

MEMORANDUM REPORT ARBRL-MR-03001

NEW NUCLEAR VULNERABILITY DATA BASE,
INPUT FORMAT, AND SUPPORTING
SOFTWARE FOR RCC

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March 1980



US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAND
BALLISTIC RESEARCH LABORATORY
ABERDEEN PROVING GROUND, MARYLAND

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The BRL developed Residual Combat Capability (RCC) methodology, which includes a nuclear vulnerability data bank, was specifically designed to be easily used. The state-of-the-art technique for the description of the nuclear vulnerability of military targets involves cumulative failure distributions. The parameters which characterize these distributions are floating point numbers: constants and logarithms of means and variances. Since many such numbers are involved, handling them is difficult and error-prone. Therefore, an interactive program to interface nuclear data into RCC, with data base management capabilities.		

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was developed. Through the program, the user can interactively store or manipulate nuclear vulnerability data in the standard format, and output data files in English-word, user-oriented format compatible with all other RCC inputs.

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I. INTRODUCTION TO THE PROBLEM

The Ballistic Research Laboratory has developed, from a research and development viewpoint, a combat capability evaluation methodology. Called RCC (Residual Combat Capability)^{1,2}, the methodology is based upon a rigorous quantification of combat capability. In developing RCC, particular attention was paid to vulnerability/lethality modeling and associated threat effectiveness factors. However, attention was also paid to the unit structure. Individual capabilities, time dependent substitutability, and alternate operating procedures were included in detail, largely with the help of the cognizant Training and Doctrine Command (TRADOC) agencies. Furthermore, a great deal of effort was spent in making the RCC code easy to use. To this end, inputs use English words and names, free field formats, and copious checks and informative diagnostics. As a result, RCC is receiving widespread attention throughout the Army as a general standard analysis tool.

The nuclear lethality module used in RCC was taken from NUDACC³, a nuclear damage assessment code produced by the Harry Diamond Laboratory. In NUDACC, equipment items in the vicinity of a nuclear detonation may become casualties (kills) due to exposure to EMP, neutron fluence, and blast environments. Any combination of these environments may be considered for any given target. (Note: Personnel are handled separately, and are not addressed in this report.) The kill probabilities for each item are expressed as cumulative distribution functions of the appropriate environmental parameters. This information is input to the nuclear module in terms of the means and standard deviations (μ and σ) of the cumulative distributions, along with certain other constants for particular environments. The data also includes a code number, IVLARY, which indicates the combination of environments to be considered.

In constructing the original NUDACC methodology, it was anticipated that the vulnerability set would be fairly stable⁴. It was, therefore, most efficient to make the data part of the NUDACC code itself, storing

¹J. Terrence Klopac, *et al*, "RCC: A Methodology/Code to Model Residual Combat Capability at the Unit Level", ARBRL-TR-02156 (Apr 79) (AD #B037451L)

²J. Terrence Klopac, *et al*, "RCC: A Methodology/Code to Model Residual Combat Capability at the Unit Level", ARBRL-TR-02196, Addendum to ARBRL-TR-02156 (Sep 79) (AD #B042085L)

³R.G. Moore, "Nuclear Damage Assessment Computer Code", HDL-R-210-78-4 (July 78)

⁴R.G. Moore, Harry Diamond Laboratory, private communication.

it in DATA statements. Each item was given an item number, which was used to obtain indices into the densely-filled data arrays. A published list of item numbers versus item name (e.g. 101, JEEP M151) completed the interface between user and code. The current list of NUDACC items is given in Appendix A.

However, the data set has proven to be dynamic, requiring periodic updates and extensions. In particular, RCC is often used to test the sensitivity of results to possible uncertainties in the data, requiring several data changes to be made. Such changes, in the original configuration, would require recompilation of the entire program. This recompilation not only requires extra computer time, but also demands that the user have in-depth knowledge of the inner details of the nuclear module. Such effort is in contrast to the highly user-oriented nature of RCC, in which all inputs are made at run-time using English words, free formats, and "cook-book" prescriptions.

On the other hand, the nuisance and error-prone nature of handling many floating-point numbers is also appreciated. (Note that the original formulation used in the NUDACC code, avoided this problem.)

II. SOLUTION

The solution created for RCC is to maintain an off-line data base compatible with NUDACC and prescribe a standard English-worded, free field format for RCC input. These are facilitated by a utility program which supports easy updating of the data base and transfers data, in RCC format, to a file for RCC input.

1. Data Base Format

The format chosen for the data base is a large, 2-dimensional array, with rows for every potential item number (1000), and columns for more than the required number of data (20). These extra storage words allow for future additions to the data base, in terms of new items, additional kill environments for old items, or entirely new kill environments (e.g. thermal kills) for the entire array. For ease in indexing the array, storage words are allocated whether currently used or not; however, binary storage of the array results in small file size.

2. RCC Format

The input of nuclear vulnerability data to RCC was reconfigured to read an external file, unit 3. Nuclear input thus becomes parallel to the RCC input form for conventional lethality data (on unit 2). The external file approach has proven most convenient and efficient. Many runstreams may access the same data file, thus eliminating much duplication of input effort. Furthermore, the format of the data and the

highly interpretive nature of the RCC input routines makes editing of the file, using locally available processors, a very easy matter.

The format for file 3 is:

ENGLISH NAME, IVLARY, required data

where ENGLISH NAME is the user-chosen, run-time specified English name for the item (or item class), IVLARY is the code number which indicates the environments considered for the item, and the data are the corresponding constants, μ s, and σ s.

Appendix B contains a print-out of the instruction element included in the RCC package. This element, INPUTINFO, contains a detailed description of the format for data on file 3, as well as a description of all other input commands.

3. Supporting Code, 4T03

The supporting code, called 4T03, is an interactive program. Upon execution, the code asks for the required action: update the data base (on unit 4), list the data (on unit 4), or write selected data, in the RCC format (described in Appendix B), onto file 3. As a special feature, typing a dollar sign (\$) causes the last line written by the code (whether on unit 3 or unit 4) to be reproduced at the user terminal. Typing \$ *item numbers* causes the data for the identified items to be listed at the terminal. A complete listing of 4T03 is contained in Appendix C.

4. Input to 4T03

a. For Updating Data Base. The 4T03 code, when put in the data base input mode (IN), will ask whether the data base (on file 4) is a new one being created, or an old one being changed. It then solicits data in the following format:

NUDACC Item Number, IVLARY, required data

where the NUDACC item number is discussed in section I, and the remaining data is described in section II.2. Typing END closes file 4 and returns the program to the 4T03 executive.

b. For Making an RCC Input File (file 3). The 4T03 code, when put in the RCC file output mode (OUT), will solicit data in the following format:

ENGLISH NAME, NUDACC Item Number

where ENGLISH NAME is described in section II.2, and NUDACC Item Number is discussed in section I. Typing END writes the word "END" on file 3 (as preferred by RCC), closes the file, and returns control to the

4T03 executive.

III. SUMMARY

The difficulty of handling strings of relatively unintelligible floating point numbers, as required for nuclear vulnerability calculations, has been largely alleviated. User-oriented, English-word-based input formats have been established for use in RCC, in consonance with all other RCC inputs. An interactive program to interface the NUDACC-compatible nuclear vulnerability data base with the RCC input files has been developed.

