0123456789012345678? ** RSX-11M V3.2 ** [20,1]LANDER - NO PAGE LIMIT
0123456789012345678? ** RSX-11M V3.2 ** FORM #0 - NORMAL HARDWARE FORMS
0123456789012345678? ** RSX-11M V3.2 ** NO IMPLIED FORM FEED
0123456789012345678? ** RSX-11M V3.2 ** DR0:[20,1]LANDER.LIS;1

10-AUG-81 08:03:34 0123456789012345678?
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10-AUG-81 08:03:34 0123456789012345678?
10-AUG-81 08:03:34 0123456789012345678?

DR0:[20,1]LANDER.MAC;24


```
;  ************************************************************
;  *                                                          *
;  *  LUNAR LANDER, BY MEYER A. HILLMERS                      *
;  *                                                          *
;  *  THIS PROGRAM IMPLEMENTS, ON THE VT100, A VERSION OF     *
;  *  DIGITAL EQUIPMENT CORPS CLASSIC GRAPHIC GAME, LUNAR     *
;  *  LANDER.  THE PLAYER IS THE PILOT OF A LUNAR ENTRY MODULE*
;  *  WITH CONTROLS THAT CONTROL THE FIRING OF ROCKETS AND    *
;  *  THE THRUST OF THE ROCKETS.  THE OBJECT IS TO MAKE A     *
;  *  SOFT LANDING ON THE LUNAR SURFACE.                      *
;  *                                                          *
;  *  GOOD LUCK!                                              *
;  *                                                          *
;  ************************************************************
```

DR0:[20,1]LANDER.MAC;24

```
18          .TITLE LUNAR LANDER, BY MEYER A. HILLMERS
19          .MCALL QIOSC,QIOW$S,ALUN$C,EXIT$S,MRKT$C,ASTX$S
20
21
22  ; SYMBOL DEFINITIONS
23          TERRCH = 55
24
25
26
27  ; MACRO DEFINITIONS
28
29
30  ; REGISTER, STACK MACROS
31          .MACRO PUSH A
32
33          MOV A,-(SP)
34
35          .ENDM
36
37          .MACRO POP A
38
39          MOV (SP)+,A
40
41          .ENDM
42          .MACRO SAVREG
43
44          PUSH R0
45          PUSH R1
46          PUSH R2
47          PUSH R3
48          PUSH R4
49          PUSH R5
50
51          .ENDM
52
53          .MACRO RESREG
54
55          POP R5
56          POP R4
57          POP R3
58          POP R2
59          POP R1
60          POP R0
61
62          .ENDM
63
64
65
66  ; VT100 SCREEN MACROS
```



```
67
68  ; SEND A CHARACTER
69
70
```

```
                .MACRO SNDCHR A
                MOVB A,WRKST1
                PUSH R0
                MOV #WRKST1,R0
                JSR PC,TYPE
                POP R0

                .ENDM

; INITIATE AN ESCAPE SEQUENCE (ESC [)

                .MACRO ESCSEQ

                SNDCHR #33
                SNDCHR #133

                .ENDM

; POSITION THE CURSOR AT A,B

                .MACRO CURPOS A,B

                MOV A,R0
                MOV B,R1
                JSR PC,POSCUR

                .ENDM

; CLEAR THE SCREEN

                .MACRO CLRSCR

                CURPOS #1,#1
                ESCSEQ
                SNDCHR #60
                SNDCHR #112

                .ENDM
```



```
; TYPE A STRING

                .MACRO SNDSTR A

                MOV A,R0
                JSR PC,TYPE

                .ENDM

; TYPE A NUMBER (SIGNED)

                .MACRO SNDNUM A

                MOV A,R1
                MOV #WRKSTR,R0
                JSR PC,NUMSTR
                JSR PC,TYPE

                .ENDM

; TYPE A NUMBER (UNSIGNED)

                .MACRO SNDABS A
                INC ABSFLG
                SNDNUM A
                CLR ABSFLG

                .ENDM

; LIGHT LED A (A = 0 => ALL LEDS OFF)

                .MACRO LEDS A

                ESCSEQ
                SNDCHR A
                SNDCHR #161

                .ENDM

; MISCELLANEOUS MACROS

; DEPOSIT N ROCKS AT ALTITUDE A

                .MACRO ROCK N,A

                .REPT N
                A,1,0
                .ENDR
```

```
161             .ENDM
162
163
164     ; DEPOSIT N FLAT SPACES AT ALITITUDE A
165             .MACRO FLAT N,A
166
167             .REPT N
168             A,0,0
169             .ENDR
170
171             .ENDM
172
173
174
```



```
175
176     START:  ALUNSC 1,TI
177             GIOSC IO.ATA,1,,,,,<TTYINT>
178             MRKTSC 2,1,1,CLKINT
179             SNDSTR #INITMS
180             INC COLFLG
181             JMP MAINLP
182
183     NEWGAM: CLR TICKS
184             MOV FUELMX,FUEL
185             MOV XVELI,XVEL
186             MOV YVELI,YVEL                  ; KEEPING TWEAKABLE CONSTANTS IN VARIABLES, SO WE
187             MOV #1,XPREV                    ; CAN CHANGE THEM USING THE MACHINES SWITCHES AT RUN TIME
188             MOV #1,YPREV
189             MOV #1,XRPREV
190             MOV #1,YRPREV
191             MOV THRSTI,THRUST
192             MOV #2,ENGIN
193
194             ; ENGINES ARE NUMBERED AS FOLLOWS:
195
196             ;           5
197             ;         6   4
198             ;       7   L   3
199             ;         8   2
200             ;           1
201
202             ; NOTE THAT THE NUMBER OF AN ENGINE IS ALSO THE INDEX INTO THE SIN AND COS TABLES
203             ; CORRESPONDING TO THE X AND Y COMPONENTS OF THRUST DUE TO THAT ENGINE.
