



`**`** 

	·····				11	TO FILE	CNO
	SECURITY CLASSIFICATION OF THIS PAGE						ME.
	REPORT DOCUMENTATION PAGE						
	TA REPORT SECURITY CLASSIFICATION			15. RESTRICTIVE MARKINGS			
	26 SECURITY CLASSIFICATION AUTHORITY			3. DISTRIBUTION/AVAILABILITY OF REPORT			
	A. PERFORMING ORGANIZATION REPORT NUMBER(S)			Approved for public release; distribution unlimited. 5. MONITORING ORGANIZATION REPORT NUMBER(S) AFOSR-TR- 87-0300			
	64 NAME OF PERFORMING ORGANIZATION BL OFFICE SYMBOL			74. NAME OF MONI	TORING ORGAN	ZATION	
	University of Pittsburgh			Air Force Of	fice of Sc	ientific Res	earch
	Sc. ADDRESS (City, State and ZIP Code)			76. ADDRESS (City.	Sinte and ZIP Cod	le)	
	Pittsburgh, PA 1	5260	ELECTE	irectorate	of Mathema	tical & Info	rmation
	•		APR 9 1987	, sciences, Bo	olling AFB	DC 20332	
	S. NAME OF FUNDING/SPONS		B. OFFICE SYMBOL	ROCUREMENT	NSTRUMENT ID	ENTIFICATION NU	MBER
	ORGANIZATION (If epplication						
	AFOSR NM-4						
נו (	Bolling AFB DC 20332			PROGRAM	PROJECT	TASK	WORK
Ľ				ELEMENT NO.	NO.	NO.	NO
C				61102F	2917	A5	1
62	Scientific Computations in Applied Mathematics. Physics. Chemistry and Crystallography						
	12. PERSONAL AUTHOR(S)						
2	12. PERSONAL AUTHORIS						
170	12. PERSONAL AUTHOR(S) Werner C. Rheinbol	ldt					<i></i>
170	12. PERSONAL AUTHORIS) Werner C. Rheinbol 134. TYPE OF REPORT	Ldt	COVERED	14. DATE OF REPO	AT (Yr., Mo., Dey	15. PAGE C	OUNT
- <b>A</b> 170	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a Type of Report Final 16. Supplementary Notati	Idt	COVERED Jul 84 Tol4 Jul	14. DATE OF REPO 85 10 September 10	ат <i>(Yr., Mo., Dey</i> mber 1985	15. PAGE C	OUNT
<b>)- A</b> 170	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13. TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATE	Ldt	COVERED Jul 84 Tol4 Jul	14. DATE OF REPO 85 10 Septem	at (Yr. Mo., Dey mber 1985	15. PAGE C	OUNT
170-0170	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 134 TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATI	Ldt 136. TIME FROM 15	COVERED Jul 84 Tol4 Jul	14. DATE OF REPO 85 10 Septe	AT (Yr. Mo., Dey mber 1985	15. PAGE C	
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13. TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATE 17. COSATE CODE FIELD GROUP	Idt 13b. TIME FROM 15 10N 15 50B. GR	JUL 84 TOL4 JUL 18 SUBJECT TERMS	14. DATE OF REPO 85 10 Septem Continue on reverse if n , Matrix Algeb	AT (Yr., Mo., Day mber 1985 eccasery and ident ra Accelera	15. PAGE C 3	OUNT
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATO	Ldt 136. TIME FROM 15 10N 13 5UB. GR	COVERED Jul 84 Tol4 Jul 18 SUBJECT TERMS	14. DATE OF REPO 5 10 Septe Continue on reverse if n , Matrix Algeb	AT (Yr. Mo., Dey mber 1985 eccuery and ident ra Accelera	15. PAGE C 3	OUNT , Llograp
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 134 TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION 17 COSATI CODE FIELD GROUP	Ldt 13b. TIME FROM 15 ION IS SUB. 2R	COVERED Jul 84 Tol4 Jul 18 SUBJECT TERMS FPS-164 MAX	14. DATE OF REPO 85 10 Septe Continue on reverse if n , Matrix Algeb	AT (Yr., Mo., Day mber 1985 ecoury and ident ra Accelera	15. PAGE C 3	ount Llograpi
AD-A179	12. PERSONAL AUTHORIS) Werner C. Rheinbol 13. TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION 17. COSATI CODE FIELD GROUP 19. ABSTRACT Continue on rec following equipment	Idt 13b. TIME FROM 15 ION IS SUB. GR SUB. GR	COVERED Jul 84 Tol4 Jul 18. SUBJECT TERMS A FPS-164 MAX	14. DATE OF REPO 10 Septem Continue on reverse if n , Matrix Algeb	AT (Yr. Mo., Dey mber 1985 eccury and ident ra Accelera ce with thi S-164 May c	15. PAGE C 3	ount llograph
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION FIELD GROUP 19. ABSTRACT Continue on The following equipment with 1M words of The	Idt 13b. TIME FROM 15 ION IS SUB. 3R Herse if necessary a nt has been memory, a m	COVERED Jul 84 Tol4 Jul 18 SUBJECT TERMS FPS-164 MAX	14. DATE OF REPO 10 Septe Continue on reverse if n , Matrix Algeb rr: In accordan stalled: a FP: celerator, and	AT (Yr. Mo. Day mber 1985 eccamery and ident ra Accelera ce with thi S-164 MAX s FPS-D64 di	15. PAGE C 3 1/y by block number itor, Crystal is URIP progra scientific co isk subsystem	Jount Llograph ram, th omputer n with
