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SOME USEFUL PROCEDURES FOR FORTRAN PROGRAMMING ON THE ADVANCED --ETC(U)
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NRL Memorandum Report 3623

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Some Useful Procedures for FORTRAN Programming on the Advanced Scientific Computer

A. K. JORDAN and R. H. LANG

*Aerospace Systems Branch
Space Systems Division*

October 1977



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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NRL Memorandum Report 3623	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
6. TITLE (and Subtitle) SOME USEFUL PROCEDURES FOR FORTRAN PROGRAMMING ON THE ADVANCED SCIENTIFIC COMPUTER.	9.	4. TYPE OF REPORT & PERIOD COVERED Interim report, on a con- tinuing NRL problem.
		6. PERFORMING ORG. REPORT NUMBER
10. AUTHOR(S) A. K./Jordan R. H./Lang	16.	8. CONTRACT OR GRANT NUMBER(s) WR02101
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Research Laboratory Washington, D. C. 20375	17.	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NRL Problem R07-40 WR0210102
11. CONTROLLING OFFICE NAME AND ADDRESS	11.	12. REPORT DATE October 1977
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 12. 21p. 14. NRL-MR-3623		13. NUMBER OF PAGES 20
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
15a. DECLASSIFICATION/DOWNGRADING SCHEDULE		
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited. 18. SBIE 19. AD-E000 024		
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) Computer programming NRL Advanced Scientific Computer FORTRAN language		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The purpose of this report is to provide NRL research staff mem- bers with a brief, unified introduction to the Advanced Scientific Computer (ASC). It is written from the viewpoint of a research scientist (the user) who knows FORTRAN programming but who is not familiar with the complexities of the ASC and its Job Specification (Continues)		

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20. Abstract (Continued)

Language (JSL). It is intended to provide the simplest procedures necessary to get on the machine, run FORTRAN programs, and get answers.

All of the procedures in this report have been used successfully by the authors. The programming consultants of the Research Computation Center contributed most of the information in this report. They are available to provide more detailed information than is given in this summary.

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DOC	Doc Section	<input type="checkbox"/>
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SOME USEFUL PROCEDURES FOR FORTRAN PROGRAMMING ON THE ADVANCED SCIENTIFIC COMPUTER

I. FOREWORD

The purpose of this report is to provide NRL Research Staff members with a brief, unified introduction to the Advanced Scientific Computer (ASC). It is written from the viewpoint of a research scientist (the user) who knows FORTRAN programming but who is not familiar with the complexities of the ASC and its Job Specification Language (JSL). It is intended to provide the simplest procedures necessary to "get on the machine", run FORTRAN programs, and get answers.

All of the procedures in this report have been used successfully by the authors. The programming consultants of the Research Computation Center contributed most of the information in this report. They are available to provide more detailed information than is given in this summary.

Obviously, this introduction is neither unique nor complete; suggestions for improvements and additions are welcomed by the authors.

Demand for the first printing, issued as NRL Memorandum Report 3518, "An Introduction to FORTRAN Programming for the Advanced Scientific Computer", has been great enough to justify a second edition. The authors have taken this opportunity to make several changes and additions, among which are:

1. The title has been changed to describe more accurately the purpose of this report.
2. The new system macro
/ KEYBOARD
has replaced the old macro
/ MACASG \$\$,USERCAT/TERMINAL/MACROS
throughout this report. See Computer Note 137 for a detailed description with all the FOSYS options listed.
3. The new load and edit (LOAD) command is used.
4. An example using a READ statement to input data for a FORTRAN program has been added.

A. References

For more detailed information, the user is referred to the following documents which are available from the Research Computation Center in Building A49.

1. Scientific Program Library User Manual for the Naval Research Laboratory; June, 1976.
2. ASC FORTRAN Manual, Texas Instruments, Inc., #930055-2; Jan., 1976.
3. Job Specification Reference Manual, Texas Instruments, Inc., #930038-4; May, 1976.
4. ASC Keyboard Concentrator System User's Manual, Texas Instruments, Inc., #934732-2; May, 1976.
5. NRL Computer Notes 103 & 110.
6. CIFER, Card Image File Editor, Texas Instruments, Inc., #930032-1; Oct., 1974.