204             MOV XPOSI,XPOS
205             MOV YPOSI,YPOS
206
207     MAINLP: TST COLFLG
208             BEQ NOCOL                       ; COLLISION?
209     1$:     TST RESFLG
210             BEQ 1$
211             CLR RESFLG                      ; TIME TO RESUME NEW GAME?
212             CLR COLFLG
213             INC NEWFLG
214             JMP NEWGAM
215
216
```

```
                SUB THRUST,FUEL         ; UNITS OF FUEL ARE THRUST PER TICK
NOCOL:          BGT 1$                  ; OUT OF FUEL?
                CLR THRUST
                CLR FUEL
1$:             ADD GRAV,YVEL           ; NOTE THAT GRAVITY MUST BE SIGNED, MAY BE POSITIVE!
                MOV THRUST,R1
                MOV ENGIN,R0
                DEC R0
                ASL R0
                MUL SINTAB(R0),R1       ; COMPUTE THE X COMPONENT OF ROCKET THRUST
                ASH #-9.,R1             ; AND TABLE ENTRIES FOR SIN, COS ARE IN OCATAL 1000THS
                ADD R1,XVEL
                MOV THRUST,R1
                MUL COSTAB(R0),R1
                ASH #-9.,R1             ; SAME FOR Y COMPONENT.
                ADD XVEL,XPOS
                ADD YVEL,YPOS
```



```
POSCHK: CMP XPOS,#50000.
        BLO POSCH1
        CURPOS #1,#3                    ; OFF THE SIDES OF THE WORLD?
        SNDSTR #SIDEMS
        JMP COLLIS

POSCH1: JSR PC,ALT                      ; GET ALTITUDE
        MOV R0,TEMP
        TST R1
        BGT POSCH2
        SUB R1,YPOS
        CURPOS #1,#3
        CMP XVEL,#5                     ; SOFT LANDING IS XVEL, YVEL < 5
        BGT 1$
        CMP XVEL,#-5
        BLT 1$
        CMP YVEL,#5
        BGT 1$
        CMP YVEL,#-5
        BLT 1$
        TST VIEW
        BNE 2$
        SNDSTR #NOSRMS
        JMP COLLIS                      ; CAN'T LAND WHERE NO SHORT RANGE VIEW EXISTS
2$:     CMP TEMP,#1                     ; LANDING ON A ROCK?
        BNE 3$
        SNDSTR #ROCKMS
        JMP COLLIS
3$:     TST SUBR
        BEQ 4$                          ; IS THERE A SUBROUTINE TO EXECUTE?
        JSR PC,@SUBR
        JMP POSOK
4$:     SNDSTR #LANDMS                  ; NOTE WE DON'T GO TO COLLIS BECAUSE SUBR MIGHT DO STUFF.
        JMP COLLIS                      ; SOFT LANDING!!
1$:     SNDSTR #COLMS
        JMP COLLIS                      ; CRASH!!!

POSCH2: CMP YPOS,#24800.
        BLE POSOK                       ; OFF TOP?
        CURPOS #1,#3
        SNDSTR #TOPMS

COLLIS: INC COLFLG                      ; OFF ANY EDGE IS TREATED AS A COLLISION
        CLR RESFLG
        CLR THRUST

POSOK:  JSR PC,DISPLY
```

DR0:[20,1]LANDER.MAC;24

```
287  18$:    CMP CLKCNT,#30.          ; WAIT FOR 1/2 SEC. TO ELAPSE
288           BLT 1$
289           INC TICKS                ; ROTATING TICK COUNT
290           INC TICROT
291           CLR CLKCNT
292           JMP MAINLP
293
```



```
294
295  ; DISPLAY THE WORLD
296
297  DISPLY: CLR R2                    ; COMPUTE VIEW TO BE DISPLAYED IN R2
298           JSR PC,ALT
299           MOV R1,ALTUDE
300           CMP R1,#1000.
301           BGE 1$
302           MOV XPOS,R1
303           CLR R0
304           DIV #1000.,R0
305           ASL R0
306           MOV ALISR(R0),R2
307  1$:      CMP R2,VIEW              ; IF VIEW CHANGED, WE RE-DISPLAY
308           BEQ DISP0
309           INC HDRFLG
310           MOV R2,VIEW
311  DISP0:   TST HDRFLG               ; DO WE NEED TO RE-DISPLAY HEADERS?
312           BNE DISPL0
313           JMP DISP1
314  DISPL0: MOV #1,XPREV
315           MOV #1,YPREV
316           MOV #1,XRPREV
317           MOV #1,YRPREV
318           CLRSCR
319           CLR HDRFLG
320           SNDSTR #VBMS
321           SNDSTR #XVELMS
322           SNDSTR #YVELMS
323           SNDSTR #THRMS
324           SNDSTR #XPOSMS
325           SNDSTR #YPOSMS
326           SNDSTR #ALTMS
327           SNDSTR #FUELMS
328
329           MOV #49.,R5
330           TST VIEW
331           BNE DISPL2               ; WHICH VIEW TO DISPLAY, LONG OR SHORT RANGE?
332
333
```