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION FIELD GROUP 19. ABSTRACT Continue on The following equipment with 1M words of the two drives. The st	Idt 13b. TIME FROM 15 ION IS SUB. 3R SUB. 3R Anther the seen nemory, a m scientific	COVERED Jul 84 Tol4 Jul 18 SUBJECT TERMS FPS-164 MAX FPS-164 MAX acquired and in acquired and in matrix algebra ac computing facili	14. DATE OF REPO 85 10 Septe Continue on reverse if n , Matrix Algeb er: In accordan stalled: a FP: celerator, and ty based on th	econory and ident ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipmen	15. PAGE C 3 17y by block number itor, Crystal scientific co isk subsystem it is now ope	ount llograp cam, th omputer n with eration
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATO 17 COSATI CODE FIELD GROUP 19. ABSTRACT Continue on The following equipment with 1M words of the two drives. The s It is housed in a principal department	Idt 13b. TIME FROM 15 FROM	COVERED Jul 84 Tol4 Jul 18 SUBJECT TERMS of FPS-164 MAX acquired and in acquired and in matrix algebra ac computing facili constructed comp	14. DATE OF REPO 10 Septe Continue on reverse if n , Matrix Algeb ri In accordan stalled: a FP celerator, and ty based on th uter room in c	AT (Yr. Mo. Day mber 1985 recevery and ident ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipment lose proxim	15. PAGE C 3 17/ by block number itor, Crystal scientific co isk subsystem it is now open ity to the f	ount llograph ram, th omputer n with eration four
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION FIELD GROUP 19. ABSTRACT Continue on res following equipmen with IM words of m two drives. The s It is housed in a principal department actively used for	Idt 13b. TIME FROM 15 ION IS SUB. 3R Interest if necessary a not has been memory, a m scientific specially ents involv a range of	COVERED Jul 84 Tol4 Jul Is SUBJECT TERMS FPS-164 MAX acquired and in acquired and in matrix algebra ac computing facili constructed comp red in this activ research projec	14. DATE OF REPO 10 Septe Continue on reverse if n , Matrix Algeb er/ In accordan stalled: a FP: celerator, and ty based on th uter room in c ity. From the ts, including:	AT (Yr. Mc. Dey mber 1985 ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipment lose proxim outset, th (1) Method	15. PAGE C 3 17/y by block number itor, Crystal scientific co isk subsystem it is now open ity to the f a facility h is for the science	Julograph ram, the pomputer n with eration four nas bee polution
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION FIELD GROUP FIELD GROUP following equipment with IM words of m two drives. The s It is housed in a principal department actively used for of differential/al	Idt 13b. TIME FROM 15 ION SUB. 3R SUB. 3R Ant has been memory, a m scientific specially ents involv a range of Igebraic equ	COVERED Jul 84 Tol4 Jul 18 SUBJECT TERMS FPS-164 MAX acquired and in acquired and in matrix algebra ac computing facili constructed comp red in this activ research projec uations with par	14. OATE OF REPO 85 10 Septe Continue on reverse if m , Matrix Algeb er: In accordan stalled: a FP: celerator, and ty based on th uter room in c ity. From the ts, including: ticular applic	AT (Yr. Mo. Dey mber 1985 results of the second ident ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipment lose proxim outset, th (1) Method ations to s	15. PAGE C 3 17/ by block number itor, Crystal cs URIP progra scientific co isk subsystem it is now ope nity to the f ise facility h is for the so sheet-metal f	Count cam, the cam, the cam, the computer n with eration four nas been plution forming
