REPORT DOCUMENTATION PAGE

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1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE	3. 01 December 1997 - 31 October 1998

4. TITLE AND SUBTITLE
An Improved SPH Technique for Fracture Modeling

5. FUNDING NUMBERS
F49620-98-1-0148

6. AUTHOR(S)
Prof. Libersky
Prof. Carney

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
New Mexico Inst. of Mining and Techology
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Campus Station
Socorro, NM 87801

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
AFOSR
801 N. Randolph Street, Room 732
Arlington, VA 22203-1977

10. SPONSORING/MONITORING AGENCY REPORT NUMBER
F49620-98-1-0148

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION AVAILABILITY STATEMENT
Approved for Public Release.

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

The purpose of the proposed research was to enhance the Smoothed Particle Hydrodynamics (SPH) code named MAGI. With these improvements, the MAGI code could solve the enormously complex problem of simulating Behind-Armor-Debris and subsequent interaction of the spall cloud with threat target components as well as the fragmentation of warheads and other explosively driven devices. The proposed work would have involved several improvements to the numerical implementation of SPH. This was possible, as two of the worlds leading experts in SPH, Larry Libersky and Ted Carney, were employed by NMIMT/EMRTC and both contributed to the proposal. The PI's were intending to add contact and free-surface boundary conditions to the normalized version of MAGI. The one-dimensional case was completed when work was suspended. Unfortunately, by the time the contract was delivered, Larry Libersky had left EMRTC and Ted Carney resigned soon after. There were no other researchers at EMRTC that were competent to complete the contract, so the work was suspended and the contract terminated.

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14. SUBJECT TERMS

15. NUMBER OF PAGES
83

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

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DTIC QUALITY INSPECTED 3

New Mexico Tech
Energetic Materials Research and Testing Center
801 Leroy Place ♦ Socorro, NM 87801
Phone: (505) 835-5312 ♦ Fax: (505) 835-5630 ♦ http://www.emrtc.nmt.edu

AN IMPROVED SPH TECHNIQUE FOR FRACTURE MODELING

Final Technical Report Submitted to:

AFOSR/NM
110 Duncan Avenue, Room B115
Bolling AFB, DC 20332-8050

Grant No. F49620-98-1-0148

DISTRIBUTION STATEMENT A
Approved for Public Release
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Energetic Materials Research and Testing Center
New Mexico Tech, Socorro, NM 87801

June 15, 2000

AN IMPROVED SPH TECHNIQUE FOR FRACTURE MODELING

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REPORT OF INVENTIONS AND SUBCONTRACTS

(Pursuant to "Patent Rights" Contract Clause) (See Instructions on Reverse Side.)

Form Approved
OMB No. 0704-0240
Expire June 30,1992

1a NAME OF CONTRACTOR/SUBCONTRACTOR	c CONTRACT NUMBER	2a NAME OF GOVERNMENT PRIME CONTRACTOR	c CONTRACT NUMBER	3. TYPE OF REPORT (X one)
NM Inst of Mining & Technology	F49620-98-1-0148	AFOSR/NM	F49620-98-1-0148	___ a. INTERIM _X_ b. FINAL
b ADDRESS (Include ZIP Code)	AWARD DATE (YYMMDD)	b ADDRESS (Include ZIP Code)	d AWARD DATE (YYMMDD)	4. REPORTING PERIOD (YYMMDD)
EMRTC 801 Leroy Place Socorro, NM 87801	19971201	110 Duncan Ave., Rm. B115 Bolling AFB, DC 20332-8050	19971201	a. FROM 19971201 b. TO 19980831

SECTION I - SUBJECT INVENTIONS

5. "SUBJECT INVENTIONS" REQUIRED TO BE REPORTED BY CONTRACTOR/SUBCONTRACTOR (If "None," so state)

a. NAME(S) OF INVENTOR(S) (Last, First, MI)	b. TITLE OF INVENTION(S)	c. DISCLOSURE NO. PATENT APPLICATION SERIAL NO. OR PATENT NO.	d. ELECTION TO FILE PATENT APPLICATIONS (1) United States (a) Yes	(b) No	(2) Foreign (c) Yes	(d) No	e. CONFIRMATORY INSTRUMENT OR ASSIGNMENT FORWARDED TO CONTRACTING OFFICER (1) Yes	(2) No
NONE								

f. EMPLOYER OF INVENTOR(S) NOT EMPLOYED BY CONTRACTOR/SUBCONTRACTOR		g. ELECTED FOREIGN COUNTRIES IN WHICH A PATENT APPLICATION WILL BE FILED	
(1)(a) Name of Inventor (Last, First, MI)	(2)(a) Name of Inventor (Last, First, MI)	(1) Title of Invention	(2) Foreign Countries of Patent Application
(b) Name of Employer	(b) Name of Employer		
(c) Address of Employer (Include ZIP Code)	(c) Address of Employer (Include ZIP Code)		

SECTION II - SUBCONTRACTS (Containing a "Patent Rights" clause)

6. SUBCONTRACTS AWARDED BY CONTRACTOR/SUBCONTRACTOR (If "None," so state)

a. NAME OF SUBCONTRACTOR(S)	b. ADDRESS (Include ZIP Code)	c. SUBCONTRACTOR NO.(S)	d. DFAR "PATENT RIGHTS" (1) Clause Number	(2) Date (YYMM)	e. DESCRIPTION OF WORK TO BE PERFORMED UNDER SUBCONTRACT(S)	f. SUBCONTRACT DATES (YYMMDD) (1) Award	(2) Estimated Completion
NONE							

SECTION III - CERTIFICATION

7. CERTIFICATION OF REPORT BY CONTRACTOR/SUBCONTRACTOR (Not required if _____ Small Business or ___X___ Non-Profit organization.) (X a

a. NAME OF AUTHORIZED CONTRACTOR/SUBCONTRACTOR OFFICIAL (Last, First, MI)
W.D. Peterson

c. I certify that the reporting party has procedures for prompt identification and timely disclosure of "Subject Inventions," that such procedures have been followed and that all "Subject Inventions" have been reported.

b. TITLE
Vice President
for Admin & Finance

d. SIGNATURE
W. D. Peterson

e. DATE SIGNED
4/19/00

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New Mexico Tech
Energetic Materials Research and Testing Center
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June 15, 2000

DEPARTMENT OF THE AIR FORCE
Air Force Office of Scientific Research / NM
110 Duncan Avenue Room B115
Bolling AFB, DC 20332-8050

RE: F49620-98-1-0148
Final Technical Report
Final Invention Report

Enclosed are the final reporting requirements under the referenced contract. New Mexico Tech and EMRTC appreciate your research opportunities and would like to work with you again in the future.

The Technical Report is limited to the initial work began by the Principal Investigator, T. Carney. He left New Mexico Tech, and therefore, was unable to complete the entire contract requirements.

If you need additional information, contact Gayle Jones at 505-835-5810.

Sincerely,

W.D. Peterson
Vice President for Admin. & Finance
NMIMT

xc: W. Veon
L. Sakell