```
334
335  DISPL1: MOV R5,R1
336          ASL R1
337          MOV ALTLR(R1),R3          ; LOOP TO DISPLAY THE SURFACE (LONG RANGE VIEW.)
338          CLR R2                    ; CONVERT TO SCREEN UNITS (1 S.U. IS 1000 LUNAR UNITS).
339          DIV #1000.,R2
340          SUB #24.,R2
341          NEG R2
342          MOV R2,R4
343          CURPOS R5,R4              ; SEND THE TERRAIN CHARACTER
344          SNDCHR #TERRCH
345          DEC R5
346          BEQ DSPL1A
347          JMP DISPL1
348
349  DSPL1A: JMP DISP1                 ; LOOP TO DISPLAY THE SURFACE (SHORT RANGE VIEW).
350
351  DISPL2: MOV R5,R1
352          MUL #6,R1
353          ADD VIEW,R1
354          MOV (R1)+,R3              ; SAVE THE TERRAIN CHARACTER IN TEMP
355          MOV (R1),TEMP
356          MOV TEMP,R1
357          MOVB TERTBL(R1),TEMP
358          CLR R2
359          DIV #40.,R2
360          SUB #24.,R2
361          NEG R2
362          MOV R2,R4
363          CURPOS R5,R4
364          SNDCHR TEMP
365          DEC R5
366          BEQ DISP1
367          JMP DISPL2
368  DISP1:  CURPOS XPREV,YPREV         ; BLANK OUT OLD SHIP POSITION
369          SNDCHR #40
370          CURPOS XRPREV,YRPREV      ; AND OLD ROCKET INDICATOR.
371          SNDCHR #40
372
```



```
373
374
375  DISP1B: TST VIEW
376          BEQ 6$
377          MOV #40.,TEMP1
378          MOV #20.,TEMP2
379          BR 7$
380  6$:     MOV #1000.,TEMP1
381          MOV #1000.,TEMP2
382  7$:     MOV XPOS,R0               ; GET POSITIONS MODULO 1000.
383          TST VIEW
384          BEQ 8$
385          JSR PC,MODULO
386  8$:     MOV R0,R3
387          CLR R2
388          DIV TEMP2,R2              ; CONVERT SHIP POSITION TO SCREEN COORDINATES.
389          MOV R2,R4
390          MOV YPOS,R0
391          DEC R0
392          BGE 10$
393          CLR R0
394  10$:    TST VIEW
395          BEQ 9$
396          JSR PC,MODULO
397  9$:     CLR R2
398          MOV R0,R3
399          BEQ 11$
400          ADD TEMP1,R3
401          SXT R2
402          DIV TEMP1,R2
403  11$:    SUB #24.,R2
404          NEG R2
405          MOV R2,R5
406          TST R4
407          BGT 1$
408          MOV #1,R4
409  1$:     CMP R4,#49.
410          BLE 2$
411          MOV #49.,R4
412  2$:     TST R5
413          BGT 3$
414          MOV #1,R5
415  3$:     CMP R5,#24.
416          BLE 4$
417          MOV #24.,R5
418  4$:     JSR PC,ALT
419          CURPOS R4,R5
420          SNDCHR #114               ; SEND OVER THE SHIP
421  5$:     MOV R4,XPREV              ; AS AN "L"
```

DR0:[20,1]LANDER.MAC;24

```
422             MOV R5,YPREV
423
424             TST FUEL                        ; IF NO FUEL LEFT, DON'T DISPLAY ROCKET INDICATOR.
425             BEQ DISP2
426
```



```
427
428  DISP1A: MOV ENGIN,R0
429          DEC R0
430          ASL R0
431          MOV SINTAB(R0),R3
432          SXT R2
433          DIV #552,R2                        ; TAKING THE INTEGER FUNCTION OF SIN, COS
434          SUB R2,R4                          ; TO COMPUTE WHICH INDICATOR TO DISPLAY
435          MOV COSTAB(R0),R3
436          SXT R2
437          DIV #552,R2
438          ADD R2,R5
439          JSR PC,ALT
440          CMP R1,TEMP1
441          BLT DISP2
442          CURPOS R4,R5
443          SNDCHR #56                         ; SEND A "." AS ROCKET FIRING INDICATOR
444          MOV R4,XRPREV
445          MOV R5,YRPREV
446
447  DISP2:  CMP TICROT,DELCT                    ; TIME TO SEND OVER VITAL STATS?
448          BGE DISP2A
449          JMP DSPEND
450  DISP2A: CLR TICROT
451          CURPOS #68.,#6.                    ; SENDING OVER VITAL STATISTICS ABOUT THE SHIP
452          MOV XVEL,TEMP
453          ASL TEMP
454          SNDNUM TEMP
455          SNDSTR #SPC
456          CURPOS #68.,#7
457          MOV YVEL,TEMP
458          ASL TEMP
459          SNDNUM TEMP
460          SNDSTR #SPC
461          CURPOS #68.,#9.
462          MOV THRUST,TEMP
463          ASL TEMP
464          SNDNUM TEMP
465          SNDSTR #SPC
466          CURPOS #68.,#11.
467          SNDABS XPOS
468          SNDSTR #SPC
469          CURPOS #68.,#12.
470          SNDNUM YPOS
471          SNDSTR #SPC
472          CURPOS #68.,#13.
473          SNDNUM ALTUDE
474          SNDSTR #SPC
475          CURPOS #68.,#15.
```

```
476           $NONUM FUEL
477           $NOSTR #SPC
478           CURPOS #99.,#99.
479
480  DSPEND: RTS PC
481
482
483
```



```
484
485  ; COMPUTE THE ALTITUDE OF THE SHIP. RETURNS ALTITUDE IN R1, TERRAIN CHARACTER IN R0
486  ; RETURNS SUBR TO CALL IF LANDED IN SUBR.