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION 17. COSATI CODE FIELD GROUP 19. ABSTRACT Continue on The following equipment with 1M words of the two drives. The so It is housed in a principal department actively used for of differential/all and related proble	Idt 13b. TIME FROM 15 FROM	COVERED Jul 84 Tol4 Jul Is SUBJECT TERMS FPS-164 MAX acquired and in acquired and in matrix algebra ac computing facili constructed comp red in this activ research projec uations with par d mechanics, (2)	14. OATE OF REPO 10 Septe 10 Septe	AT (Yr. Mo. Day mber 1985 recevery and ident ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipmen lose proxim outset, th (1) Method ations to s f computabl	15. PAGE C 3 17. by block number ator, Crystal scientific co isk subsystem it is now ope ity to the f is for the so sheet-metal f is error est	ount llograph ram, the omputer n with eration four four four forming imates
AD-A179	12. PERSONAL AUTHORIS) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION 17. COSATI CODE FIELD GROUP 19. ABSTRACT Continue on rea following equipmen with IM words of m two drives. The s It is housed in a principal department actively used for of differential/al and related proble solutions of nonic	Idt 13b. TIME FROM 15 ION IS SUB. 2R SUB. 2R Ant has been memory, a m scientific specially ents involv a range of Igebraic eq ems in soli inear bound s. (3) Comp	Ind identify by block number acquired and in actrix algebra ac computing facili constructed comp red in this activ research projec uations with par d mechanics, (2) ary value proble	Continue on reverse if n Continue on reverse if n , Matrix Algeb r' In accordan stalled: a FP: celerator, and ty based on th uter room in c ity. From the ts, including: ticular applic Development o ms for partial	AT (Yr. Mo. Day mber 1985 ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipment lose proxim outset, th (1) Method ations to s f computabl different	15. PAGE C 3 17/y by block number itor, Crystal scientific co isk subsystem it is now open ity to the f is for the so sheet-metal f le error est ial equations	Julograp ram, th pomputer n with eration four nas bee plution forming imates s by fi
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION FIELD GROUP FIELD GROUP 19. ABSTRACT Continue on rea following equipment with 1M words of m two drives. The s It is housed in a principal department actively used for of differential/al and related proble solutions of nonli- element techniques the determination	Idt 13b. TIME FROM 15 ION IS SUB. 3R Arrow if necessary of the source of the source of the source of specially ents involv a range of Igebraic equents in soli inear bound s, (3) Comp of three-d	In subject terms FPS-164 MAX acquired and in fatrix algebra ac computing facili constructed comp red in this activ research projec uations with par d mechanics, (2) ary value proble utational resear imensional struc	14. OATE OF REPO 85 10 Septe Continue on reverse if m , Matrix Algeb er' In accordan stalled: a FP celerator, and ty based on th uter room in c ity. From the ts, including: ticular applic Development o ms for partial ch in crystall tures of biolo	AT (Yr. Mo. Day mber 1985 recevery and ident ra Accelera ce with this S-164 MAX s FPS-D64 di is equipment lose proximoutset, the (1) Method ations to so f computable differentions ography invo	15. PAGE C 3 Try by block number itor, Crystal cs URIP program scientific co isk subsystem it is now open it is now open ity to the f le facility h ls for the sci sheet-metal f le error esti- tal equations yolving prince prince at	Count cam, the cam, the computer n with eration four nas been olution forming imates s by fir cipally t atomi
AD-A179	12. PERSONAL AUTHOR(S) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION 17. COSATI CODE 19. ABSTRACT CONUME ON THE following equipment with 1M words of m two drives. The s It is housed in a principal department actively used for of differential/all and related problet solutions of nonliselement techniques the determination resolution by x-rate	Idt 13b. TIME FROM 15 ION IS SUB. 3R SUB. 3R IS SUB. 3R IS SUB. 3R IS SUB. 3R IS SUB. 3R IS SUB. 3R IS SUB. 3R IS SUB. 3R IS SUB. 3R IS IS SUB. 3R IS IS IS IS IS IS IS IS IS IS	COVERED Jul 84 Tol4 Jul 18 SUBJECT TERMS FPS-164 MAX FPS-164 MAX acquired and in actrix algebra ac computing facili constructed comp red in this activ research projec uations with par d mechanics, (2) ary value proble putational resear imensional struc-	14. OATE OF REPO 10 Septe 10 Septe	AT (Yr. Mo. Day mber 1985 recevery and ident ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipmen lose proxim outset, th (1) Method ations to s f computabl differenti ography inv gical macro	15. PAGE C 3 17/ by block number ator, Crystal cis URIP progra cientific co isk subsystem it is now ope it is now	ount llograph ram, the omputer n with eration four nas bee olution forming imates s by fi cipally t atomi terized
