

Section 1 and the section of the sec

DISPOSITION INSTRUCTIONS

in the later

Destroy this report when it is no longer needed. Do not return it to the originator.

NOTICE

The citation in this report of the names of commercial firms or commercially available products or services does not constitute official endorsement or approval of such commercial firms, products, or services by the U.S. Government.

The findings in U s report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

REPORT DOCUMENTATION PAGE READ DISTUICIONS BEPORT DOCUMENTATION PAGE BEPORT COMPLETING FORM 'A-TH-16854 'GOVT ACCESSION NO. 'GOVT ACCESSION NO. 'THE ING SAMA 'GOVT ACCESSION NO. 'GOVT ACCESSION NO. 'EACH-16854 'GOVT ACCESSION NO. 'GOVT ACCESSION NO. 'THE ING SAMA 'GOVT ACCESSION NO. 'GOVT ACCESSION NO. 'EACH-16854 'GOVT ACCESSION NO. 'GOVT ACCESSION NO. 'THE ING SAMA 'GOVT ACCESSION NO. 'GOVT ACCESSION NO. 'GATTA-DEAD 'GOVT ACCESSION NO. 'GOVT ACCESSION NO. 'UNROKO' 'GOVTACKED' 'GOVTACKED' 'GOVTACKED' 'OUNROKO ONGARITATION NAME AND ADDRESS 'GONTRALKED' AND SECONDESS 'GOVTACKED' 'GOL'. 'GOVTACKED' 'GOL'. 'CANTADIANO OFFICE NAME AND ADDRESS 'GONTACKED''GOVTACKED''GOL'	ECURITY CLASSIFICATION	STELED	Entered)	
Sour ACCESSION HO. Sour ACCESSION HO. Sour ACCESSION HO. Sourcession Sour		وموافقة مسوا بالكرجيب ويتكلموه بجوي الفكمان	والاحتفاظ بالمراجية فيهوا أعقوه فستعو وتعييره فيست	
The fore down PERSIBILITY DEMONSTRATION OF A LOW COST MODIFI Final Signeering Merer Resources of Miguze TO ACHIEVE A If METER NON-ARM DISTANCE. ANTONYO IONN P. AUNT PERFORMING DATABLEATION HAVE AND ADDRESS PERFORMING DATABLEATION HAVE AND ADDRESS CONTRACLING SPICE HAVE AND ADDRESS CONTRACLING SPICE HAVE AND ADDRESS CONTRACT OF TAKE AND ADDRESS CONTRACT OF TAKE A ADDRESS(II different free Controlling Office) 14 UNITORING AGENCY HAVE & ADDRESS(II different free Controlling Office) 14 UNITORING AGENCY HAVE & ADDRESS(II different free Controlling Office) 14 DEFINIOUTOR STATEMENT (of the desing of the desing of the Micro II DEFINIOUTOR STATEMENT (of the desing of the desing of the Micro II DEFINIOUTOR STATEMENT (of the desing of the desing of the Micro II DEFINIOUTOR STATEMENT (of the desing of the Micro II DEFINIOUTOR STATEMENT (III DEFINIOUTOR STATEMENT (III DEFINIOUTOR STATEMENT (IIII DEFINIOUTOR STATEMENT (IIIII DEFINIOUTOR STAT	TREFERT WUEDEN	7		
EASIBILITY DEMONSTRATION OF A LOW COST MODIFIC CATION TO THE MSOSA3 20 MM GUZE TO ACHIEVE A IF MANAGEMENT AND ADDRESS WINDOWS IO METER NON-ARM DISTANCE. IO METER NON-ARM DISTANCE. IO MANY AND A SECOND TO BRANT HUMBER(U) IONN P. /-UNIT FROMMED DEMONTRATION HAME AND ADDRESS PRANKFORD ARSENAL ATTN: SARTA-NUAD D PRINCE CODE: 3652.5000.204 DA FROJECT: 662616.11.877D CONTRACT OR GRANT HUMBER(U) IONN ATTRACE AND ADDRESS INFORMED TO BRANTA HUMBER(U) IONN ATTRACE AND ADDRESS INFORMATION STATEMENT (IN THE AND ADDRESS INFORMATION STATEMENT (IN THE ADDRESS(I) different free ACCENT INCLASSIFIED	FA-TR-76054			(9)
CATION TO THE MSOSAS 20 MM EDZE TO ACHIEVE A PITAL Segments and Reference and Second S	TITLE (and Bobility)			STATE OF REPORT & PERIOU COVENED
10 METER NON-ARM DISTANCE. 10 TO SUITE THE ENDING AND ADDRESS NUTROWO E. CONTRACT ON DAME AND ADDRESS PERFORMING OMGANITATION NAME AND ADDRESS 10 TARGET AN ELANGENT MODESS. FRANKFORD ARSENAL ATTR: SARTA-DUA-D 10020 PHILADELPHIA, PA. 19020 AMCMS CODE: 3652.5000.204 CONTROLLING OFFICE NAME AND ADDRESS Schedular and Constant And ADDRESS Commander Schedular and ADDRESS Commander Schedular and ADDRESS Control office NAME AND ADDRESS Schedular and ADDRESS Commander Schedular and ADDRESS Constraction office Office Schedular and ADDRESS Constraction of the ADDRESS of ADDRESS of ADDRESS Schedular and ADDRESS Constraction of the ADDRESS of ADDRESS of ADDRESS of ADDRESS of ADDRESS (IN ADDRESS of ADDRESS (IN ADDRES				Final Engineering Kepert
AUTHORY AUTHORY IDHN P. HUNT FREWDORMED CONSULTATION HAME AND ADDRESS FRANKPORD ARSENAL ATTM: SARTA-BLA-D PHILADELPHIA, PA. 19020 CONTROLLING OFFICE HAME AND ADDRESS CONTROLLING OFFICE HAME AND ADDRESS CONTROL OF ADDRESS CONTROL OFFICE HAME AND ADDRESS CONTROL OF ADDRESS CONTROL OF ADDRESS CONTROL OFFICE HAME AND ADDRESS CONTROL			IO ACHIEVE A	
DINN P. HUNT IIII PROVIDENT ON MARE AND ADDRESS FRANKTOR MASENAL NASENAL ON ANSE AND ADDRESS FAILLADELPHIA, PA. 19020 AMCMS CODE: 3652.5000.204 Contractured orfice HAME AND ADDRESS Dentition of the second of the sec		2	يونيو اليوني المحمد المحمد المحمد المحمد	E. CONTRACT OR GRANT NUMBER(4)
PERFORMENT ON CARLEASENAL ATTN: SARTA-DUA-D PROJECT: G62616.11.H77D PROJECT: G62616.11.	/ /			