487
488  ALT:    PUSH R2
489          PUSH R3
490          PUSH R4
491          PUSH R5
492          MOV XPOS,R1
493          CLR R0
494          DIV #1000.,R0
495          MOV R0,R3
496          MOV YPOS,R1
497          ASL R0
498          SUB ALTLR(R0),R1
499          CMP R1,#1000.
500          BGE ALTDN
501          MOV ALTBR(R0),R2
502          BEQ ALTDN
503          MUL #1000.,R3
504          MOV XPOS,R5
505          SUB R3,R5
506          CLR R4
507          DIV #20.,R4
508          MOV R4,R3
509          MUL #6,R3
510          ADD R3,R2
511          SUB (R2)+,R1
512          MOV (R2)+,R0
513          MOV (R2),SUBR
514
515  ALTDN:  POP R5
516          POP R4
517          POP R3
518          POP R2
519          RTS PC
520
521  ; COMPUTE THE VALUE OF R0 MOD 1000.. RETURNS RESULT IN R0
522
523  MODULO: PUSH R2
524          PUSH R3
525          MOV R0,R3
526          CLR R2
527          DIV #1000.,R2
528          MOV R2,R3
529          MUL #1000.,R3
530          SUB R3,R0
531          POP R3
532          POP R2
```

```
533                 RTS PC
534
```



```
535
536  ; TYPE AN ASCIZ STRING POINTED TO BY R0
537
538  TYPE:   CLR BUFCTR
539          MOV R0,BUFPTR
540
541  1$:     TSTB (R0)+
542          BEQ 2$
543          INC BUFCTR
544          BR 1$
545
546  2$:     QIOW$S #IO.WVB,#1,#1,,,,<BUFPTRF,BUFCTR>
547          RTS PC
548
549
550  ; CONVERT A NUMBER TO AN ASCIZ STRING.  NUMBER IN R1,POINTER TO STRING
551  ; TO RETURN IN R0. PRINTS UNSIGNED NUMBERS IF ABSFLG IS SET.
552
553  NUMSTR: PUSH R0
554          PUSH R2
555          PUSH R3
556          CLR -(SP)
557          CLR NEGFL
558          TST ABSFLG
559          BNE 1$
560          TST R1
561          BPL 1$
562          INC NEGFL
563          NEG R1
564  1$:     MOV R1,R3
565          CLR R2
566  NS1:    DIV #10.,R2
567          ADD #60,R3
568          PUSH R3
569          TST R2
570          BEQ NS2
571          MOV R2,R3
572          CLR R2
573          BR NS1
574
575  NS2:    TST NEGFL
576          BEQ NS3
577          MOVB #55.,(R0)+
578  NS3:    POP R2
579          MOVB R2,(R0)+
580          TSTB R2
581          BNE NS3
582          POP R3
583          POP R2
```

```
584             POP R0
585             RTS PC
586
587
588
```



```
589
590  MAC1:   SNDSTR #MACMS
591          CLR CLKCNT
592  1$:     CMP CLKCNT,#360.
593          BLT 1$
594          MOV #10.,YVEL
595          MOV #12.,THRUST
596          MOV #1,ENGIN
597          CLR XVEL
598          ADD #10.,YPOS
599          SNDSTR #MACMS2
600          RTS PC
601
602  MAC2:   SNDSTR #MACMS3
603          INC COLFLG
604          CLR RESFLG
605          CLR FUEL
606          CLR THRUST
607          RTS PC
608
609  WBS1:   SNDSTR #WBSMS
610          INC COLFLG
611          CLR RESFLG
612          CLR FUEL
613          CLR THRUST
614          RTS PC
615
616  WBS2:   SNDSTR #WBSMS2
617          INC COLFLG
618          CLR RESFLG
619          CLR FUEL
620          CLR THRUST
621          RTS PC
622
623  GAS1:   SNDSTR #GASMS
624          CLR CLKCNT
625  1$:     CMP CLKCNT,#240.
626          BLT 1$
627          MOV #10.,YVEL
628          MOV #12.,THRUST
629          MOV #1,ENGIN
630          CLR XVEL
631          MOV #2000.,FUEL
632          ADD #10.,YPOS
633          SNDSTR #GASMS2
634          RTS PC
635
636  GAS2:   SNDSTR #GASMS3
637          INC COLFLG
```

```
638             CLR RESFLG
639             CLR FUEL
640             CLR THRUST
641             RTS PC
642
643
```



```
644
645  ; POSITION IN R0, R1 (X, Y). POSITION THE CURSOR THERE.
646
647  POSCUR: PUSH R2
648          PUSH R5
649          MOV #CPMS1,R2
650          MOV R0,R5
651          MOV #WRKSTR,R0
652          JSR PC,NUMSTR
653          TSTB WRKSTR
654          BEQ PC1
655          MOVB WRKSTR,(R2)+
656          TSTB WRKSTR+1
657          BEQ PC1
658          MOVB WRKSTR+1,(R2)+
659
660  PC1:    MOVB #73,(R2)+
661          MOV R5,R1
662          MOV #WRKSTR,R0
663          JSR PC,NUMSTR
664          TSTB WRKSTR
665          BEQ PC2
666          MOVB WRKSTR,(R2)+
667          TSTB WRKSTR+1
668          BEQ PC2
669          MOVB WRKSTR+1,(R2)+
670
671  PC2:    MOVB #146,(R2)+
672          CLRB (R2)+
673          SNDSTR #CPMS
674          POP R5
675          POP R2
676          RTS PC
677
678  MTNTOP: SNDSTR #MTNMS
679          CLR THRUST
680          INC COLFLG
681          CLR RESFLG
682          RTS PC
683
```

```
684
685  ;  ************************************
686  ;  *                                  *
687  ;  *        AST INTERRUPT ROUTINES    *
688  ;  *                                  *
689  ;  ************************************
690
691
692  CLKINT: INC CLKCNT
693          TST (SP)+
694          MRKT$C 2,1,1,CLKINT
695          ASTX$S
696
697
698  TTYINT: PUSH R0
699          MOV 2(SP),R0
700          BIC #177400,R0
701          CMP R0,#3
702          BNE TTYI1
703          CLRSCR                  ; HERE FOR CNTRL-C TO RETURN TO MCR
704          SNDSTR #VT52
705          EXIT$S
706
707  TTYI1:  CMP R0,#101
708          BNE TTYI2
709          INC THRUST              ; UP-ARROW INCREASES THRUST
710          CMP THRUST,#15.
711          BLE 1$
712          MOV #15.,THRUST
713  1$:     JMP TTYIDN
714
715  TTYI2:  CMP R0,#102             ; DOWN-ARROW DECREASES THRUST
716          BNE TTYI3
717          DEC THRUST
718          BGT 1$
719          MOV #1,THRUST
720  1$:     JMP TTYIDN
721
722
```