APPENDIX A
NUDACC Item List

NUDACC VULNERABILITY DATA

DOSE BLAST TREE EMP

001	PERSONNEL - EXPOSED	*	
002	PERSONNEL - OPEN VEHICLE	*	
003	PERSONNEL - FOX HOLE	*	
004	PERSONNEL - APC	*	
005	PERSONNEL - TANK	*	
101	TRUCK UTILITY 1/4-TON M151		*
102	TRUCK CARGO 5/4-TON M715		
103	TRUCK CARGO 5/4-TON M715 W/S250 SHELTER		*
104	TRUCK CARGO 1 1/4-TON GAMA GOAT M561 W/TRAILER		
105	TRUCK CARGO 2 1/2-TON M35		*
106	TRUCK VAN SHOP 2 1/2-TON W/S280 SHELTER		*
107	TRUCK TANK FUEL SERVICING 2 1/2-TON		
108	TRUCK VAN EXPANSIBLE 2 1/2-TON M292		
109	TRUCK VAN EXPANSIBLE 5-TON M820		*
110	TRUCK CARGO 5-TON M656		*
111	TRUCK TRACTOR 5-TON W/SEMITRAILER		
112	TRUCK WRECKER 5-TON M816		
113	TRUCK TANK FUEL SERVICING 2500 GAL M559		
114	TRUCK CARGO 8-TON M520		*
115	TRUCK WRECKER 10-TON M553		
116	TRUCK 1 1/4-TON M881		*
117	TRUCK 6X6 5-TON M814		*
118	TRACTOR 6X6 5-TON M818		*
119	TRACTOR 5-TON W/12-TON SEMI M818-M127A2		*
120	TRACTOR 5-TON W/25-TON SEMI M818-M172A1		*
201	CARRIER PERSONNEL APC M113		*
202	CARRIER COMMAND AND RECON M114		
203	CARRIER COMMAND POST M577		*
204	CARRIER MORTAR 4.2-IN M109		*
205	CARRIER MORTAR 81-MM M125		*
206	CARRIER GUIDED MISSILE TOW M113		*
207	CARRIER CARGO M548		*
208	COMBAT ENGINEER VEHICLE M728		
209	BRIDGE AND LAUNCHER AVLB		
210	RECOVERY VEHICLE LIGHT M578		
211	RECOVERY VEHICLE MEDIUM M88		
212	FORK LIFT RT 5-TON M488		*
213	TRACTOR-WRECKER 5-TON M819		*
214	SEMITRAILER 12-TON (FULL) M127A2		*
215	SEMITRAILER 25-TON (EMPTY) M172A1		*
299	CONCRETE IGLOO IN SASP		*
301	RADIO VRC-12 FAMILY		*
302	RADIO VRC-46 MTD IN 1/4-TON M151		*
303	RADIO VRC-47 MTD IN 1/4-TON M151		*
304	RADIO VRC-49 MTD IN 1/4-TON M151		*
305	RADIO VRC-46 MTD IN 1 1/4-TON GAMA GOAT M561		*

NUDACC VULNERABILITY DATA

DOSE BLAST TREE EMP

306	RADIO VRC-47 MTD IN 1 1/4-TON GAMA GOAT M561		*	
307	RADIO VRC-49 MTD IN 1 1/4-TON GAMA GOAT M561		*	
308	RADIO VRC-48 MTD IN 1/4-TON M151	*	*	
310	RADIO VRC-12 MTD IN CARRIER APC M113	*	*	
311	RADIO VRC-46 MTD IN CARRIER APC M113	*	*	
312	RADIO VRC-47 MTD IN CARRIER APC M113	*	*	
313	RADIO VRC-49 MTD IN CARRIER APC M113	*	*	
315	RADIO VRC-12 MTD IN CARRIER CMD AND RECON M114		*	
316	RADIO VRC-46 MTD IN CARRIER CMD AND RECON M114		*	
317	RADIO VRC-47 MTD IN CARRIER CMD AND RECON M114		*	
318	RADIO VRC-12 MTD IN CARRIER CMD POST M577	*	*	
319	RADIO VRC-46 MTD IN CARRIER CMD POST M577	*	*	
320	RADIO VRC-47 MTD IN CARRIER CMD POST M577	*	*	
321	RADIO VRC-49 MTD IN CARRIER CMD POST M577	*	*	
322	RADIO VRC-46 MTD IN RECOVERY VEHICLE LT M578		*	
323	RADIO VRC-46 MTD IN RECOVERY VEHICLE MED M88		*	
324	RADIO VRC-12 MTD IN ARMORED RECON VEHICLE M551		*	
325	RADIO VRC-12 MTD IN TANK M60A1		*	
331	RADIO PRC-77		*	*
332	RADIO VRC-64 MTD IN 1/4-TON	*	*	*
333	RADIO GRC-160 MTD IN 1/4-TON	*	*	*
334	RADIO VRC-64 MTD IN 1 1/4-TON GAMA GOAT M561		*	*
335	RADIO GRC-160 MTD IN 1 1/4-TON GAMA GOAT M561		*	*
336	RADIO VRC-64 MTD IN 5/4-TON M715	*	*	*
337	RADIO GRC-160 MTD IN 5/4-TON M715	*	*	*
338	RADIO VRC-64 MTD IN CARRIER APC M113	*	*	*
339	RADIO GRC-160 MTD IN CARRIER APC M113	*	*	*
340	RADIO VRC-64 MTD IN CARRIER CMD AND RECON M114		*	*
341	RADIO GRC-160 MTD IN CARRIER CMD AND RECON M114		*	*
342	RADIO VRC-64 MTD IN CARRIER CMD POST M577	*	*	*
343	RADIO GRC-160 MTD IN CARRIER CMD POST M577	*	*	*
344	RADIO GRC-160 MTD IN CARRIER MORTAR 4.2-IN M106	*	*	*
345	RADIO VRC-64 MTD IN BRIDGE AND LAUNCHER AVLB		*	*
346	RADIO VRC-64 MTD IN RECOVERY VEHICLE LT M578		*	*
347	RADIO VRC-64 MTD IN TANK M60A1		*	*
348	RADIO VRC-64 MTD IN TANK M60A2		*	*
349	RADIO VRC-64 MTD IN ARMORED RECON VEHICLE M551		*	*
350	RADIO GRC-160 MTD IN CARRIER GUIDED MISSILE TOW	*	*	*
351	RADIO TT SET GRC-142 MTD IN 1 1/4-TON GOAT M561		*	
352	RADIO TT SET GRC-142		*	
353	RADIO SET GRC-142 MTD IN 5/4-TON W/S250 SHELTER	*	*	
354	RADIO GRC-106		*	
355	RADIO GRC-106 MTD IN 1 1/4-TON GAMA GOAT M561		*	
356	RADIO GRC-106 MTD IN CARRIER APC M113	*	*	
357	RADIO GRC-106 MTD IN CARRIER CMD POST M577	*	*	
358	RADIO GRC-106 MTD IN 1/4-TON VEHICLE	*	*	