AMCMS CODE: 3652.5000.204 AMCMS CODE: 3652.5000.204 DA PROJECT: 662616.11.H77D PHILADELPHIA, PA. 19020 CONTROLLING OFFICE NAME AND ADDRESS Commander In Cations of research and and address in Cations of ten fuzzes fired at 15 meter targets. MCLASSIFIED AMCMS CODE: 3652.5000.204 DA PROJECT: 662616.11.H77D PORT DATS PORT DATS POR	JOHN P. HUNT			
AMCMS CODE: 3652.5000.204 AMCMS CODE: 3652.5000.204 DA PROJECT: 662616.11.H77D PHILADELPHIA, PA. 19020 CONTROLLING OFFICE NAME AND ADDRESS Commander In Cations of research and and address in Cations of ten fuzzes fired at 15 meter targets. MCLASSIFIED AMCMS CODE: 3652.5000.204 DA PROJECT: 662616.11.H77D PORT DATS PORT DATS POR	PERFORMING ONGANIZA	TION NAME AND ADDRESS		10. FROGRAM ELEMENT PROJECT, TASK
ATTR: SARIA-NDA-D PHILADELPHIA, PA. 19020 CONTROLLING OFFICE NAME AND ADDRESS Commander Castrander Controlling Agency NAME & ADDRESS() different from Controlling Office) Controlling Office Name & ADDRESS() different from Matter Scheduler Controlling Office Name & ADDRESS() different from Account N/A Controlling Office Name & ADDRESS() N/A Controlling Office Name & ADDRESS() Controlling Offi				
CONTROLLING OFFICE HAME AND ADDRESS COMMINDER CONTROLENG ADDRESS (II AND ADDRESS (II ADDRESS				1
Pleating Arsenal 13 Jover, NJ 07801 14 Import of the second of the se		and the second		PORT DATE
14 14 15 16 17 18 19 19 19 19 19 19 19 19 19 19 10 10 10 10 10 10 10 10 10 11 12 12 13	Commander Rightinny Argona			the second se
A DESTRIGUTION STATEMENT (of the obstract intered in Block 20, 17 difformit from Accur) Approved for public release; distribution unlimited.	•	-		14
The supplementance of the model of the scalary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block n		ANE & ADDRESS(II differen	at from Controlling Office)	15. SECURITY CLASS. (of this report)
The supplementance of the model of the scalary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block number) Asstract (Continue on reverse cide if necessary and identify by block n			(2) N	
N/A Approved for public release; distribution unlimited. Approved for public release; distribution u			, grip.	15. DECLASSIFICATION DOWN GRADING
Approved for public release; distribution unlimited.				N/A
 KEY WORDS (Continue on reverse cide if necessary and identify by block number) ASSTRACT (Continue on reverse cide if necessary and identify by block number) ASSTRACT (Continue on reverse cide if necessary and identify by block number) ASSTRACT (Continue on reverse cide if necessary and identify by block number) ASSTRACT (Continue on reverse cide if necessary and identify by block number) ASSTRACT (Continue on reverse cide if necessary and identify by block number) This report details the test results of a supporting research effort to extend the minimum arming distance of the M505A3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets. INT TO 1473 EDATION OF INDUSE 16 OBSOLETE UNCLASSIFIED 			tribution unlim	ited.
 KEY WORDS (Continue on reverse cide if necessary and identity by block number) ASSTRACT (Continue on reverse cide if necessary and identity by block number) ASSTRACT (Continue on reverse cide if necessary and identity by block number) ASSTRACT (Continue on reverse cide if necessary and identity by block number) ASSTRACT (Continue on reverse cide if necessary and identity by block number) ASSTRACT (Continue on reverse cide if necessary and identity by block number) ASSTRACT (Continue on reverse cide if necessary and identity by block number) This report details the test results of a supporting research effort to extend the minimum arming distance of the M505A3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets. INT TO THAT A TATA EDATION OF INDUCES DESOLETE UNCLASSIFIED 	Approved for pub	lic release; dis	In Block 20, 11 dillerent fr	The Headerst
4505A3 fuze 20 mm fuze Extended non-arm distance This report details the test results of a supporting research effort to ex- tend the minimum arming distance of the M505A3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets.	Approved for pub	lic release; dis ENT (of the observed entered 62.6263	In Block 20, 11 dillerent fr	The Headerst
4505A3 fuze 20 mm fuze Extended non-arm distance This report details the test results of a supporting research effort to ex- tend the minimum arming distance of the M505A3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets.	Approved for pub $\frac{12}{2}$ DISTRIBUTION STATEM	lic release; dis ENT (of the observed entered 62.6263	In Block 20, 11 dillerent fr	The Headerst
4505A3 fuze 20 mm fuze Extended non-arm distance This report details the test results of a supporting research effort to ex- tend the minimum arming distance of the M505A3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets.	Approved for pub	lic release; dis ENT (of the observed entered 62.6263	In Block 20, 11 dillerent fr	The Headerst