```
723
724  TTYI3:  CMP R0,#103             ; RIGHT-ARROW ROTATES ENGINE COUNTER-CLOCKWISE
725          BNE TTYI4
726          INC ENGIN
727          CMP ENGIN,#8.
728          BLE 1$
729          MOV #1,ENGIN
730  1$:     JMP TTYIDN
731
732  TTYI4:  CMP R0,#104             ; LEFT-ARROW ROTATES ENGINE CLOCKWISE
733          BNE TTYI5               ; ALL OTHER CHARACTERS ARE IGNORED.
734          DEC ENGIN
735          BGT 1$
736          MOV #8.,ENGIN
737  1$:     JMP TTYIDN
738
739  TTYI5:  CMP R0,#40
740          BNE TTYI6
741          INC RESFLG
742          JMP TTYIDN
743
744  TTYI6:  CMP R0,#61
745          BLT TTYIDN
746          CMP R0,#71
747          BGT TTYIDN
748          SUB #60,R0
749          MOV R0,DELCT
750
751  TTYIDN: POP R0
752          TST (SP)+
753          ASTX$S
754
755
```

```
                ;**********************************
                ;*                                *
                ;*      VARIABLES, ARRAYS, DATA   *
                ;*                                *
                ;**********************************

WRKSTR: .BLKB 30
WRKSTI: 0
BUFPTR: 0
BUFCTR: 0
FUELMX: 2000.           ; INITIAL FUEL ALLOCATION
FUEL:   0               ; CURRENT FUEL REMAINING
XPOSI:  1000.           ; INITIAL X POSITION
XPOS:   0               ; CURRENT X POSITION
YPOSI:  24000.          ; INITIAL Y POSITION
YPOS:   0               ; CURRENT Y POSITION
XVELI:  600.            ; INITIAL X VELOCITY
XVEL:   0               ; CURRENT X VELOCITY
YVELI:  -350.           ; INITIAL Y VELOCITY
YVEL:   0               ; CURRENT Y VELOCITY
ENGIN:  0               ; WHICH ENGINE IS FIRING?
GRAV:   -2              ; ACCELERATION DUE TO GRAVITY
THRSTI: 12.             ; INITIAL THRUST
THRUST: 0               ; CURRENT THRUST
COLFLG: 0               ; COLLITION HAS OCCURRED.
TICKS:  0
RESFLG: 0               ; SET TO PLAY A NEW GAME
HDRFLG: 0               ; NEED TO DISPLAY SCREEN HEADERS
XPREV:  0               ; SAVES OLD X POS. OF SHIP
YPREV:  0               ; SAVES OLD Y POS. OF SHIP
XRPREV: 0               ; SAVES OLD X POS. OF ROCKET INDICATOR
YRPREV: 0               ; SAVES OLD Y POS. OF ROCKET INDICATOR
CLKCNT: 0
NEGFL:  0
TEMP:   0
TEMP1:  0
TEMP2:  0
ABSFLG: 0
VIEW:   0               ; ADDRESS OF SHORT RANGE VIEW TABLE, OR 0 IF LONG RANGE VIEW
SUBR:   0               ; CONTAINS SUBROUTINE TO EXECUTE
ALTUDE: 0               ; SAVES THE ALTITUDE
DELCT:  1               ; DELAY COUNT FOR DISPLAYING VITALS STATS (1 IF NON-REMOTE TERMINAL)
TICROT: 0
```



```
SINTAB: 0               ; TABLE OF SINES, IN OCTAL, TIMES OCTAL 1000
        -552
        -1000
        -552
        0
        552
        1000
        552

COSTAB: 1000            ; TABLE OF COSINES, IN OCTAL, TIMES OCTAL 1000
        552
        0
        -552
        -1000
        -552
        0
        552
```

```
822
823  ALTLR:  4000.,3000.,2000.,2000.,2000.,3000.,4000.,3000.,3000.,3000.,2000.,1000.,1000.,0,0,0,0,0,0,0
824          0,0,0,2000.,3000.,4000.,1000.,2000.,0,0,0,0,0,0,0,0,0,0,0
825          0,0,0,1000.,2000.,3000.,4000.,5000.,5000.,6000.
826
827  ALTSR:  0,0,ALT1,ALT2,ALT3,0,0,ALT4,ALT5,ALT6,0,0,0,0,ALT7,ALTR,ALT9,ALT10,ALT11,ALT12
828          ALT13,ALT14,0,0,0,ALT15,0,0,0,ALT16,ALT17,ALT18,ALT19,ALT20,ALT21,ALT22
829          ALT23,ALT24,ALT25,ALT26,ALT27,ALT28,0,0,0,0,0,ALT29,ALT30,0
830
831  ; SHORT RANGE ALTITUDE TABLES.  EACH TABLE IS POINTED TO BY AN ENTRY IN ALTSR,
832  ; AND CONSISTS OF 3 WORDS FOR EACH X GRADATION: ALTITUDE, CHARACTER TO DISPLAY
833  ; (THIS SECOND WORD IS AN INDEX INTO TERTBL) AND POINTER TO SUBROUTINE TO CALL
834  ; IF A LANDING OCCURS THERE.  AN X GRADATION HERE IS 20. AND A Y GRADATION
835  ; IS 40.