B. Notation Used in This Report

A simple program is short with few--if any--short subroutines. It is filed sequentially.

A complex program contains many long subroutines. It is partitioned into its various members and filed as a library (PD) file.

In the following programs, information written in lower case is to be supplied by the user.

Comments on the programming procedures are written in lower case and are indented from the actual program listing.

All listings begin in Column 1 and spaces--or lack of spaces--must be typed as given.

The account number, user code, and password are established with the Research Computation Center on their application forms. (See Computer Note #107.)

The job name (usually the user's last name) designates the alphabetical bin in which output is placed at the Work Control Center.

For convenience, the author's division (D79) and branch (B40) are used in these programs. The user must change these to the appropriate numbers.

The FØRTRAN program name can contain 6 alphabetic characters.

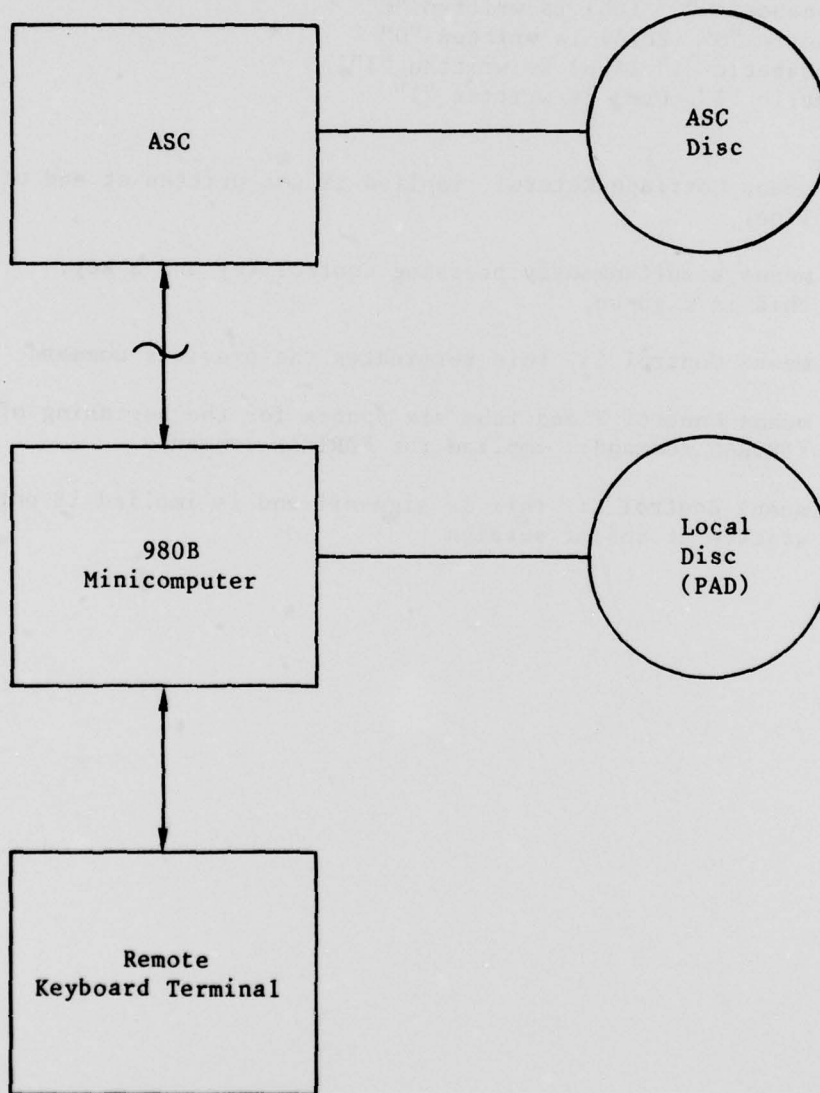
Catalogue maintenance is described in Reference 3, Chap. 7.
Also defined are file, node, pathname, version.

Macro is described in Reference 3, Chap. 9.