20 mm fuze Extended non-arm distance ABSTRACT (Continue on reverse also if necessary and identify by block number) This report details the test results of a supporting research effort to ex- tend the minimum arming distance of the M505A3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets. N D : JAM 73 1473 EDVITON OF ! NOV # 18 OBSOLETE UNCLASSIFIED	Approved for pub	lic release; dis ENT (of the observed entered 62.6263	In Block 20, 11 dillerent fr	The Headerst
Extended non-arm distance ABSTRACT (Continue on reverse also if necessary and identify by block number) This report details the test results of a supporting research effort to ex- tend the minimum arming distance of the M505A3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets. N D : JAM 73 1473 EDVITON OF 1 NOV 64 18 OBSOLETE UNCLASSIFIED	Approved for pub 2. DISTRIBUTION STATEM DH-CCC 10. SUPPLEMENTARY NOT	lic release; dis	in Block 20, 11 dillorent fr 1 1 - H - 1	Nepart)
ABSTRACT (Continue on reverse aldo if macadeers and identify by block mamber) This report details the test results of a supporting research effort to ex- tend the minimum arming distance of the M505A3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets. NC D 1 JAN 73 1473 EDVITON OF 1 NOV 64 18 OBSOLETE UNCLASSIFIED	Approved for pub	lic release; dis	in Block 20, 11 dillorent fr 1 1 - H - 1	Nepart)
This report details the test results of a supporting research effort to ex- tend the minimum arming distance of the MSOSA3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets.	Approved for pub DH-CC B. SUPPLEMENTARY NOT IS. KEY WORDS (Continue of M505A3 fuze 20 mm fuze	lic release; dis ENT (of the observed 6.2.6.2.6.3 25 25	in Block 20, 11 dillorent fr 1 1 - H - 1	Nepart)
This report details the test results of a supporting research effort to ex- tend the minimum arming distance of the MSOSA3 20 mm point detonating fuze to 10 meters. Minor modifications to the standard M405 resulted in zero functions out of twenty-five (25) fuzes fired at 10 meter targets and zero functions of ten fuzes fired at 15 meter targets.	Approved for pub Approved for pub H-CC ADH-CC SUPPLEMENTARY NOT S. KEY WORDS (Continue or M505A3 fuze 20 mm fuze	lic release; dis ENT (of the observed 6.2.6.2.6.3 25 25	in Block 20, 11 dillorent fr 1 1 - H - 1	Nepart)
D + JAN 73 EDITION OF 1 NOV 65 18 OBSOLETE UNCLASSIFIED	Approved for pub Approved for pub H-CC H-CC SUPPLEMENTARY NOT S. KEY WORDS (Continue or M505A3 fuze 20 mm fuze Extended non-arm	lic release; dis ENT (of the obsirect entered 1.1.6.1.6.1 S reverse cide if necessary = distance	In Block 26, 11 dillerant fr 1 1 - H - 1 nd Identity by block number	
	Approved for pub Approved for pub H-GO H-GO IS. SUPPLEMENTARY NOT IS. SUPPLEMENTARY IS. SUPPLEMENTARY	lic release; dis ENT (of the obsirect entered ()). (). (). (). (). (). (). (). (). (). (). (). ().	In Block 20, 11 different fr 1 1 - H - 7 Ind Identify by block number ults of a support of the M505A3 ns to the stand.) fuzes fired a	rting research effort to ex 20 mm point detonating fuze ard M405 resulted in zero t 10 meter targets and zero
	Approved for pub Approved for pub H-CC H-CC SUPPLEMENTARY NOT SUPPLEMENTARY NOT SUPPLEMENTARY NOT MODSA3 fuze 20 mm fuze Extended non-arm C. ABSTRACT (Continue or This report deta tend the minimum to 10 meters. M functions out of	lic release; dis ENT (of the obsirect entered ()). (). (). (). (). (). (). (). (). (). (). (). ().	In Block 20, 11 different fr 1 1 - H - 7 Ind Identify by block number ults of a support of the M505A3 ns to the stand.) fuzes fired a	rting research effort to ex 20 mm point detonating fuze ard M405 resulted in zero t 10 meter targets and zero s.
	Approved for pub DH-CC SUPPLEMENTARY NOT KEY WORDS (Continue or M505A3 fuze 20 mm fuze Extended non-arm C ABSTRACT (Continue or This report deta tend the minimum to 10 meters. M functions out of	lic release; dis ENT (of the obsirect entered ()). (). (). (). (). (). (). (). (). (). (). (). ().	In Block 20, 11 different fr 1 1 - H - 7 Ind Identify by block number ults of a support of the M505A3 ns to the stand.) fuzes fired a	rting research effort to ex 20 mm point detonating fuze ard M405 resulted in zero t 10 meter targets and zero s.
	Approved for pub Approved for pub H-GO H-GO M-GO	lic release; dis ENT (of the obstract entered ()). () . () . () . IS reverse cide if necessary = distance reverse cide if necessary = ils the test rest arming distance inor modification twenty-five (25) fuzes fired at	In Block 20, 11 different fr 1 1 - H - 1 nd Identify by block number ults of a suppo of the M505A3 ns to the stand.) fuzes fired a 15 meter target	rting research effort to ex 20 mm point detonating fuze ard M405 resulted in zero t 10 meter targets and zero s.