836
837          .NLIST BEX
838
839          .RADIX 10
840
841
842  ALT1:   ROCK 2,280
843          ROCK 1,240
844          ROCK 1,200
845          ROCK 2,160
846          ROCK 2,120
847          ROCK 4,80
848          ROCK 2,40
849          ROCK 2,80
850          ROCK 2,40
851          ROCK 2,80
852          ROCK 2,120
853          ROCK 2,80
854          ROCK 2,40
855          FLAT 10,40
856          FLAT 8,0
857          ROCK 6,40
858
859  ALT2:   ROCK 10,40
860          FLAT 8,40
861          FLAT 7,0
862          ROCK 1,0
863          FLAT 3,0
864          ROCK 2,0
865          FLAT 4,0
866          0,0,GAS1
867          0,0,GAS1
868          0,0,GAS1
869          0,0,GAS1
870          0,0,GAS1
```



```
871          0,4,GAS2
872          0,0,GAS1
873          0,0,GAS1
874          0,0,GAS1
875          0,0,GAS1
876          0,0,GAS1
877          ROCK 4,0
878
879
```

DR0:[20,11]LANDER.MAC;24

```
880
881  ALT3:   ROCK 3,0
882          FLAT 4,0
883          ROCK 3,40
884          FLAT 12,40
885          ROCK 1,80
886          FLAT 5,80
887          ROCK 1,80
888          FLAT 5,80
889          ROCK 1,120
890          ROCK 15,160
891
892
893  ALT4:   ROCK 8,240
894          ROCK 3,200
895          ROCK 1,160
896          ROCK 2,120
897          FLAT 5,80
898          ROCK 2,80
899          FLAT 5,40
900          FLAT 3,0
901          ROCK 1,40
902          FLAT 8,40
903          ROCK 6,80
904          FLAT 6,80
905
906  ALT5:   FLAT 5,80
907          ROCK 2,80
908          FLAT 3,80
909          ROCK 6,40
910          FLAT 7,40
911          ROCK 2,40
912          FLAT 4,0
913          ROCK 1,0
914          FLAT 7,0
915          ROCK 2,0
916          FLAT 5,40
917          ROCK 7,40
918          FLAT 9,40
919
920  ALT6:   ROCK 4,40
921          FLAT 5,80
922          ROCK 1,40
923          FLAT 4,40
924          ROCK 1,40
925          FLAT 6,40
926          ROCK 1,80
927          FLAT 3,80
928          ROCK 6,80
```


DR0:[20,11]LANDER.MAC;24

```
929          FLAT 5,40
930          ROCK 1,0
931          FLAT 5,0
932          ROCK 6,0
933
934
```

```
935
936  ALT7:    FLAT 3,0
937           ROCK 1,0
938           FLAT 3,0
939           FLAT 5,40
940           ROCK 3,40
941           ROCK 5,80
942           ROCK 2,40
943           FLAT 3,40
944           ROCK 4,0
945           FLAT 5,0
946           ROCK 2,40
947           ROCK 1,80
948           ROCK 2,120
949           FLAT 3,120
950           ROCK 1,120
951           ROCK 3,80
952           ROCK 2,40
953           FLAT 2,40
954
955  ALT8:    FLAT 3,40
956           ROCK 4,80
957           FLAT 3,40
958           ROCK 1,40
959           FLAT 10,40
960           ROCK 1,40
961           ROCK 1,80
962           FLAT 6,80
963           ROCK 3,80
964           FLAT 11,80
965           ROCK 2,80
966           ROCK 2,40
967           FLAT 3,40
968
969  ALT9:    FLAT 5,40
970           ROCK 2,40
971           FLAT 8,0
972           ROCK 1,0
973           FLAT 5,0
974           ROCK 1,0
975           ROCK 1,40
976           ROCK 1,80
977           ROCK 2,40
978           FLAT 3,40
979           ROCK 1,80
980           FLAT 18,80
981           ROCK 1,80
982           FLAT 1,80
983
984
```



```
985
986  ALT10:   FLAT 5,80
987           ROCK 1,80
988           ROCK 1,120
989           ROCK 1,160
990           FLAT 5,160
991           ROCK 1,120
992           ROCK 1,80
993           ROCK 1,40
994           40,0,WBS1
995           40,0,WBS1
996           40,0,WBS1
997           40,0,WBS1
998           40,0,WBS1
999           40,0,WBS1
1000          40,3,WBS2
1001          40,0,WBS1
1002          40,0,WBS1
1003          40,0,WBS1
1004          40,0,WBS1
1005          40,0,WBS1
1006          ROCK 1,80
1007          ROCK 1,120
1008          FLAT 7,120
1009          ROCK 1,120
1010          FLAT 3,120
1011          ROCK 1,160
1012          FLAT 5,160
1013          ROCK 3,160
1014
1015
```

```
1016
1017  ALT11:  ROCK 1,200
1018          ROCK 1,240
1019          ROCK 1,280
1020          ROCK 2,320
1021          FLAT 4,320
1022          ROCK 2,320
1023          ROCK 2,360
1024          ROCK 1,400
1025          ROCK 2,440
1026          ROCK 1,480
1027          ROCK 1,520
1028          ROCK 1,600
1029          ROCK 2,640
1030          FLAT 3,640
1031          ROCK 1,680
1032          ROCK 2,720
1033          FLAT 8,720
1034          ROCK 1,680
1035          ROCK 1,600
1036          ROCK 1,520
1037          ROCK 2,480
1038          ROCK 1,440
1039          ROCK 2,400
1040          ROCK 1,360
1041          FLAT 4,360
1042          ROCK 2,320
1043
1044
```



```
1045
1046  ALT12:  ROCK 3,320
1047          ROCK 1,360
1048          ROCK 1,400
1049          ROCK 1,440
1050          ROCK 1,400
1051          ROCK 1,320
1052          ROCK 1,240
1053          ROCK 1,200
1054          ROCK 2,160
1055          ROCK 5,120
1056          ROCK 3,80
1057          FLAT 10,80
1058          FLAT 5,40
1059          ROCK 1,40
1060          FLAT 3,40
1061          ROCK 3,80
1062          FLAT 8,80
1063
1064  ALT13:  FLAT 7,80
1065          ROCK 3,80
1066          ROCK 1,40
1067          FLAT 8,40
1068          ROCK 1,80
1069          ROCK 1,120
1070          ROCK 1,160
1071          FLAT 5,160
1072          ROCK 2,120
1073          FLAT 6,120
1074          ROCK 3,160
1075          FLAT 12,160
1076
1077  ALT14:  FLAT 3,160
1078          ROCK 1,80
1079          FLAT 8,80
1080          ROCK 1,80
1081          FLAT 1,80
1082          ROCK 1,40
1083          FLAT 6,40
1084          ROCK 1,40
