'd)

curves from inputs representative of repeated firing cycles are presented. The emphasis in this report is on the transient temperature response and on the thermo-elastic stresses and mechanical stresses in the layers.

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1. REPORT NUMBER ARLCB -TR-81045	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) SUPERCONDUCTIVITY IN HYDROGEN-CHARGED COPPER-IMPLANTED PALLADIUM		5. TYPE OF REPORT & PERIOD COVERED FINAL
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) A. Leiberich, W. Scholz, W. J. Standish, and C. G. Homan (CONT'D ON REVERSE)		8. CONTRACT OR GRANT NUMBER(s) AMCMS NO.611102H600011 PRON No.1A1283121A1A
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Armament Research & Development Command Benet Weapons Laboratory, DRDAR-LCB-TL Watervliet, NY 12189		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS US Army Armament Research & Development Command Large Caliber Weapon Systems Laboratory Dover, NJ 07801		12. REPORT DATE December 1981
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18. SUPPLEMENTARY NOTES Presented at Third Ion Beam International Meeting, Grenoble, France, September 1981. To be published in the Journal of Physics, <u>A</u> .		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Superconductivity Ion Implantation Palladium-Copper Hydride		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) A superconducting transition temperature, T_c , of 124. K has been observed in palladium implanted with copper ions and electrolytically charged with hydrogen at dry ice temperature. A step-wise warmup procedure between 77 K and 273 K produces considerable variations in T_c . Annealing the copper implanted palladium before electrolysis does not change T_c to a substantial degree.		

7. AUTHOR(S)

A. Leiberich, W. Scholz, and W. J. Standish
Department of Physics
State University of New York at Albany
Albany, NY

C. G. Homan
US Army Armament Research & Development Command
Large Caliber Weapon Systems Laboratory
Benet Weapons Laboratory

20. ABSTRACT (CONT'D)

conducted in the 20 mm M24A1 gun system compare the LC Cr/steel with conventional (hard) chromium plated steel liners subjected to the same test conditions. Preliminary tests indicate that the LC Cr/steel combination reduces erosion in the 20 mm gun system.

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