「「「「「「「」」」」

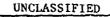
A State of the second se

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Date Untered)

Ś

Ann At - Fight and a share share



SECURITY CLASSIFICATION OF THIS PAGE(When Date Entered)

HČŠív-s.

alitikas arealas

TABLE OF CONTENTS

	Page
INTRODUCTION	2
Background	2
Current Status	2
IMPLEMENTATION	2
TEST RESULTS	3
CONCLUSIONS	4
RECOMMENDATIONS	5
APPENDIX A	6
APPENDIX B	7
DISTRIBUTION.	. 13

List of Illustrations

Figure

1.	M505 Fuze Target Panels (.063 Inch 2024T3 Aluminum) of	
	Typical "No-Go" (Left) and "Go" (Right) Impacts	11

ACCESSION	1w
NTID 1906 Qlaning (M July 16 Jak	
Π	TIBN/AVAILADILITY GOURS
Jist.	AVAIL BOL W SPECIAL
A	



بي بي

A SUCCESSION OF

INTRODUCTION

Background

The current Joint Services Operational Requirements (JSOR), being staffed through the three services, calls for a 10 meter non-arm distance of all cannon caliber (20 to 40 mm) fuzes. The M505A3 fuze, when fired in the 20 mm Vulcan Air Defense System (VADS) weapon, demonstrates a nonarm distance of 3 to 4 meters. The M505A3 fuze obtains its arming delay when an out-of-line ball rotor is moved into alignment by forces generated in the ballistic environment.

Another requirement of the JSOR, for the Army Air Defense Role, is self destruct and target sensitivity to highly oblique targets (graze sensitivity). The self destruct and graze functions have been successfully demonstrated in previous ball rotor fuzing efforts. If the ten moter non-arm requirement could be demonstrated with a ball rotor fuze and all elements married into one fuze, the intent of the JSOR for air defense role fuzes could be satisfied. This report address a successful demonstration effort at achieving a 10 meter non-arm distance for ball rotor fuzes fired in the VADS weapon.