1085          FLAT 14,40
1086          ROCK 1,40
1087          FLAT 4,40
1088          ROCK 1,0
1089          FLAT 8,0
1090
1091
```

DR0:[20,11]LANDER.MAC;24

```
1092  ALT15:  ROCK 8,0
1093          ROCK 6,40
1094          ROCK 1,80
1095          ROCK 1,120
1096          ROCK 1,160
1097          ROCK 1,240
1098          ROCK 2,280
1099          ROCK 5,320
1100          ROCK 1,360
1101          ROCK 1,400
1102          ROCK 1,440
1103          ROCK 3,480
1104          ROCK 1,520
1105          ROCK 2,560
1106          560.0,MTNTOP
1107          560.0,MTNTOP
1108          560.0,MTNTOP
1109          ROCK 1,560
1110          ROCK 1,520
1111          ROCK 1,440
1112          ROCK 3,400
1113          ROCK 1,360
1114          ROCK 1,320
1115          ROCK 1,280
1116          ROCK 2,240
1117          ROCK 2,200
1118
1119
1120  ALT16:  FLAT 7,0
1121          ROCK 1,0
1122          FLAT 3,0
1123          ROCK 2,40
1124          ROCK 1,80
1125          ROCK 1,40
1126          FLAT 3,40
1127          ROCK 3,80
1128          ROCK 1,120
1129          FLAT 2,80
1130          ROCK 1,80
1131          ROCK 5,40
1132          ROCK 3,0
1133          FLAT 6,0
1134          ROCK 3,0
1135          FLAT 8,0
1136
1137  ALT17:  FLAT 14,0
1138          ROCK 1,0
1139          FLAT 11,0
1140          ROCK 1,0
```


DR0:[20,11]LANDER.MAC;24

```
1141          ROCK 1,40
1142          FLAT 3,40
1143          ROCK 1,40
1144          ROCK 1,0
1145          FLAT 12,0
1146          ROCK 1,0
1147          FLAT 4,0
1148
1149  ALT18:  FLAT 9,0
1150
```

DR0:[20,1]LANDER.MAC;24

```
1151            ROCK 1,0
1152            FLAT 7,0
1153            ROCK 1,0
1154            FLAT 6,0
1155            ROCK 1,40
1156            FLAT 5,40
1157            ROCK 1,40
1158            FLAT 19,40
1159
1160
1161  ALT19:    FLAT 6,40
1162            ROCK 1,40
1163            FLAT 5,80
1164            ROCK 1,80
1165            FLAT 15,80
1166            ROCK 1,80
1167            ROCK 2,120
1168            FLAT 9,120
1169            ROCK 1,80
1170            FLAT 7,80
1171
1172  ALT20:    FLAT 22,80
1173            ROCK 1,80
1174            ROCK 1,40
1175            FLAT 6,40
1176            ROCK 1,40
1177            FLAT 11,40
1178            ROCK 2,0
1179            FLAT 6,0
1180
1181  ALT21:    FLAT 27,0
1182            0,0,MAC1
1183            0,0,MAC1
1184            0,0,MAC1
1185            0,0,MAC1
1186            0,0,MAC1
1187            0,2,MAC2
1188            0,0,MAC1
1189            0,0,MAC1
1190            0,0,MAC1
1191            0,0,MAC1
1192            0,0,MAC1
1193            FLAT 12,0
1194
1195  ALT22:    FLAT 12,0
1196            ROCK 1,0
1197            FLAT 6,0
1198            ROCK 1,40
1199            FLAT 15,40
```


DR0:[20,1]LANDER.MAC;24

```
1200            ROCK 3,40
1201            ROCK 1,0
1202            FLAT 11,0
1203
1204  ALT23:    FLAT 14,0
1205            ROCK 1,0
1206            FLAT 6,0
1207            ROCK 1,40
1208            ROCK 1,80
1209            ROCK 1,120
1210            FLAT 5,120
1211            ROCK 1,120
1212            FLAT 6,120
1213            ROCK 1,120
1214            FLAT 3,120
1215            ROCK 1,120
1216            ROCK 1,80
1217            ROCK 1,40
1218            FLAT 7,40
1219
1220
```

```
1221
1222  ALT24:  FLAT 4,40
1223          ROCK 1,40
1224          ROCK 1,0
1225          FLAT 16,0
1226          ROCK 3,0
1227          ROCK 1,40
1228          FLAT 5,40
1229          ROCK 1,80
1230          FLAT 18,80
1231
1232  ALT25:  FLAT 10,80
1233          ROCK 1,80
1234          FLAT 3,80
1235          ROCK 1,120
1236          ROCK 1,40
1237          ROCK 2,0
1238          FLAT 12,0
1239          ROCK 1,0
1240          FLAT 19,0
1241
1242  ALT26:  FLAT 5,0
1243          ROCK 1,0
1244          FLAT 8,0
1245          ROCK 1,0
1246          FLAT 9,0
1247          ROCK 1,40
1248          FLAT 13,40
1249          ROCK 1,40
1250          FLAT 11,40
1251
1252  ALT27:  FLAT 3,40
1253          ROCK 2,40
1254          ROCK 1,0
1255          FLAT 8,0
1256          ROCK 3,0
1257          FLAT 11,0
1258          ROCK 2,0
1259          FLAT 13,0
1260          ROCK 1,0
1261          ROCK 1,40
1262          FLAT 5,40
1263
1264  ALT28:  FLAT 6,40
1265          ROCK 1,80
1266          ROCK 1,120
1267          FLAT 5,120
1268          ROCK 3,120
1269          FLAT 2,120
```



```
1270          ROCK 1,160
1271          FLAT 7,160
1272          ROCK 5,160
1273          FLAT 3,160
1274          ROCK 1,160
1275          ROCK 1,200
1276          FLAT 3,200
1277          ROCK 5,200
1278          ROCK 1,240
1279          ROCK 5,280
1280
1281
```

```
1282
1283  ALT29:  FLAT 3,120
1284          ROCK 6,160
1285          FLAT 8,160
1286          ROCK 3,160
1287          ROCK 4,200
1288          ROCK 3,240
1289          FLAT 10,240
1290          ROCK 8,240
1291          FLAT 5,240
1292
1293  ALT30:  ROCK 6,240
1294          FLAT 5,240
1295          ROCK 2,240
1296          ROCK 1,200
1297          ROCK 1,160
1298          ROCK 1,120
1299          FLAT 8,120
1300          ROCK 1,120
1301          ROCK 1,160
1302          ROCK 1,200
1303          ROCK 4,240
1304          ROCK 5,280
1305          ROCK 4,320
1306          FLAT 5,320
1307          ROCK 5,320
1308
1309
1310          .RADIX 8
1311
1312
1313
1314  ; TERRAIN TABLE TO INDICATE WHICH CHARACTERS IN THE SHORT RANGE TABLES
1315  ; SHOULD BE DISPLAYED. THE SECOND WORD OF THE S.R. TABLE IS AN INDEX
1316  ; INTO THIS TABLE, OF THE CHARACTER TO DISPLAY AT THAT ALTITUDE.