NUDACC VULNERABILITY DATA

NOSE BLAST TREE EMP

359	RADIO GRC-160 MTD IN CARRIER MORTAR 81-MM	*	*	*
360	RADIO TRC-145 MTD ON 5/4-TON M715 W/S250 SHELTER	*	*	
361	RADIO TRC-113 MTD ON 5/4-TON M715 W/S250 SHELTER	*	*	
362	RADIO TCC-65 MTD ON 5/4-TON M715 W/S250 SHELTER	*	*	
363	RADIO GRC-103		*	
364	RADIO TTC-23 MTD ON 2 1/2-TON W/S280 SHELTER	*		
365	RADIO TTC-29 MTD ON 5/4-TON M715 W/S250 SHELTER	*		
366	TELETYPE VSC-3 MTD IN CARRIER CMD POST M577	*	*	
367	MULTIPLEXER TD-660		*	
368	MULTIPLEXER CABLE COMBINER TD-204/754		*	
369	CONVERTER CV-1548		*	
371	RADIO VRC-64 MTD IN CARRIER MORTAR 4.2-IN M106	*	*	*
372	RADIO VRC-64 MTD IN RECOVERY VEHICLE MED M88		*	*
373	RADIO VRC-64 MTD IN CARRIER GM TOW M113	*	*	*
374	RADIO GRC-160 MTD IN CARRIER GM TOW M113	*	*	*
375	RADIO VRC-46 MTD IN 5/4-TON M715		*	
376	RADIO VRC-47 MTD IN 5/4-TON M715		*	
377	RADIO VRC-49 MTD IN 5/4-TON M715		*	
378	RADIO GRC-106 MTD IN 5/4-TON M715		*	
379	RADIO GRC-160 MTD IN RECOVERY VEHICLE LT M578		*	*
380	PATCH CNTR TSC-76 MTD IN 5/4-TON W/S250 SHELTER	*		
381	MSG CNTR GSG-80 MTD ON 2 1/2-TON W/S280 SHELTER	*		
382	TGRAPH TML TSC-58 ON 2 1/2-TON W/S280 SHELTER	*		
383	TELETYPEWRITER SET TT-4/T6			
384	TELETYPEWRITER SET AN/FGC-25			
385	OPS CTR CMO AN/MSC-31 ON 2 1/2-TON W/S280	*		
386	TEL CNTRL OFF AN/TCC-29 ON 1 1/4-TON M561			
387	TEL TML AN/TCC-29 ON 1 1/4-TON GAMA GOAT W/S250			
388	RADIO TT SET AN/UGC-74 ON 1 1/4-TON GAMA GOAT			
389	RADIO TT SET AN/UGC-75 ON 1 1/4-TON GAMA GOAT			
390	RADIO VRC-44 MTD IN 1/4-TON M151	*	*	
391	RADIO VFC-44 MTD IN CARRIER APC M113	*	*	
401	DIVISION ARTILLERY COMPUTER (TACFIRE)	*	*	
402	BATTALION COMPUTER (TACFIRE)	*	*	
403	VARIABLE FORMAT MESSAGE ENTRY DEVICE (VFMED)		*	
404	BATTERY DISPLAY UNIT (BDU)		*	
405	DIGITAL MESSAGE DEVICE (DMD)		*	
406	BATTERY COMPUTER SYSTEM (BCS)		*	
501	AN/TVS-4 NIGHT SIGHT			
502	PPS-5 RADAR SET		*	
503	PPS-15 RADAR SET			
504	MPQ-49 FWD AREA ALTERING RADAR			
505	GVS-3 RANGE FINDER-LASER			
506	AN/MPQ-4 RADAR SET COUNTER MORTAR			
508	TPS-25 RADAR SET			
601	TOW			

NUDACC VULNERABILITY DATA

DOSE BLAST TREE FMP

602	DRAGON		
603	REDEYE		
604	LANCE	*	*
605	TRACKER DRAGON		
701	PU 617/M 3KW TMD	*	
702	PU 618/M 5KW TMD		
703	PU 619/M 10KW TMD		
704	PU 564A/G 10KW TMD		
705	PU 620/M 5KW TMD		
706	PU 628 3KW TMD		
707	PU 625/G 3KW TMD		
801	HOWITZER 155MM SP M109A1	*	
802	HOWITZER 155MM TOWED M114		
803	HOWITZER 8-IN SP M110	*	
804	TANK COMBAT M60A1		
805	TANK COMBAT M60A2		
901	HELICOPTER OBSERVATION OH-58		
902	HELICOPTER UTILITY UH-1		
903	HELICOPTER ATTACK AH-1G		
FURPUR	27R3A	E33	SL73R1 10/17/79 12:51:27

APPENDIX B
RCC Input Info

AMUCK*VALRCC.INPUTINFO

INPUT FOR RCC

GENERAL COMMENTS
.....

RCC INPUTS ARE ALL MNEMONIC AND FREE-FIELD (AND MACHINE INDEPENDENT, ALMOST). THREE FORMS OF INPUT ARE SOLICITED:
ALL HOLLERITH, ONE HOLLERITH NAME (TWO WORDS) FOLLOWED BY NUMBERS (FIXED AND F.P., MIXED), AND ALL NUMBERS.
HOLLERITH STRINGS ARE SEPARATED BY COMMAS. NUMBERS BY COMMAS OR SPACES. LEADING BLANKS ARE IGNORED.

THE GENERAL FORM OF A RUNSTREAM IS AS FOLLOWS:

REPETTOIRE: ALL NAMES TO BE USED FOR FUNCTIONAL GROUPS AND WEAPONS

END

ENCOUNTER1 INPUTS: ALL OTHER DATA, INCLUDING PROGRAM CONTROLS, FOR THE ENCOUNTER. STANDARD FORM IS:

MNEMONIC - TO INDICATE TYPE OF DATA

DATA

END

(NOTE, HOWEVER, THAT RCC TRIES VERY HARD TO COMPENSATE FOR MISSING END CARDS. AT PRESENT, ONLY THE END

CARD AFTER THE REPETTOIRE IS ESSENTIAL)

AFTER THE DATA IS IN:

GO THE PROGRAM EXECUTES ONE ENCOUNTER AND RETURNS FOR NEW ENCOUNTER INPUTS

STOP ENDS PROGRAM

SPECIAL FEATURE: A CARD BEGINNING WITH A DOLLAR SIGN, \$, IS INTERPRETED AS A CONTINUATION CARD, IF POSSIBLE.
IF NOT, IT IS REINTERPRETED AS A COMMENT CARD. HENCE, FOR EXAMPLE, COMMENTS CAN BE INSERTED IN THE RUNSTREAM
AFTER ANY END CARD.

** ANY ITEM IN SQUARE BRACKETS [] IS NOT ESSENTIAL TO THE INPUT FORMAT, BUT CONVEYS ADDED
INFORMATION. NESTED BRACKETS INDICATE OPTIONS W/IN OPTIONS. PARENTHESES () ENCLOSE COMMENTS FOR THIS LISTING **

REPETTOIRE INPUT

FORMAT
.....

WEAPON
WEAPON NAME1 [, ALT. NAME, ALT. NAME,]
WEAPON NAME2 [, ALT. NAME, ALT. NAME,]
WEAPON NAME3 [, ALT. NAME, ALT. NAME,]
.....
FUNCTIONAL GROUP (OR FG OR FGS)
FUNCTIONAL GROUP NAME1 [, ALT. NAME, ALT. NAME,]
FUNCTIONAL GROUP NAME2 [, ALT. NAME, ALT. NAME,]
FUNCTIONAL GROUP NAME3 [, ALT. NAME, ALT. NAME,]
.....
END

COMMENTS ON REPETTOIRE INPUT
.....

1. SOME NAMES MAY BE COMMON TO SEVERAL FG S OR WEAPONS. THIS ALLOWS SUBSCRIBING A COMMON CHARACTERISTIC TO SEVERAL ITEMS BY ATTACHING THE CHARACTERISTIC TO THE COMMON NAME.
2. FG OR WEAPON NAMES MAY BE INPUT IN ANY ORDER, OR MIXED, AS LONG AS AN FG OR WEAPON CARD PRECEDES THE NAMES.
3. FOR SECONDARY EXPLOSION, COLOCATE EXPLOSIVE WITH TARGET. EXPLOSIVE MUST APPEAR IN BOTH TARGET AND WEAPON REPETTOIRE LISTS.

ENCOUNTER INPUTS

FORMAT
.....

NOTE: TIMES ARE IDENTIFIED AS ENCOUNTER TIME (CLOCK) OR TIME INTERVALS (INTRVL) - USED TO INPUT A PERIOD OF TIME AFTER AN EVENT
Mnemonic
.....

UNIT INPUTS
.....