Current Status

المتعالية المراجع المحالية والمحالية والمحالية والمحالية والمحالية والمحالية والمحالية والمحالية والمحالية والم

Breed Corporation, a firm that has been investigating ball rotor fuzes for the government for the past 20 years, has developed an analytical computer model of the ball rotor "system" which is more thorough and complete than any, to date. Their Analysis indicates that the nonarming distance of a ball rotor is determined by the rate at which energy is supplied to the ball, through contact of the ball with the cavity in which it is confined. This "contact" action supplies external energy (external to the ball rotor) to the rotor, thus causing the rotor to arm (i.e., align the explosive train). This external energy is proportional to the frictional forces between these two components. Thus, reduction of the frictional forces will result in a longer non-arm distance, since less friction means less energy is being supplied to the rotor by contact with the rotor cavity. Theoretically, the complete lack of friction and other perturbing forces would result in a infinite non-arm distance since the rotor would never align.

IMPLEMENTATION

The MSO5A3 fuze utilizes a ball rotor for arming delay, however, the non-arm distance of this fuze can be as close on 3 meters or as far as 25 to 40 meters. The ball rotor analysis has indicated that the nonarm distance is proportional to the frictional forces. These frictional forces are the result of many factors, the three most important being: the spin eccentricity of the round, that is, the tendency of the round

to spin about its center of mass rather than its geometric center; the clearance between critical parts in the fuze specifically, the rotor and the ogive inner cavity varying as a result of the range of manufacturing tolerances allowed by the Technical Data Package of the fuze; and the variability of the value of the coefficient of friction as a result of material properties and surface finishes. When existing eccentricity, clearance variations and the coefficient of friction were inputted into the computerized hall rotor analysis, theoretical results indicated a wide non-arm band which coincides with test and operational observations. To both reduce the width of the non-arm band and to guarantee a minimum non-arm distance, numberous design modification concepts were evaluated with the aim being to maintain the producibility of the current M505A3 at no (or minor) increase in cost. The modifications being evaluated here consist of: reducing eccentricity between the fuze ogive threads and ogive inner cavity; reducing the tolerance build-up of the rotor and cavity clearance to a set clearance value plus or minus 0.001 inches; and reducing and stabilizing the coefficient of friction by coating the rotor with a 0.5 mil thickness of "Emralon" (a dry film lubricant manufactured by Acheson Colloids).

The modifications were initiated by first screening standard M505A3 bodies to obtain those parts manufactured to minimum values of the dimensional tolerance bands of certain critical dimensions. Ball rotors were similarly screened for consistant diameter values. The inner cavity of the bodies were then remachined with a one tool operation which simultaneously: corrected eccentricity; provided a smoother cavity finish of better than 63 microinches roughness value; and opened up the original cavity to produce a cavity of a known consistant value. The final dimensions of the inner cavity as a result of this one operation are all within the dimensional and tolerance bands of the existing technical manufactoring drawing of the body and the capability of screw machine manufacturing technology.

The ball rotors that were screened to obtain a certain diameter ball were subsequently coated with a 0.5 mil thickness of "Emralon." This is the only alteration of this element from the standard bell rotor. These two screened and slightly modified parts were then assembled with all other standard components to produce 45 live, modified M505A3 fuzes.

Three bodies and coated ball rotors of this lot of fuzes were randomly selected and independently checked by government inspectors. Results indicate that the final dimensions and configuration are within the dimension and tolerance bands of the standard components.

TEST RESULTS

The forty-five (45) fuzes were assembled to M56A4 HEI rounds and fired from the 7° progressive-twist Mann barrel at 0.063 inch aluminum 2024T3 targets in two groups. The first group of 15 fuzes was a comfirmatory test to verify computer predictions. There were zero functions

for ten rounds fired at 10 meter targets and five for five functions high order when fired at 60 meters. For the second test group, a group of standard M505A3 fuzes were fired at 60 meter, 15 meter and 10 meter targets as a control group. The remaining modified M505A3 fuzes were then fired, 10 each, at 60 meters, 15 meters and 10 meters. Results were as follows:

Distance to Taxast	Control	Madded Dura
Distance to Target	(Standard M505A3)	Modified Fuze
60 meters	10/10*	10/10
15 meters	4/10	0/10
10 meters	1/10	0/10

* - number functioned on target impact versus the number tested

All rounds that functioned on the target functioned high order and all rounds that did not function on the target functioned on the earth mound behind the target. The firing records from the independent testing laboratory for the two tests are reproduced in Appendices A and B respectively.

For both tests, the combined results for the modified fuze are:

Distance to Target	Fuzes Functioned/Fuze Fired
60 meters	15/15
15 meters	0/10
10 meters	0/20

CONCLUSIONS

The results of these test indicate that it may be possible to achieve a more consistant and more desirable 10 meter non-arming distance from the M505A3 fuze with minor modifications, minor cost increase and no loss of a production base. Quality control will probably be the primary cost increase because of the reduced tolerance bands.

The effort involved in this test is indeed not exhaustive and a need for subsequent in depth testing is required to verify if this approach is indeed viable and/or desirable.