Alphabetic "O" (Oh) is written "Ø"
Numeric "0" (Zero) is written "0"
Alphabetic "I" (Eye) is written "I"
Numeric "1" (One) is written "l"

- ⓐ means Carriage Return: implied if not written at end of line.
- ⓑ means simultaneously pressing Control key and S key: this is sign-on
- ⓒ means Control C: this terminates the previous command
- ⓓ means Control T and tabs six spaces for the beginning of a FØRTRAN command: implied for FØRTRAN commands
- ⓔ means Control X: this is sign-off and is implied if not written at end of session

C. Block Diagram of ASC Remote Keyboard Terminal System
(Reference 4)



II. ASC REMOTE KEYBOARD TERMINAL PROCEDURES

A. Simple Programs

1. Sign on and CReate a Program (see Reference 4)

If the ASC remote terminal uses an acoustic coupler, then first extension 75904 is dialed and when the tone is heard the telephone handset is put into the acoustic coupler.

Ⓢ

computer responds

accountno.,usercode,password

Ⓢ

computer responds

jobname

Ⓢ

CR,programname

Type FØRTRAN program

To correct minor typing errors, press RUBOUT key

Ⓒ

The program is STored from the local keyboard computer memory to the ASC disc.

ST,programname

L,A

Program is listed for review.

2. Execute a Program and Print Output at Remote Terminal

Wait for computer response after typing these commands. A special set of JSL macros is called upon so that the user can interact with the main ASC through the remote keyboard terminal.

```
/ KEYBOARD  
/ FTNLX IN=programname
```

The ASC compiles and executes the FØRTRAN Program. A special file in the memory, FT06F001, is used for the PRINT output of all FØRTRAN programs. The file FT06F001 is LØaded from the ASC to the local keyboard computer memory. (See Appendix.)

```
LØED,FT06F001  
L,A
```

We List All the file FT06F001 by EDiting it. FT06F001 contains the output of the program. Any programming errors and diagnostic messages will be printed now--if compiling and link editing are successful.

3. Example: Calculation of Chebyshev Polynomials

Ⓢ accountno.,usercode,password ⓄCR
jobname
CR,CHEBYS
Ⓣ PROGRAM CHEBYS
C THIS PROGRAM CALCULATES THE CHEBYSHEV
C POLYNOMIALS $T_N(X) = \cos(N \cdot \arccos X)$
X=0.50
DO 10 N=1,5
T=COS(N*ARCOS(X))
PRINT 20,N,X,T
20 FORMAT(5X,'N=',I4,2X,'X=',F7.4,2X,'TN(X)=',F10.7)
10 CONTINUE
STOP
END

Ⓞ ST,CHEBYS
L,A

Program is listed

/ KEYBOARD
/ FTNLX IN=CHEBYS
LØED,FT06F001
L,A

Output is listed

Ⓧ Computer responds

Ⓧ

4. Execute a Program and Print Output at Work Control Center

Follow procedure of paragraph 2. (See Appendix.)
After / FTNLX IN=programname type

```
/ FØSYS SYS.PRT  
/ FØSYS FT06F001
```

Output will be printed at both ASC Work Control Center
and at remote terminal.

5. Catalogue a Program from Remote Terminal to ASC.
(See Computer Note 99.)

Follow procedure of paragraph 1, then type.

```
PD,MY,USERCAT/D79/B40/usercode
```

Note: MY is a synonym for the pathname
USERCAT/D79/B40/usercode

```
/ CAT MY/programname,ACNM=programname
```

Follow procedure of paragraph 2, for example.

6. Repetitive Editing and Executing of Programs

This program gives the procedure for the repetitive editing (making correction, adding new commands, etc.) to a program already catalogued on the ASC.

⑤

```
accountno.,usercode,password  
jobname  
/ KEYBOARD  
PD,MY,USERCAT/D79/B40/usercode  
AS,programname,MY/programname,USE=SHR  
LØ,programname  
→ ED,programname
```

Edit and correct program: The many keyboard commands are given in the appendices of Reference 4.

```
ST,programname  
L,A
```

program is listed.

When this procedure is used repetitively, the next command, / REL etc., should be omitted for the first execution (since there is nothing to RElease).