CHAINS

LINKS - HOLLERITH STRINGS IN EACH CHAIN
LINKS MUST BE DEFINED PRIOR TO USE IN 'CHAINS' INPUT. SEE LINKS BELOW
'CLEAR' WILL CLEAR ALL PREVIOUS CHAINS

COMPOUND LINK

\$COMPOUND LINK NAME
LINK, (REAL) MAXIMUM CONTRIBUTION OF THIS LINK
LINK, (REAL) MAXIMUM CONTRIBUTION OF THIS LINK

DEPLOY

FG,X,Y OF TARGET POINT, [-J NO. THERE, CONV. KILL CRITERION, NUCLEAR K.C., POSTURE CODE, NUC COVER CODE
(NEGATIVE NO. THERE INDICATES A DUMMY TARGET)
FOR SECONDARY EXPLOSIVE SOURCE, PUT KILL CRITERIA (BOTH CONV. AND NUCL.) = 0.
(UNDERSTOOD IN LETHALITY (UNIT 2.) THAT ONE CRIT. (EXPLODE) PERTAINS)

DUCK4
EXTERNAL RECONSTITUTION
FATIGUE

FG, TIME (INTRVL) TO DUCK, FROM CONV. POSTR, FROM NUCVR, TO CONV. POSTR, TO NUCVR
FG REINFORCING, TIME (CLOCK) OF ARRIVAL, NUMBER OF THEM
LINK NAME, TIME, NEW CAP100%, CAP0%, MAXEFF%

LINKS

(SEE LINKS, BELOW)
LINK NAME (= NAME OF HOMELINK FG), (REAL) NO. OF FG FOR 100% CAP., 0 % CAP. [, MAX. EFF.]
(IF 1 INTEGER, TAKEN AS REMAINING CAP. AT 0. SURV.)
(IF NO MAX. EFFECTIVENESS, MAX EFF = 1.)

[\$, FG SUB1, FG SUB2, ... (SUBSTITUTES)]
[\$,] ST1, ST2, ... (SUBSTITUTION TIMES (INTRVL))]

(EACH SUBSTITUTE CARD MUST BE FOLLOWED BY A SUBST. TIMES CARD)
'CLEAR' WILL CLEAR ALL PREVIOUS LINKS

SIGNIFICANCE

FRACTIONAL AMOUNT OF IMPROVEMENT NEEDED BEFORE COMMANDER WILL VIOLATE PRIORITY IN SUBSTITUTION

WEAPON INPUTS
.....

DELIVERY ERROR

WEAPON NAME, [TIME (CLOCK),] RANGE ERRORS - INDEP., CORR., DEFLECTION ERRORS - INDEP., CORR., HOB ERROR
** NOTE: IN RCC, ALL ERRORS ARE INPUT AS SINGLE AXIS STANDARD DEVIATIONS (= SQR(VARIANCE, 1-AXIS)) **
** NOTE: IF TIME IS PRESENT, INPUT IS AN EVENT (CHANGE IN VALUE DURING ENCOUNTER). ELSE = INITIAL VALUE

ROUND
TLE
VOLLEY

WEAPON NAME, TIME (CLOCK), DGZ X, Y, Z
[TIME (CLOCK),] ERRORX AND ERRORY SEE NOTE ON ERROR FORM, ABOVE
WPN NAME, TIME (CLOCK), PATTERN MIDPT - X, Y, Z, NO. RNDs, DIRECTION OF PATTERN - DEG., LENGTH OF PATTERN
[\$,] TOTAL DURATION, TIME (INTRVL) BETWEEN VOLLEYS, DIRECTION OF MOVE OF MIDPT., DISTANCE OF MOVE]
(THIS ALLOWS INPUT OF A MOVING BARRAGE)

NOTE: DIRECTION ANGLE IS MEASURED CCW FROM +X (FRONT TO RFAR)

LETHALITY INPUTS
.....

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CONVENTIONAL
CUMULATIVE DOSE

NO DATA FOLLOWS IN RUNSTREAM - DATA READ FROM UNIT 2 ( SEE CONVENTIONAL DATA, BELOW )
FG, CUMULATIVE DOSE FOR CASUALTY
OPTIONS: ALL, LFVEL ( SFTS ALL FGS TO SAME DOSE LEVEL )
        NONE ( TURNS OFF CUMULATIVE DOSE KILLS )
DEFAULT IS LOWEST DOSE LEVEL OF ANY LINK IN WHICH EACH FG CAN SERVE
DESCRIPTION ( <= 12 CHARACTER HOLLERITH STRING ), KILL CRITERION ( 1-5 ), LD50
NO DATA FOLLOWS IN RUNSTREAM - DATA READ FROM UNIT 3 ( SEE NUCLEAR DATA, BELOW )
NUCLEAR
SHIELDING
YIELD
*WEAPON NAME, YIELD ( KT - USED IN NUC ONLY )

CONTROL INPUTS
*****

NO DATA FOLLOWS - CAUSES ENCOUNTER EXECUTION
READ ONE HOLLERITH STRING - ENCOUNTER OUTPUT HEADING
OPTION, 'ON' OR 'OFF'
OPTIONS: DEBUG ( PROCESS INPUT, BUT DO NOT EXECUTE )
TIMES(INTRVL) AFTER ARRIVAL OF RND AT WHICH RECONSTITUTION IS TO BE EVALUATED ( .LE. 11 INTRVL )
RECONSTITUTION SUPPRESSED IF ANOTHER RND ARRIVES IN THE MFANTIME
OPTION, 'ON' OR 'OFF'
OPTIONS: (OUTPUT AFTER EACH:) ITERATION, RECONSTITUTION, WEAPON DELIVERY, CASUALTIES,
        PRINT7 ( PRINT ON ALT. PRNT. FILE 7 )
        DOSE (NUCLEAR), LETHALITY (LISTING OF TAPE 2 AT END OF RUN), DEPLOYMENT PLOT ( DEFAULT=ON )
        SUMMARY, NAME1, NAME2 / OR SUMMARY, OFF ( SUM OF SURVIVORS HAVING SAME NAME ( MAX 13 ) )
        LINK SUMMARY, LINK1, LINK2 / OR LINK SUMMARY, OFF ( NO. TIMES WEAKEST BY CHAIN ( MAX 12 ) )
        INTEGER R.N. SEED FOR ENCOUNTER - ALLOWS RUNNING NEW ENCOUNTER W/ SAME R.N.S
        NO. OF REPLICATIONS PER ENCOUNTER
        END OF RUN. NO INPUT FOLLOWS
NO DATA FOLLOWS THIS CARD - AFTER ENCOUNTER, SURVIVORS ARE SAVED.
AFTER 'GO' CARD, NEW LINKS, CHAINS, HEADINGS CAN BE INPUT FOR OPTIMIZATION
END SUCH INPUT WITH ANOTHER 'GO'. SUBSEQUENT MISSIONS CAN BE LINKED

CONVENTIONAL LETHALITY DATA ( UNIT 2 )
*****

WEAPON
WEAPON PARAMETERS ( FROM SANDMEYER, ANSAA )
CARD 1: 8 (REAL) VALUES
CARD 2: 4 (REAL) VALUES
CARD 3: A6, I6 ( IF A6 .NE. 3HICM, I6 IS MEANINGLESS AND DO NOT READ CARDS 4 AND 5 )
CARD 4: 5 ( REAL ) ICM VALUES
CARD 5: 10 ( REAL ) ICM VALUES
CARD 6: 3-COOKIE, 7 = FRONT/BACK ASYMMETRIC CARLTON
CARD 7: 1-CONTOUR COOKIE CUTTER, 4 = ICM, 5 = 2-CONTOUR COOKIE
CARD 8: 1-COOKIE, 9 = ASYM, 2-COOKIE, 1- = ASYM, 3-COOKIE
CARD 9: ( ASYM. FORMAT: RX FOR TRGT X > HURST, RY, RX FOR TRGT X < HURST )
CARD 10: NOMINAL HOB VALUE FOR WHICH EACH LETHALITY APPLIES
CARD 11: ( RCC CONSTRUCTS RANGES ABOUT EACH HOB TO INTERPOLATE FOR ANY HOB )
CARD 12: NPOSTURES, DESCRIPTIONS
CARD 13: NKILLCRITERIA, DESCRIPTIONS
CARD 14: .....
CARD 15: ...NHOB*NPOSTURES*NKILLCRITERIA DATA CARDS...
CARD 16: ...EACH DATA CARD CONTAINS...
CARD 17: DATA TYPE 2: 3 ( REAL ) VALUES