RECOMMENDATIONS

It is recommended that an additional minimum quantity of 1,000 fuzes be obtained and tested to establish a trend of performance for this modified fuze. Concurrent with this effort, the modifications being proposed for this fuze should be reviewed by the current vendors to determine cost variations, if any, with current parts. This concept could have applicability to the Air Force 20 mm Lightweight Program.

APPENDIX A

H. P. WHITE LABORATORY

5 x 135 But Air Maryland 21014 (301) £38-6550



10 June 1976

Commander Frankford Arsenal ATTN: SARFA-ISE, Bldg 44-1 (Mr. John Hunt) Philadelphia, PA 19137

Gentlemen:

In accordance with the direction of your Technical Representative, H.P. White Laboratory, Inc., conducted firing tests of fifteen (15) experimental 20mm fuzes on 7 June 1976.

The test fuzes were assembled to MS6A4, HEI cartridges and were fired from a 20mm Mann Barrel, 60 inches long with progressive twist and an exit angle of 7°03'.

Five (5) of these fuzes were fired over a range of 60 meters to impact a .063", aluminum (2024T3) target at 0° obliquity--all of which were observed to function properly.

Ten (10) test cartridges were fired as above at a range of 10 meters--all of which were observed to penetrate the target without explosive reaction.

Should you have any questions regarding this matter, or if we may be of any further service, please do not hesitate to contact us.

Very truly yours, HITE LABORATORY, INC.

D.R.Dunn

6

DRD/gd

ALLENDIY D

H. P. WHITE LABORATORY, INC.



「「ない」のないです。「ない」のないで、「ない」のできた。

16 June 1976

Commander Frankford Arsenal ATTN: SARFA-MDA-D, Building 200-3 (Mr. John Hunt) Philadelphia, Pennsylvania 19137

Dear Sir:

In accordance with the direction of your technical representative and the provisions of Purchase Order No. DAAA25-76-M-2590, H.P. White Laboratory, Inc. conducted comparative fuze functioning tests on thirty (30) of each of two (2) types of 20mm fuzes—the standard M505 (Lot No. LC-SP-1532) and an experimental Breed Corporation fuze.

All fuzes were assembled to M56A4, HEL, 20mm cartridges from Lot LC-SP-1531 and were fired from a 60-inch long, 20mm Mann barrel with progressive twist rifling and an exit angle of 7° 3'. Firings were conducted against 1 foot square panels of .063 inch 2024T3 aluminum.

Ten (10) rounds fitted with the M505 and ten (10) rounds fitted with the Breed fuze were fired at each of three (3) ranges-60, 15 and 10 meters from the gun muzzle. Velocities at 60, 20 and 20 feet from the muzzle were determined for the 60, 15 and 10-meter firings, respectively, from lumiline screens over a distance of 10 feet.

Proper fuze action was determined from observations and inspection of the target panels subsequent to each firing. Figures 1 and 2 are representative of M505 and Breed "go" and "no-go" hits, respectively.

Table I is a summary of the results of these firings. The attached data record provides the details upon which this summary is based.

APPENDIX B (Cont)

بحسب والجارية المعامين

Commander, Frankford Arsenal 16 June 1976 Page 2

	Average Velocity (fps) of 10 Rounds	
Target Distance)		
ers	3381	

TABLE I. SUMMARY OF RESULTS

60 meters	3381	10/0
15 meters	3412*	4/6
10 meters	3401*	1/9
Total	3398	15/15
reed Fuze (Target Distance)		
60 meters	3369*	10/0
	3415*	0/10
60 meters		

Should you have any questions regarding this data or if we may be of any further service, please do not hesitate to contact us.

Very truly yours,

H.P. WHITE LABORATORY, INC.

Go/No-Go

D.R. Dunn .*

DRD:1c

1 enclosure

APPENDIX B (Cont)