This command must be used on subsequent execution to release the files FT06F001,SYS.ØMØD,SYS.LMØD,SYS.PRT, so they can be used again.

```
/ REL FT06F001,SYS.ØMØD,SYS.LMØD,SYS.PRT  
/ FTNLX IN=programname
```

This Release command should be omitted on the first execution.

```
RE,FT06F001  
LØED,FT06F001  
L,A
```

Output is printed

This procedure may be repeated until final program is obtained.

Go back to ED,programname to repeat procedure.

The final version of the program will now be catalogued to RePLace the original Version.

```
/ RPLV MY/programname,ACNM=programname
```

7. Enter Data from a Keyboard Terminal

After editing is completed, as in paragraph 6, type

```
ST,programname  
CR,INPUT
```

type input data: READ statement must be in FORTRAN
program

Ⓒ

```
ST,INPUT
```

The command / FTNLX IN=programname of paragraph 6 is
changed to:

```
/ FTNLX IN=programname,DATA=INPUT
```

continue as before

8. Catalog Status of a User's Program

Ⓒ

```
accountno.,usercode,password  
jobname  
CS,USERCAT/D79/B40/usercode,LIST=VANS
```

a user's files catalogued under this pathname are listed

9. Catalog Status of Other User's Program

```
LIMIT USCØ=otherusercode  
CS,USERCAT/D79/B40/otherusercode,LIST=VANS
```

10. Punch Deck of Cards for Program Stored on ASC Disc

The program to be punched is assumed to have been STORED
on the ASC disc, as in Paragraph 2.

```
/ FØSYS programname,TYPE=PUNCH
```

cards will be punched out at RCC.

11. Example: Calculation of Chebyshev Polynomials Using READ
Input Data

```
Ⓢ accountno.,usercode,password ⓄCR
jobname
CR,CHEBYD
Ⓣ PROGRAM CHEBYD
C THIS PROGRAM CALCULATES THE CHEBYSHEV
C POLYNOMIALS  $T_N(X) = \cos(N \cdot \arccos X)$ 
DØ 30 I=1,3
READ 5,X
5 FØRMAT (5X,F7.4)
DØ 10 N=1,5
T=CØS(N*ARCØS(X))
PRINT 20,N,X,T
20 FØRMAT(5X,'N=',I4,2X,'X=',F7.4,2X,'TN(X)=',F10.7)
10 CØNTINUE
30 CØNTINUE
STØP
END
```

```
Ⓞ ST,CHEBYD
L,A
```

Program is listed

```
CR,INPUT
0.50 }
1.0 } Formatted data
0.25 }
```

```
Ⓞ ST,INPUT
/ KEYBØARD
/ FTNLX IN=CHEBYD,DATA=INPUT
LØED,FT06F001
L,A
```

Output is listed

```
Ⓧ
Ⓧ Computer responds
```

B. Complex Problems

1. Sign-on Procedure

Ⓢ

accountno.,usercode,password
jobname

Note: The security classification is assumed to be
UNCLASSIFIED.

/ KEYBOARD

SE,terminalsectors,ASCsectors,Cptime

Note: This command SETs aside extra disc memory space
for long, complex programs.

terminalsectors = no. of sectors for remote
terminal

lower limit = 3125 (default value)

upper limit = 32767

ASCsectors = no. of sectors reserved on ASC

lower limit = 5120 (default value)

upper limit = 128000

Cptime = Central Processor time in seconds
(default value = 60 secs.)

User may have to wait for computer response
(SET=OKAY); simple programs can be created now,
however.

If the program is already catalogued on the ASC, use
procedure of paragraph 3.

If the program is to be Created and then CATalogued,
use procedure of paragraph 2.

2. Create and Catalog Programs

Follow procedure of paragraph 1. Then type

CR,programname

Type FØRTRAN program

Note: It is good practice to CALL R\$STØP, an ASC debugging aid (see Computer Note #94) before the first executable FØRTRAN command.

Ⓒ

ST,programname

PD,MY,USERCAT/D79/B40/usercode

/ CAT MY/programname,ACNM=programname

Note: It is good practice to print out a Job Activity (JA) after commands ST, / CAT, PD, AS, etc. to see if they worked. See Reference 4.

Now follow procedure of paragraph 4.