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DATA TYPE 3: 3 ( REAL ) VALUES - PK, RX, RY
DATA TYPE 4: 1 ( REAL ) VALUES
DATA TYPE 5: 6 ( REAL ) VALUES
DATA TYPE 6: 9 ( REAL ) VALUES
DATA TYPE 7: 4 ( REAL ) VALUES
DATA TYPE 8: 4 ( REAL ) VALUES - PK, RX, RY, RXP
DATA TYPE 9: 8 ( REAL ) VALUES
DATA TYPE 10: 12 ( REAL ) VALUES
.....

      LOOP BACK FOR NEW TARGET
      END - LOOP BACK FOR NEW WEAPON
      END - EXIT BACK TO MAIN ROUTINE

      NUCLEAR VULNERABILITY DATA ( UNIT 3 )
      *****

TARGET ( FG ), CODE, DATA ( AS REQUIRED BY CODE )
CODES: 1 = EMP, 2 = TRFE, 3 = EMP+TRFE, 4 = BLAST, 5 = 1+4, 6 = 2+4, 7 = 1+2+4
DATA: AS SPECIFIED BY NUDACC
      EMP: MU AND SIGMA
      TREE: T2, MU, AND SIGMA
      BLAST: K, MU, AND SIGMA
      ORDER: AS NEEDED, EMP, THEN TREE, THEN RLAST

      *** AUXILIARY PROGRAM RCCFILE.4T03 ***

      MAINTAINS DATA BASE UNIT 4 ( NUDACC DATA )
      MAKES FILE 3 IN PROPER FORMAT FOR RCC RUNS
      DOES NOT RCCFILE.4T03. INSTRUCTIONS APPEAR INTERACTIVELY

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APPENDIX C
4T03 Listings

AMUCK*RCFILE(1).4TO3

```

1      C      THIS PROGRAM STORES DATA ON FILE 4 AND MAKES UP FILE 3 FOR RC
2      C      PRINT OPTION IS ALSO PROVIDED
3      DIMENSION DATA(1000,20)
4      DIMENSION IVLARY(1000,20)
5      EQUIVALENCE ( IVLARY,DATA )
6      COMMON/CARD/ NAME(2), NR, RR(17), NI, INT(20)
7      DIMENSION IFORM(2), NAMHLD(2)
8      DATA IFORM /6HQBKRPT, 6H 7 /
9      DATA IN, IOUT, ILIS / 3HIN , 3HOUT, 3HLIS /
10     DATA NEW, IOLD, IEND / 3HNEW, 3HOLD, 3HEND /
11     CALL MACSET
12     10     WRITE(6,19)
13     19     FORMAT(' TYPE OUT FOR OUTPUT ( FILE 3 ), IN FOR INPUT ',
14     + '(FILE 4)',/' TYPE LIS FOR TOTAL LISTING OF 4 , OR END TO STOP')
15     READ(5,29) IWD
16     29     FORMAT( A3 )
17     IF( IWD .EQ. IEND ) GO TO 9000
18     IF( IWD .EQ. IN ) GO TO 5000
19     IF( IWD .EQ. ILIS ) GO TO 3000
20     IF( IWD .NE. IOUT ) GO TO 10
21     REWIND 4
22     REWIND 3
23     READ(4) DATA
24     90     WRITE(6,129)
25     129    FORMAT(' TYPE NAME, NUDACC CODE NO.... TO STOP, TYPE END')
26     WRITE(6,919)
27     919    FORMAT(' TYPE $ FOR LOOK AT LAST PROGRAM-WRITTEN LINE ',/
28     $ ' TYPE $ ITEM NUMBERS FOR DATA ON SPECIFIC ITEMS' )
29     100    CALL READ1(5,$1500,$2000,$2000)
30     NAMHLD(1) = NAME(1)
31     NAMHLD(2) = NAME(2)
32     IF( NI .EQ. 1 .AND. NR .EQ. 0 ) GO TO 110
33     103    WRITE(6,109)
34     109    FORMAT(' INPUT ERROR' )
35     GO TO 90
36     110    NDX = INT(1)
37     IF( IVLARY(NDX,1) .GE. 0 ) GO TO 120
38     WRITE(6,119) NDX
39     119    FORMAT(' NO DATA FOR ITEM W/ NUDACC NUMBER ', I6 )
40     GO TO 100
41     120    CONTINUE
42     NDD = IVLARY(NDX,1)+1
43     GO TO (1990,1001,1002,1003,1004,1005,1006,1007), NDD
44     1001    CONTINUE
45     C      EMP ONLY
46     WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=2,3 )
47     1109    FORMAT( 2A6,' ', I2,' ', 15(1X,F6.2) )
48     GO TO 100
49     1002    CONTINUE
50     C      TREE ONLY
51     WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=4,6 )
52     GO TO 100
53     1003    CONTINUE
54     C      EMP AND TREE
55     WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=2,6 )
56     GO TO 100

```

```

57      1004 CONTINUE
58      C      BLAST ONLY
59          WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=7,9 )
60          GO TO 100
61      1005 CONTINUE
62      C      EMP AND BLAST
63          WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=2,3 ),
64          + ( DATA(NDX,L), L = 7,9 )
65          GO TO 100
66      1006 CONTINUE
67      C      TREE AND BLAST
68          WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=4,9 )
69          GO TO 100
70      1007 CONTINUE
71      C      EMP, TREE, AND BLAST
72          WRITE(3,1109) NAME, IVLARY(NDX,1), ( DATA(NDX,L), L=2,9 )
73          GO TO 100
74      1990 CONTINUE
75      C      PERSONNEL
76          WRITE(3,1999) NAME, IVLARY(NDX,1)
77      1999 FORMAT( 2A6, ' ', I4 )
78          GO TO 100
79      1500 CONTINUE
80      C      IF HERE, SAW $
81          IF( NI .EQ. 0 .AND. NR .EQ. 0 ) GO TO 1550
82          IF( NI .LT. 1 .OR. NR .NE. 0 ) GO TO 103
83      C      IF HERE, WANT DATA FROM ITEMS
84          NBACK = 1
85          GO TO 7000
86      1550 CONTINUE
87      C      IF HERE, WANT TERMINAL PRINT OF LAST OUTPUT
88          GO TO (1790,1601,1602,1603,1604,1605,1606,1607), NDD
89      1601 CONTINUE
90      C      EMP ONLY
91          WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=2,3 )
92      1609 FORMAT( 1X, 2A6, ' ', I2, ' ', 15(1X,F6.2) )
93          GO TO 100
94      1602 CONTINUE
95      C      TREE ONLY
96          WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=4,6 )
97          GO TO 100
98      1603 CONTINUE
99      C      EMP AND TREE
100          WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=2,6 )
101          GO TO 100
102      1604 CONTINUE
103      C      BLAST ONLY
104          WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=7,9 )
105          GO TO 100
106      1605 CONTINUE
107      C      EMP AND BLAST
108          WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=2,3 ),
109          + ( DATA(NDX,L), L = 7,9 )
110          GO TO 100
111      1606 CONTINUE
112      C      TREE AND BLAST
113          WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=4,9 )