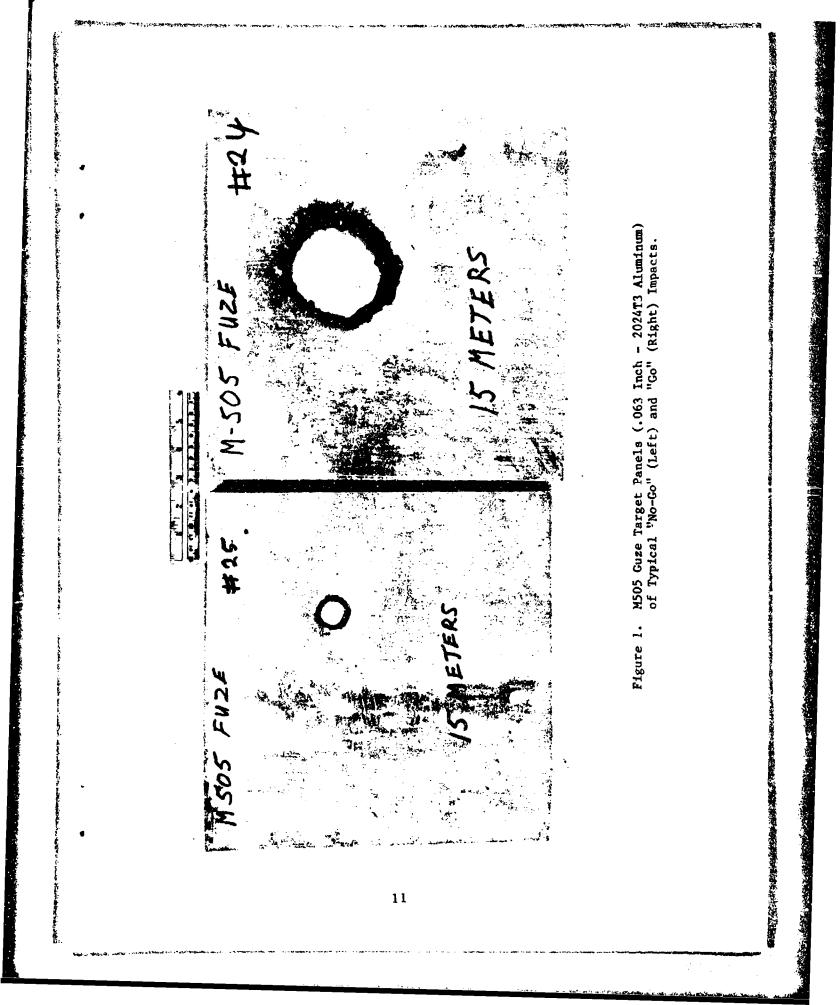
TEST DATA

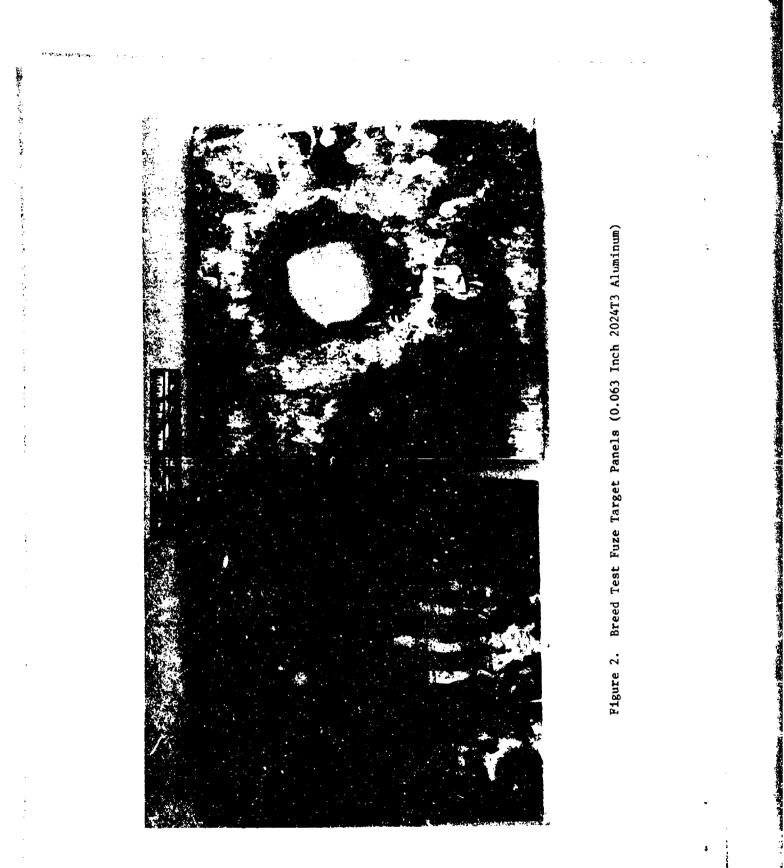
4	D1	Velocity (fps)	Target	
	Round	@ 60 Feet @ 20 Feet	Range (M)	Go/No-Go
	1	3354.5	60	Go
•	2	3397.8	60	Go
	3	3367.0	60	Go
	4	3355.7	60	Go
	5	3385.2	60	Go
	6	3350.0	60	Go
	7	3414.1	60	Go
	8	3395.5	60	Go
	9	3393.2	60	Go
	10	3381.8	60	Go
	T-1	3392.1	6 0	Go
	T-2	3351.2	60	Go
	T-3	3364.7	6 0	Go
	T-4	3363.6	6 0	Go
	T-5	3369.2	60	Go
	T-6	3367.0	60	Go
	T-7	3393.2	60	Go
	T-8	3374.9	60	Go
	T-9	3342.2	60	Go
	T-10	no reading	60	Go
	11	no reading	10	No-Go
	12	3408.3	10	Go
	13	3403.6	10	No-Go
	14	3395.5	10	No-Go
	15	3392.1	10	No-Go
	16	3409.4	10	No-Go
	17	3378.3	10	No-Go
	18	3400.2	10	No-Go
	19	3409.4	10	No-Go
	20	3412.9	10	No-Go
	T-11	3422.0	10	No-Go
	T-12	3427.0	10	No-Go
	T-13	3408.3	10	No-Go
	T-14	3386.3	10	No-Go
	T-15	3386, 3	10	No-Go
	T-16	3370.4	10	No-Go
	T-17	3429.6	10	No-Go
•	T-18	3405,9	10	No-Go
	T-19	3417.6	10	No-Go
	T-20	3421.1	10	No-Go
•				