AD-A179	12. PERSONAL AUTHORIS) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION FIELD GROUP 19. ABSTRACT Continue on rea following equipmen with 1M words of m two drives. The s It is housed in a principal department actively used for of differential/al and related proble solutions of nonli- element techniques the determination resolution by x-ra equations with par	Idt 13b. TIME FROM 15 ION IS SUB. 2R And has been memory, a m scientific specially ents involv a range of Igebraic eq ems in soli inear bound s, (3) Comp of three-d ay diffract rticular em	COVERED Jul 84 tol4 Jul FPS-164 MAX FPS-164 MAX acquired and in atrix algebra ac computing facili constructed comp red in this activ research projec uations with par d mechanics, (2) ary value proble putational resear imensional struc- tion, (4)Computat phasis on bifurc	Continue on reverse if m Continue on reverse if m , Matrix Algeb "" In accordan stalled: a FP celerator, and ty based on th uter room in c ity. From the ts, including: ticular applic Development o ms for partial ch in crystall tures of biolo ional methods ation phenomen	AT (Yr. Mo. Day mber 1985 ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipment lose proxim outset, th (1) Method ations to s f computabl different ography inv gical macro for solutio a.	15. PAGE C 3 Try by block number ator, Crystal Scientific co sk subsystem at is now open t	ount llograp ram, the omputer n with eration four nas bee olution forming imates s by fit cipally t atomit terized
AD-A179	12. PERSONAL AUTHORIS) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION FIELD GROUP FIELD GROUP 19. ABSTRACT Continue on The following equipment with 1M words of the two drives. The so It is housed in a principal department actively used for of differential/all and related probles solutions of nonic element techniques the determination resolution by X-ra equations with part	Idt 13b. TIME FROM 15 SUB. 3R SUB. 3R SUB. 3R Ant has been memory, a m scientific specially ents involv a range of Igebraic eq ems in soli inear bound s, (3) Comp of three-d ay diffract rticular em	COVERED Jul 84 Tol4 Jul Is SUBJECT TERMS FPS-164 MAX FPS-164 MAX acquired and in actrix algebra ac computing facili constructed comp red in this activ research projec uations with par d mechanics, (2) ary value proble sutational resear imensional struc- tion, (4)Computat sphasis on bifurc	14. OATE OF REPO 85 10 Septe Continue on reverse if m , Matrix Algeb erri In accordan stalled: a FP celerator, and ty based on th uter room in c ity. From the ts, including: ticular applic Development o ms for partial ch in crystall tures of biolo ional methods ation phenomen	AT (Yr., Mo., Dey mber 1985 ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipment lose proxim outset, th (1) Method ations to s f computabl differentions ography inv gical macro for solutiona uRITY CLASSIF	15. PAGE C 3 Thy by block number ator, Crystal is URIP program cientific co isk subsystem is now open t is now open t	ount nam, the computer n with eration four nas bee olution forming imates s by fi cipally t atomi terized