```

```

114      GO TO 100
115 1607 CONTINUE
116 C     EMP, TREE, AND BLAST
117      WRITE(6,1609) NAMHLD, IVLARY(NDX,1), ( DATA(NDX,L), L=2,9 )
118      GO TO 100
119 1790 CONTINUE
120 C     PERSONNEL
121      WRITE(6,1799) NAMHLD, IVLARY(NDX,1)
122 1799 FORMAT( 1X, 2A6, ' ', ' ', I4 )
123      GO TO 100
124 2000 CONTINUE
125      WRITE(3,29) IEND
126      ENDFILE 3
127      GO TO 10
128 3000 REWIND 4
129      READ(4) DATA
130      WRITE(6,2989)
131 2989 FORMAT(' TO WRITE ON FILE 7, TYPE 7. ELSE 6 ' )
132      IM6 = 6
133      READ(5,2979) IX
134 2979 FORMAT( I1 )
135      IF( IX.EQ. 7 ) IM6 = 7
136      WRITE(IM6,2999)
137 2999 FORMAT('1PRINT-OUT OF DATA FROM FILE 4',/,1X,29(' '*),//
138      + ' NUDACC',/, ' NUMBER IVLARY DATA',/,1X, 29(' '-'),/)
139      DO 3100 I = 1, 1000
140      IF( IVLARY(I,1) .LT. 0 ) GO TO 3100
141      NDD = IVLARY(I,1)+1
142      GO TO (3990,3001,3002,3003,3004,3005,3006,3007), NDD
143 3001 CONTINUE
144 C     EMP ONLY
145      WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=2,3 )
146 3109 FORMAT( I7, I7, 3X, 15F7.2 )
147      GO TO 3100
148 3002 CONTINUE
149 C     TREE ONLY
150      WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=4,6 )
151      GO TO 3100
152 3003 CONTINUE
153 C     EMP AND TREE
154      WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=2,6 )
155      GO TO 3100
156 3004 CONTINUE
157 C     BLAST ONLY
158      WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=7,9 )
159      GO TO 3100
160 3005 CONTINUE
161 C     EMP AND BLAST
162      WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=2,3 ),
163      + ( DATA(I,L), L = 7,9 )
164      GO TO 3100
165 3006 CONTINUE
166 C     TREE AND BLAST
167      WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=4,9 )
168      GO TO 3100
169 3007 CONTINUE
170 C     EMP, TREE, AND BLAST

```

```

171         WRITE(IM6,3109) I, IVLARY(I,1), ( DATA(I,L), L=2,9 )
172         GO TO 3100
173     3990 CONTINUE
174     C     PERSONNEL
175         WRITE(IM6,3999) I, IVLARY(I,1)
176     3999 FORMAT( 2I7 )
177     3100 CONTINUE
178         IF( IM6 .EQ. 7 ) CALL ERTRAN(6,IFORM)
179     C     THE PRECEEDING CLOSES A UNIVAC BRKPT FILE. THIS IS MACHINE DEPENDENT
180         GO TO 10
181     5000 CONTINUE
182     C     THIS SECTION MAKES FILE 4
183         REWIND 4
184     5005 WRITE(6,5009)
185     5009 FORMAT(' FOR NEW FILE, TYPE NFW. ELSE, OLD . TO STOP, END' )
186         READ(5,29) IWD
187         IF( IWD .EQ. NEW ) GO TO 5010
188         IF( IWD .NE. IOLD ) GO TO 5005
189         READ(4) DATA
190         GO TO 5020
191     5010 DO 5015 I = 1, 1000
192     5015 IVLARY(I,1) = -1
193     5020 CONTINUE
194         WRITE(6,5019)
195     5019 FORMAT(' ENTER NUDACC NO., CONC ( IVLARY ), APPROPRIATE DATA' )
196         WRITE(6,919)
197     5022 CONTINUE
198         CALL READ0(5,$5500,$6000,$6000)
199         IF( NI .EQ. 2 ) GO TO 5030
200     5025 WRITE(6,5029)
201     5029 FORMAT(' INPUT ERROR' )
202         GO TO 5020
203     5030 NDX1 = INT(1)
204         NDX2 = INT(2)+2
205         GO TO ( 5990,5990,5101,5102,5103,5104,5105,5106,5107 ), NDX2
206     5101 CONTINUE
207     C     EMP ONLY
208         IF( NR .NE. 2 ) GO TO 5025
209         IVLARY(NDX1,1) = INT(2)
210         DATA(NDX1,2) = RR(1)
211         DATA(NDX1,3) = RR(2)
212         GO TO 5022
213     5102 CONTINUE
214     C     TREE ONLY
215         IF( NR .NE. 3 ) GO TO 5025
216         IVLARY(NDX1,1) = INT(2)
217         DATA(NDX1,4) = RR(1)
218         DATA(NDX1,5) = RR(2)
219         DATA(NDX1,6) = RR(3)
220         GO TO 5022
221     5103 CONTINUE
222     C     EMP AND TREE
223         IF( NR .NE. 5 ) GO TO 5025
224         IVLARY(NDX1,1) = INT(2)
225         DATA(NDX1,2) = RR(1)
226         DATA(NDX1,3) = RR(2)
227         DATA(NDX1,4) = RR(3)

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228      DATA(NDX1,5) = RR(4)
229      DATA(NDX1,6) = RR(5)
230      GO TO 5022
231      5104 CONTINUE
232      C      TREE ONLY
233      IF( NR .NE. 3 ) GO TO 5025
234      IVLARY(NDX1,1) = INT(2)
235      DATA(NDX1,7) = RR(1)
236      DATA(NDX1,8) = RR(2)
237      DATA(NDX1,9) = RR(3)
238      GO TO 5022
239      5105 CONTINUE
240      C      EMP AND BLAST
241      IF( NR .NE. 5 ) GO TO 5025
242      IVLARY(NDX1,1) = INT(2)
243      DATA(NDX1,2) = RR(1)
244      DATA(NDX1,3) = RR(2)
245      DATA(NDX1,7) = RR(3)
246      DATA(NDX1,8) = RR(4)
247      DATA(NDX1,9) = RR(5)
248      GO TO 5022
249      5106 CONTINUE
250      C      TREE AND BLAST
251      IF( NR .NE. 6 ) GO TO 5025
252      IVLARY(NDX1,1) = INT(2)
253      DATA(NDX1,4) = RR(1)
254      DATA(NDX1,5) = RR(2)
255      DATA(NDX1,6) = RR(3)
256      DATA(NDX1,7) = RR(4)
257      DATA(NDX1,8) = RR(5)
258      DATA(NDX1,9) = RR(6)
259      GO TO 5022
260      5107 CONTINUE
261      C      EMP, TREE, AND BLAST
262      IF( NR .NE. 8 ) GO TO 5025
263      IVLARY(NDX1,1) = INT(2)
264      DATA(NDX1,2) = RR(1)
265      DATA(NDX1,3) = RR(2)
266      DATA(NDX1,4) = RR(3)
267      DATA(NDX1,5) = RR(4)
268      DATA(NDX1,6) = RR(5)
269      DATA(NDX1,7) = RR(6)
270      DATA(NDX1,8) = RR(7)
271      DATA(NDX1,9) = RR(8)
272      GO TO 5022
273      5990 CONTINUE
274      C      PERSONNEL OR ERASE ( -1 )
275      IVLARY(NDX1,1) = INT(2)
276      DO 5992 L = 2,9
277      5992 DATA(NDX1,L) = 0.
278      GO TO 5022
279      5500 CONTINUE
280      C      IF HERE, SAW $
281      IF( NI .EQ. 0 .AND. NR .EQ. 0 ) GO TO 5520
282      IF( NI .LT. 1 .OR. NR .NE. 0 ) GO TO 5025
283      C      IF HERE, WANT DATA FROM ITEMS
284      NBACK = 2