APPENDIX B (Cont)

TEST DATA (Continued)

	Velocity (fps)	Target	
Round	<u>@ 60 Feet @ 20 Feet</u>	Range (M)	<u>Go/No-Go</u>
21	3415.3	15	No-Go
22	3429.3	15	No-Go
23	3427.0	15	No-Go
24	3403.6	15	Go
25	3393.2	15	No-Go
26	3414.1	15	Go
27	3424.6	15	No-Go
28	3397.8	15	Go
29	3408.3	15	No-Go
30	no reading	15	Go
T-21	3405.9	15	No-Go
T-22	3423.4	15	No-Go
'T-23	3401,3	15	No-Go
T-24	3422.3	15	No-Go
T-25	3414.1	15	No-Go
T-26	3389,8	15	No-Go
T-27	3414.1	15	No-Go
T-28	3422,3	15	No-Go
T-29	3447.0	15	No-Go
T-30	no reading	15	No-Go





DISTRIBUTION

化等级 "你们,你们不可以不知道你?""你们的你的你们的你们的你们,你们还没有什么?""你们还是我们没有不能不能的吗?"

Commander US Army Research & Development Center Ballistic Research Laboratory Aberdeen Proving Ground Aberdeen, MD 21005

1 Attn: AMXBR-DL

A STATE AND A STAT

1 Attn: Tech Ref Sec

Commander Army Material Systems Analysis Agency Attn: AMXSY-GS, R. Scungio Aberdeen Proving Ground Aberdeen, MD 21005

Commander Aberdeen Proving Ground Attn: Technical Library Aberdeen, MD 21005

Commander Picatinny Arsenal Dover, NJ 07801

1 Attn: SARPA-MD-F-D, R. Goldstein

1 Attn: SARPA-MD-F-D, F. Tepper

2 Attn: Tech Library

Commander US Army Material Development & Readiness Command Attn: DRCRD-BN, W. Ralph 5001 Eisenhower Avenue Alexandria, VA 22333 Commander US Army Armaments Command Rock Island, IL 62201

1 Attn: Dir. Rsch, Dev & Engr

1 Attn: DASAR-RDF, G. Taylor

Commander Naval Weapons Center China Lake, CA 93555

l Attn: Code 4023, Paul Miller

1 Attn: Tech Library

Commander Harry Diamond Laboratories Attn: Tech Ref Library 2800 Powder Mill Road Adelphia, MD 20783

Commander Eglin Air Force Base Eglin, FL 32542

1 Attn: AFATL/DLDD, A. Welle

1 Attn: AFATL/DLDD, Mr. Slotkin

l Attn: AFATI./DCDD, R. Blair

1 Attn: AFATL/DCDD, Lt. Col. J. D'Arey

Commander Lake City Army Ammunition Plant Independence, MO 64056

1 Attn: ATD-ED

1 Attn: ATD-IED

DISTRIBUTION (Cont)

Breed Corporation 20 Spielman Road Fairfield, NJ 07006

Defense Documentation Center (12) Cameron Station Alexandria, VA 22314

Commander Frankford Arsenal Philadelphia, PA 19137

- 1 Attn: SARFA-AOA-M
- 1 Attn: SARFA-TD
- 1 Attn: SARFA-MDA, Mr. G. Bornheim
- 1 Attn: SARFA-PA
- 1 Attn: SARFA-GC
- 1 Attn: SARFA-QAA-R, Mr. E. Glowacki
- 1 Attn: SARFA-MDA-D, Project File
- 6 Attn: SLAFA-MDA-D, Nr. J. Hunt
- 1 Attn: SARFA-MDA-D, Mr. F. Luke
- 1 Attn: SARFA-MDC-A, Mr. B. Siegel
- -1 Attn: SARFA-MDC-E, Mr. R. Trifiletti
- 3 Attn: SARFA-TSP-L,
 - 1 Reference Copy
 - 1 Circulation Copy
 - 1 Tech Reports Editing

Printing & Reproduction Division FRANKFORD ARSENAL Date Printed: 27 Sept 1976