AD-A179	12. PERSONAL AUTHORIS) Werner C. Rheinbol 13. TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION 17. COSATI CODE FIELD GROUP 19. ABSTRACT Continue on real following equipment with IM words of real two drives. The solutions of real two drives. The solutions of nonisistic solutions with part 20. DISTRIBUTION AVAILABLE UNCLASSIFIED C. SOLUTION AVAILABLE	Idt 13b. TIME FROM 15 ION IS SUB. 2R SUB. 2R SUB. 2R IN SUB. 2R SUB. 2R IN SUB. 2R I	In SUBJECT TERMS FPS-164 MAX FPS-164 MAX acquired and in acquired and in atrix algebra ac computing facili constructed comp red in this activ research projec uations with par d mechanics, (2) ary value proble putational resear imensional struction, (4)Computat impasis on bifurce ACT T _ DTIC USERS □	Continue on reverse if m Continue on reverse if m , Matrix Algeb r In accordan stalled: a FP celerator, and ty based on th uter room in c ity. From the ts, including: ticular applic Development o ms for partial ch in crystall tures of biolo ional methods ation phenomen 21. AESTRACT SEC UNCL.SCIPIED	AT (Yr. Mc. Dey mber 1985 ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipment lose proxim outset, th (1) Method ations to s f computabl differenti ography inv gical macro for solutiona uRITY CLASSIF	15. PAGE C 3 The second secon	ount llograph ram, the omputer n with eration four bas been olution forming imates s by fin cipally t atomit terized
AD-A179	12. PERSONAL AUTHORIS) Werner C. Rheinbol 13a TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION FIELD GROUP FIELD GROUP 19. ABSTRACT Continue on rea following equipment with 1M words of m two drives. The s It is housed in a principal departme actively used for of differential/al and related proble solutions of nonlis element techniques the determination resolution by X-ra equations with par	Idt 13b. TIME FROM 15 SUB. 3R SUB. 3R And the seen nemory, a m scientific specially ents involv a range of lgebraic eq ems in soli inear bound s, (3) Comp of three-d ay diffract rticular em LITY OF ABSTR Z SAME AS RP INDIVIDUAL	In SUBJECT TERMS FPS-164 MAX FPS-164 MAX acquired and in acquired and in atrix algebra ac computing facili constructed comp red in this activ research projec uations with par d mechanics, (2) ary value proble outational resear imensional struc- tion, (4)Computat phasis on bifurc ACT T = DTIC USERS =	14. OATE OF REPO 85 10 Septe Continue on reverse if m , Matrix Algeb er: In accordan stalled: a FP: celerator, and ty based on th uter room in c ity. From the ts, including: ticular applic Development o ms for partial ch in crystall tures of biolo ional methods ation phenomen 21. ABSTRACT SEC UNCL.SCIPICD 225. TELEPHONE N	AT (Yr. Mo. Dey mber 1985 ra Accelera ce with thi S-164 MAX s FPS-D64 di is equipment lose proxim outset, th (1) Method ations to s f computabl differentions for solutiona differentions for solutiona a.	15. PAGE C 3 The second seco	ount cam, the omputer n with eration four nas been olution forming imates of s by fin cipally t atomic terized
AD-A179	12. PERSONAL AUTHORIS) Werner C. Rheinbol 13. TYPE OF REPORT Final 16. SUPPLEMENTARY NOTATION 17. COSATI CODE FIELD GROUP 19. ABSTRACT Continue on real following equipment with 1M words of real two drives. The solutions of real two drives. The solutions of non- actively used for of differential/al and related proble solutions of non- element techniques the determination resolution by X-rate equations with part 20. DISTRIBUTION AVAILABIN UNCLASSIFIED CONSIDER John P. Thomas. In	Idt 13b. TIME FROM 15 SUB. 3R SUB. 3R SUB. 3R Ant has been memory, a m scientific specially ents involv a range of Igebraic eq ems in soli inear bound s, (3) Comp of three-d ay diffract rticular em LITY OF ABSTR Z SAME AS RP INDIVIDUAL C. Capt.	In SUBJECT TERMS FPS-164 MAX FPS-164 MAX acquired and in facturity by block number acquired and in facturing facilit constructed comp red in this active research project uations with part d mechanics, (2) ary value problect butational researt fimensional struction, (4)Computatt action, (4)Com	14. OATE OF REPO 14. OATE OF REPO 10 Septe 10 Septe	AT (Yr. Mo. Day mber 1985 recement and ident ra Accelera ce with this S-164 MAX is FPS-D64 di is equipment lose proxim outset, the (1) Method ations to se f computable differentions ography investigation differentions differentions ography investigation differentions provide a solution a.	15. PAGE C 3 Thy by block number ator, Crystal is URIP progra- scientific co isk subsystem is now open it is now open	ount llograph ram, the omputer n with eration four ness bution forming imates of s by fin cipally t atomic terized