```

```

285      GO TO 7000
286      5520 CONTINUE
287      C      IF HERE, WANT LAST ITEM
288      NBACK = 2
289      NI = 1
290      INT(1) = NDX1
291      GO TO 7000
292      6000 CONTINUE
293      C      WRITE NEW FILE 4
294      REWIND 4
295      WRITE(4) DATA
296      ENDFILE 4
297      GO TO 10
298      7000 CONTINUE
299      DO 7100 IX = 1, NI
300      I = INT(IX)
301      IF( IVLARY(I,1) .LT. n ) GO TO 7098
302      NDD = IVLARY(I,1)+1
303      GO TO (7990,7001,7002,7003,7004,7005,7006,7007), NDD
304      7001 CONTINUE
305      C      EMP ONLY
306      WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=2,3 )
307      7109 FORMAT( I7, I7, 3X, 15F7.2 )
308      GO TO 7100
309      7002 CONTINUE
310      C      TREE ONLY
311      WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=4,6 )
312      GO TO 7100
313      7003 CONTINUE
314      C      EMP AND TREE
315      WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=2,6 )
316      GO TO 7100
317      7004 CONTINUE
318      C      BLAST ONLY
319      WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=7,9 )
320      GO TO 7100
321      7005 CONTINUE
322      C      EMP AND BLAST
323      WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=2,3 ),
324      + ( DATA(I,L), L = 7,9 )
325      GO TO 7100
326      7006 CONTINUE
327      C      TREE AND BLAST
328      WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=4,9 )
329      GO TO 7100
330      7007 CONTINUE
331      C      EMP, TREE, AND BLAST
332      WRITE(6,7109) I, IVLARY(I,1), ( DATA(I,L), L=2,9 )
333      GO TO 7100
334      7990 CONTINUE
335      C      PERSONNEL
336      WRITE(6,7999) I, IVLARY(I,1)
337      7999 FORMAT( 2I7 )
338      GO TO 7100
339      7098 WRITE(6,7899) I
340      7899 FORMAT(' NO DATA FOR ITEM ', I6 )
341      7100 CONTINUE

```

```
342      GO TO ( 90, 5020 ), NRACK  
343 9000 STOP  
344      . END
```

AMUCK*RCFILE(1).MACSET

```
1      SUBROUTINE MACSET
2      C      THIS ROUTINE SETS MACHINE DEPENDENT CONSTANTS
3      COMMON/MACHIN/ ISIZE, MSIZE, MNAM
4      C      ISIZE IS NUMBER OF CHARACTERS PER WORD
5      ISIZE = 6
6      C      MSIZE IS MAX WORDS ALLOWED FOR A NUMBER
7      MSIZE = 3
8      C      MNAM IS MAX WORDS ALLOWED FOR A NAME
9      MNAM = 2
10     RETURN
11     END
```

AMUCK*RCFILE(1).READ1

```
1      SUBROUTINE READ1(IUN,$,$,$)
2      C      THIS ROUTINE READS A CARD, CHECKS FOR $, END, OR FOF, AND CALLS RD1
3      COMMON/CRD80 / IR(80)
4      DATA IDOLL,IE,N,ID,IB / 1H$, 1HE, 1HN, 1HD, 1H /
5      LOGICAL LDOLL
6      LDOLL = .FALSE.
7      READ(IUN,9,END=300) IR
8      9      FORMAT( 80A1 )
9      IF( IR(1).EQ.IE .AND. IR(2).EQ.N .AND. IR(3).EQ.ID .AND.
10     $ IR(4).EQ.IB .AND. IR(5).EQ.IR ) RETURN3
11     IF( IR(1) .EQ. IDOLL ) LDOLL = .TRUE.
12     CALL RD1
13     IF(LDOLL) RETURN2
14     RETURN
15     300 RETURN4
16     END
```

AMUCK*RCFILE(1).RD1

```

1      SUBROUTINE RD1
2      C      THIS ROUTINE READS A NAME, THEN A STRING OF NUMBERS
3      C      NO. OF INTEGERS PUT IN NI, AND VALUES IN IN
4      C      REALS IN NR, AND RR
5      C      THE NAME GOES IN IWORD. NOTE: DIMENSION OF IWORD MUST BE MNAM - SET IN MACSET
6      COMMON/MACHIN/ ISIZE, MSIZE, MNAM
7      COMMON/ CARD / NAME(2), NR, RR(17), NI, INT(20)
8      COMMON IS(80), IWORK(5)
9      COMMON/CRD80 / IR(80)
10     DATA IB,IC,ID,IE,IDOLL / 1H , 1H, , 1H., 1HE, 1HS /
11     LOGICAL LEXP, LREAL, LEAD, LONE
12     NQUIT = MSIZE*ISIZE
13     IF( IR(1) .NE. IDOLL ) GO TO 2
14     IO = 2
15     IF( IR(2) .EQ. IC ) IO = 3
16     GO TO 22
17     2      LEAD = .TRUE.
18     LONE = .FALSE.
19     N2 = ISIZE*MNAM
20     C      LOOK FOR COMMA
21     NC = 0
22     DO 10 I = 1, 80
23     N1 = I
24     IF( IR(I) .EQ. IC ) GO TO 12
25     IF( IR(I) .EQ. IB .AND. LEAD ) GO TO 10
26     LEAD = .FALSE.
27     NC = NC+1
28     IF( NC .LE. N2 ) GO TO 8
29     LONE = .TRUE.
30     GO TO 20
31     8      IS(NC) = IR(I)
32     10     CONTINUE
33     12     CONTINUE
34     C      COMMA FOUND LEFT JUSTIFY NAME, AND BLANK FILL TO RIGHT
35     IF( N2-NC ) 20,20,15
36     15     NC1 = NC+1
37     DO 16 I = NC1,N2
38     16     IS(I) = IB
39     20     ENCODE(N2,9,NAME) ( IS(I), I=1,N2 )
40     9      FORMAT( 80A1 )
41     IF(LONE) GO TO 7744
42     IO = N1+1
43     22     NL = 0
44     NC = 0
45     NI = 0
46     NR = 0
47     LEXP = .FALSE.
48     LREAL = .FALSE.
49     LEAD = .TRUE.
50     DO 100 I = IO, 80
51     IF( IR(I) .EQ. IB .OR. IR(I) .EQ. IC ) GO TO 50
52     IF( IR(I) .EQ. ID ) LREAL = .TRUE.
53     IF( IR(I) .EQ. IE ) LEXP = .TRUE.
54     IF( LEAD ) NO = I
55     LEAD = .FALSE.
56     NC = NC+1