3. List Catalogued FØRTRAN Program

Follow procedure of paragraph 1. Then type

PD,MY,USERCAT/D79/B40/usercode

AS,PDFILE\$\$,MY/programname,USE=SHR

LØED,programname

Note: Here we are using some complex--but very useful--catalog maintenance procedures; see Reference 3, Chap. 7 or the RCC consultants.

Here we let programname = membername of file.

Also note that PDFILE\$\$ is the only name that can be used for Partitioned Direct Secondary (PDS) files.

L,A

program is listed

ST,programname

Now follow procedure of paragraph 4.

4. JSL Macro for Repetitive Executing and Cataloguing

This procedure is typed once only. See Reference 6. A set of JSL commands, which are used repeatedly, are combined into the macro we call JSL. After procedures of paragraphs B.1 and B.2 or B.1 and B.2 type

```
CR,JSL
/ REL FT06F001,SYS.ØMØD,SYS.LMØD,SYS.PRT.
/ CIFER
<<COPY programname,PDFILE$$/programname
<<MERGE PDFILE$$,SEQN
/ FD FT06F001,BAND=4/12/4
/ FTNLX IN=SEQN,FTNØPT=(K),FTVERS=FX
Ⓢ ST,JSL
```

Note: Either the FX compiler (FTVERS=FX) or the NX compiler can be used here. The authors have found the FX compiler to be more convenient for problems requiring complex arithmetic. The optimizing compiler, NX, is useful for large production runs.

5. Repetitive Editing, Executing, and Cataloguing

The procedure of paragraph 4 need only be performed once. Then type

→ AP,JSL

Omit this RElease command for the first execution.

```
RE,FT06F001
LØED,FT06F001
L,A
```

Output is listed

```
ED,programname
L,A
```

Program is listed.
Modifications may be made.

```
ST,programname
```

Go back to AP,JSL and repeat until final program is obtained.

III. ASC PUNCHED CARDS FOR COMPLEX PROGRAMS

1. Execute a FORTRAN Program on ASC

/ JOB jobname,accountno.,usercode,OPT=(C,D,R)
/ FTNLX OPT=(I),FTNOPT=(K)

FORTRAN source deck

/ EØJ

2. Catalog Complex Program on ASC

/ JOB same as above
/ PD,MY,USERCAT/D79/B40/usercode
/ CATN MY/programname
/ CIPHER
<<SPLIT *,SOURCE

source deck

/ CATV MY/programname,ACNM=SOURCE
/ EØJ

3. Punch a Duplicate Deck of Cards

/ JOB same as above
/ FØSYS SYS.IN,TYPE=PUNCH,CØPIES=n

Deck to be punched (less than 3200 cards)

Note: One copy is punched unless CØPIES = n is added
after PUNCH; n = no. of copies

/ EØJ

4. List Deck of Cards

/ JOB same as above
/ FØSYS SYS.IN

Deck to be listed (less than 3200 cards)

/ EØJ

5. Convert CDC FORTRAN Deck to ASC Format

```
/ JOB same as above  
/ PD DICK,USERCAT/D42/B20/MCGIR1/LPAD  
/ ASG SYS.LMDD,DICK,USE=SHR  
/ FXQT OPT=(Z,A),CPTIME=3000
```

```
1 0 1 1
```

Deck to be converted

```
E  
/ REL SYS.LMDD  
/ FTN FTNOPT=(X,M),IN=FT07FO01,FTVERS=FX  
/ FOSYS FT07FO01,TYPE=PUNCH  
/ LNK  
/ FXQT OPT=(Z,A),CPTIME=3000
```

Data cards, if any

```
/ E0J
```

6. List User's Catalogued Files

```
/ JOB same as before  
/ CATLST CPOPT=(A,B)  
7USERCAT usercode 4  
USERCAT D79 B40 usercode  
/ E0J
```

7. Enter Data in FORTRAN Program

```
/ JOB same as before  
/ FTNLX OPT=(I),DATA=INPUT
```

FORTRAN Source deck (READ Statement)

```
/ START ACNM=INPUT
```

Data Cards

```
/ STOP  
/ E0J
```

IV. Appendix: Block Diagram of FTNLX Macro
Rectangular blocks are files.
Elliptical blocks are machine functions.