•



TOTAT STYLE OF STITUTEIC RESEARCH (APS3) TOE OF ID MEMITTLE TO DTIC this technical report has been reviewed and is opproved for public release IAW AFR 190-12. D'stribution is unlimited. TTHEW J. KENPER Chief, Technical Information Division

### University of Pittsburgh

## AFOSR-TH- 87-0300

87

154

7

FACULTY OF ARTS AND SCIENCES Department of Mathematics and Statistics

September 10, 1985

#### FINAL REPORT

# UNITED STATES AIR FORCE GRANT AFOSR-84-0274 FOR SCIENTIFIC COMPUTATIONS IN APPLIED MATHEMATICS, PHYSICS, CHEMISTRY AND CRYSTALLOGRAPHY

The Grant has been issued under the Department of Defense - University Research Instrumentation Program for 1984/85. In line with the proposal the following equipment has been acquired and installed: Approved for public release distribution unlimited.

- 1 FPS-164 MAX Scientific Computer with 1M word of memory,
- 1 Matrix Algebra Accelerator,
- 1 FPS-D64 Disk subsystem with two drives FORTRAN cross compiler, system job executive, Boeing Computer Services Library, and fast matrix solution library.

As outlined in the proposal, the equipment was needed to overcome some of the serious lack of access to sufficiently powerful scientific computing equipment for research efforts in mathematics, physics, chemistry, and crystallography at the University of Pittsburgh. The University recognized that urgent need and decided to augment the funding received under this grant and to establish a more comprehensive scientific computing facility. This facility is now operational and incorporates the following computer equipment:

PITTSBURGH, PA. 15260

1 Gould 32/9780 Dual Processor system,

1 FPS-164 MAX Scientific Computer as outlined above,

1 VAX/VMS 11/750 which serves also as the host for the FPS.

The facility is housed in a specially constructed computer room on the seventh floor of Thackeray Hall on the University's main campus. This location is in close proximity of the four principal departments involved in this activity. The computers are currently accessible from hardwired terminals and over dial-up lines. It will also be connected to the University's new fiber-optic cable network.

The Scientific Computing Facility (SCF) is being operated by the University's Center for Computing and Information Systems under the policy supervision of a Working Group for Scientific Computing which consists of a representative subgroup of the researchers listed in the original proposal for the AFOSR grant. The chairman of this committee is currently Professor W. C. Rheinboldt, the principal investigator of the grant. From the outset, the facility has been actively used for a range of research projects. We list here only a few representative examples:

Methods for the solution of differential/algebraic equations with particular applications to sheet-metal forming and related problems in solid mechanics.

- Development of computable error estimates of solutions of nonlinear boundary value problems for partial differential equations by finite element techniques.
- Computational research in crystallography involving principally the determination of three-dimensional structures of biological macromolecules at atomic resolution by x-ray diffraction.
- Computational methods for the solution of parameterized equations with particular emphasis on bifurcation phenomena in scientific systems and the determination of singular points.

-2-

Computational research on finite difference solutions of time dependent Navier-Stokes equations of compressible fluid flow. Computational research related to high energy physics problems.

The facility has already proved invaluable in the research work of the proposing interdisciplinary group. It has not only provided a much needed increase in the computing facilities available for scientific computations, but it has stimulated also a much closer cooperation between the members of the group. This increased interaction should prove to be of growing importance in the coming years.

Accession For NTIS GRAAT ביד זופת Unsations Justification .... Visit Tibution/ 1:**V** ... Availability Corre Avail and the . . . . . . . . Spr : 1nl. 1:1:51

- 3-