```

```

57      GO TO 100
58      50  CONTINUE
59      C   A BLANK/COMMA WAS READ.  IF LEADING, IGNORE
60          IF( LEAD ) GO TO 98
61      C   NOT LEADING.  IT ENDS THE CURRENT NUMBER
62      C   NOW WANT TO RIGHT JUSTIFY CHARACTERS IN MSIZE WORDS
63          NWD = ( NC-1 )/ISIZE + 1
64          IF( NWD .GT. MSIZE ) GO TO 7734
65          N2 = MSIZE*ISIZE-NC
66          IF( N2 .GT. 0 ) GO TO 58
67          N2 = 0
68          GO TO 65
69      58  DO 60  J = 1, N2
70      60  IS(J) = IB
71      65  IF( NC .EQ. 0 ) GO TO 72
72          N1 = N2+1
73          N2 = N2+NC
74          IX = 0
75          DO 70  J = N1, N2
76          IS(J) = IR( N0+IX )
77          IX = IX+1
78      70  CONTINUE
79      72  ENCODE(N2,9,IWORK) ( IS(J),J=1,N2 )
80      C   THAT SQUINCHED THE NUMBER INTO COMPUTER WORDS.  NOW READ IT
81          IF( LREAL ) GO TO 75
82      C   IT'S AN INTEGER
83          NI = N1+1
84          DECODE(N2,709,IWORK) INT(NI)
85      709  FORMAT( I18 )
86      C   NOTE.  FIELD LENGTH IN ABOVE FORMAT = MSIZE*ISIZE
87          GO TO 95
88      75  NR = NR+1
89      C   IT'S A REAL.  SEE IF IT'S AN EXPONENTIAL
90          IF( LEXP ) GO TO 78
91          DECODE(N2,759,IWORK) RR(NR)
92      759  FORMAT( F18.0 )
93          GO TO 95
94      78  DECODE(N2,789,IWORK) RR(NR)
95      789  FORMAT( E18.0 )
96      95  CONTINUE
97      C   WE HAVE DECODED A NUMBER.  NOW CLEAR OUT FOR NEXT WORD
98          NL = 0
99          NC = 0
100         LEXP = .FALSE.
101         LREAL = .FALSE.
102         LEAD = .TRUE.
103         GO TO 100
104      98  CONTINUE
105      C   MSIZE*ISIZE LEADING BLANKS/COMMAS INDICATES NO MORE DATA
106          NL = NL+1
107          IF( NL .GE. NQUIT ) GO TO 5000
108      100  CONTINUE
109      5000 CONTINUE
110          RETURN
111      7734 CONTINUE
112      C   ERROR  NUMBER TOO LONG
113          WRITE(6,7799)

```

```

114      7799 FORMAT(' NUMBER TOO LONG ON THIS CARD' )
115      WRITE(6,7789) IR
116      7789 FORMAT( 1X, 80A1 )
117      STOP
118      7744 CONTINUE
119      C      DETECTED MORE THAN ONE NAME'S WORTH OF CHARACTERS WITHOUT A COMMA
120      C      AFTER THE LEADING BLANKS ( IF ANY ). ASSUME THAT THIS IS A ONE
121      C      WORD CARD
122      NR = 0
123      NI = 0
124      RETURN
125      END

```

AMUCK*RCFILE(1).READ0

```
1      SUBROUTINE READ0(IUN,$,$,$)
2      C      THIS ROUTINE READS A CARD OF NUMBERS
3      C      NO. OF INTEGERS PUT IN NI, AND VALUES IN INT
4      C      REALS IN NR, AND RR
5      C      RETURN1 = $ ( CONTINUATION CARD ), RETURN2 = END CARD
6      C      RETURN3 = EOF, RETURN4 = NON-NUMERICAL CHARACTER
7      COMMON/MACHIN/ ISIZE, MSIZE, MNAM
8      COMMON/ CARD / NAME(2), NR, RR(17), NI, INT(20)
9      COMMON IS(80), IWORK(5)
10     COMMON/CRD80 / IR(80)
11     DATA IDOLL, IEND /1H$,1HE/
12     DIMENSION IOK(16)
13     DATA IOK / 1H0, 1H1, 1H2, 1H3, 1H4, 1H5, 1H6, 1H7, 1H8, 1H9,
14     $ 1H , 1H., 1H., 1HE, 1H+, 1H- /
15     LOGICAL LEXP, LREAL, LEAD, LDOLL
16     NQUIT = MSIZE*ISIZE
17     I1 = 1
18     LDOLL = .FALSE.
19     READ(IUN,9,END=6000) IR
20     IF( IR(1) .NE. IDOLL ) GO TO 2
21     LDOLL = .TRUE.
22     I1 = 2
23     IF( IR(2) .EQ. IOK(12) ) I1 = 3
24     2 IF( IR(1) .EQ. IEND ) RETURN3
25     9 FORMAT( 80A1 )
26     NL = 0
27     NC = 0
28     NI = 0
29     NR = 0
30     LEXP = .FALSE.
31     LREAL = .FALSE.
32     LEAD = .TRUE.
33     DO 100 I = I1, 80
34     DO 10 J = 1, 16
35     10 IF( IR(I) .EQ. IOK(J) ) GO TO 15
36     C IF HERE, IT'S A NON-NUMERICAL CHARACTER. STOP
37     STOP
38     15 CONTINUE
39     IF( IR(I) .EQ. IOK(11) .OR. IR(I) .EQ. IOK(12) ) GO TO 50
40     IF( IR(I) .EQ. IOK(13) ) LREAL = .TRUE.
41     IF( IR(I) .EQ. IOK(14) ) LEXP = .TRUE.
42     IF( LEAD ) NO = I
43     LEAD = .FALSE.
44     NC = NC+1
45     GO TO 100
46     50 CONTINUE
47     C A BLANK/COMMA WAS READ. IF LEADING, IGNORE
48     IF( LEAD ) GO TO 98
49     C NOT LEADING. IT ENDS THE CURRENT NUMBER
50     C NOW WANT TO RIGHT JUSTIFY CHARACTERS IN MSIZE WORDS
51     NWD = ( NC-1 )/ISIZE + 1
52     IF( NWD .GT. MSIZE ) GO TO 7734
53     N2 = MSIZE*ISIZE-NC
54     IF( N2 .GT. 0 ) GO TO 58
55     N2 = 0
56     GO TO 65
```

```

57      58      DO 60 J = 1, N2
58      60      IS(J) = IOK(11)
59      65      IF( NC .EQ. 0 ) GO TO 72
60      N1 = N2+1
61      N2 = N2+NC
62      IX = 0
63      DO 70 J = N1, N2
64      IS(J) = IR( N0+IX )
65      IX = IX+1
66      70      CONTINUE
67      72      ENCODE(N2,9,IWORK) ( IS(J),J=1,N2 )
68      C      THAT SQUINCHED THE NUMBER INTO COMPUTER WORDS. NOW READ IT
69      IF( LREAL ) GO TO 75
70      C      IT'S AN INTEGER
71      NI = NI+1
72      DECODE(N2,709,IWORK) INT(NI)
73      709      FORMAT( I18 )
74      C      NOTE. FIELD LENGTH IN ABOVE FORMAT = MSIZE*ISIZE
75      GO TO 95
76      75      NR = NR+1
77      C      IT'S A REAL. SEE IF IT'S AN EXPONENTIAL
78      IF( LEXP ) GO TO 78
79      DECODE(N2,759,IWORK) RR(NR)
80      759      FORMAT( F18.0 )
81      GO TO 95
82      78      DECODE(N2,789,IWORK) RR(NR)
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84      95      CONTINUE
85      C      WE HAVE DECODED A NUMBER. NOW CLEAR OUT FOR NEXT WORD
86      NL = 0
87      NC = 0
88      LEXP = .FALSE.
89      LREAL = .FALSE.
90      LEAD = .TRUE.
91      GO TO 100
92      98      CONTINUE
93      C      MSIZE*ISIZE LEADING BLANKS/COMMAS INDICATES NO MORE DATA
94      NL = NL+1
95      IF( NL .GE. NQUIT ) GO TO 5000
96      100      CONTINUE
97      5000      CONTINUE
98      IF( LDOLL ) RETURN2
99      RETURN
100     6000      RETURN4
101     7734      CONTINUE
102     C      ERROR NUMBER TOO LONG
103     WRITE(6,7799)
104     7799      FORMAT(' NUMBER TOO LONG ON THIS CARD' )
105     WRITE(6,7789) IR
106     7789      FORMAT( 1X, 80A1 )
107     STOP
108     END

```

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