1317
1318  TERTBL: .BYTE '-,'*,'M,'W,'G
1319          .EVEN
1320
1321
1322
```



```
1323
1324  ;  ****************************************
1325  ;  *                                      *
1326  ;  *            MESSAGES                  *
1327  ;  *                                      *
1328  ;  ****************************************
1329
1330
1331
1332
1333          .NLIST BEX
1334          .ENABL LC
1335
1336  COLMS:  .BYTE 7,7,7
1337          .ASCII/WELL, YOU CERTAINLY BLEW THAT ONE!!!/<15><12>
1338          .ASCII/FATAL COLLISION, THERE WERE NO SURVIVORS./<0>
1339
1340
1341  TOPMS:  .BYTE 7,7,7
1342          .ASCIZ/IT'S TOO LATE TO RETURN TO EARTH./
1343
1344  SIDEMS: .BYTE 7,7,7
1345          .ASCIZ/YOU CLOD!! YOU'VE RUN INTO THE EDGE OF THE MOON!!/
1346
1347  LANDMS: .ASCIZ/THAT'S ONE SMALL STEP FOR MAN, ONE GIANT LEAP FOR MANKIND./
1348
1349  NOSRMS: .BYTE 7,7,7
1350          .ASCIZ/SORRY, IT'S TOO ROCKY TO LAND HERE. COLLISION!!!/
1351
1352  ROCKMS: .BYTE 7,7,7
1353          .ASCIZ/YOU'VE CRASHED INTO A ROCK!!!/
1354
1355  MTNMS:  .ASCIZ/CONGRATULATIONS, SIR EDMOND, YOU'VE REACHED THE TOP!/
1356
1357
1358
1359
```

```
1360
1361  MACMS1:  .ASCII/TWO BIG MACS AND A CHEESEBURGER TO GO, PLEASE.../<15><12><0>
1362
1363
1364  MACMS2: .ASCIZ/OVER 34 TRILLION SOLD.../
1365
1366  MACMS3: .BYTE 7,7,7
1367          .ASCII/YOU JUST CRASHED INTO THE ONLY MACDONALDS ON THE MOON./<15><12>
1368          .ASCIZ/YOU DISSOLVE INTO A HUGE POOL OF GREASE./
1369
1370  WBSMS1:  .ASCII/WELCOME TO THE LUNAR OFFICE OF WBS./<15><12>
1371          .ASCIZ/YOUR AUDITS WILL BE RUN AUTOMATICALLY./
1372
1373  WBSMS2: .BYTE 7,7,7
1374          .ASCIZ/MSR002-01: YOU'VE JUST CRASHED INTO WBS!!!/
1375
1376  GASMS1:  .ASCII/MEYER'S MOON MOBIL. LAST GAS UNTIL SATURN. FILL 'ER 'UP?/<15><12><0>
1377  GASMS2: .ASCIZ/HAPPY MOTORING!/
1378
1379  GASMS3: .BYTE 7,7,7
1380          .ASCII/YOU'VE CRASHED INTO MEYER'S MOON MOBIL./<15><12>
1381          .ASCIZ/YOU GO UP IN A HUGE FIREBALL. YOU DESERVE IT!/
1382
1383
```



```
1384
1385  VBMS:    .BYTE 33,133,61,73,65,62,146
1386           .REPT 24.
1387           .BYTE 174,33,133,104,33,133,102
1388           .ENDR
1389           .BYTE 0
1390           .EVEN
1391
1392  XVELMS: .BYTE 33,133,66,73,65,65,146
1393           .ASCIZ/X VELOCITY:/
1394  YVELMS: .BYTE 33,133,67,73,65,65,146
1395           .ASCIZ/Y VELOCITY:/
1396  XPOSMS: .BYTE 33,133,61,61,73,65,65,146
1397           .ASCIZ/X POSITION:/
1398  YPOSMS: .BYTE 33,133,61,62,73,65,65,146
1399           .ASCIZ/Y POSITION:/
1400  THRMS:   .BYTE 33,133,71,73,65,65,146
1401           .ASCIZ/THRUST:/
1402  FUELMS: .BYTE 33,133,61,65,73,65,65,146
1403           .ASCIZ/FUEL:/
1404  ALTMS:   .BYTE 33,133,61,63,73,65,65,146
1405           .ASCIZ/ALTITUDE:/
1406  SPC:     .ASCIZ/       /
1407
1408           .EVEN
1409
1410  CPMS:    .BYTE 33,133
1411  CPMS1:   .BLKB 6
1412           0
1413
1414  INITMS: .BYTE 33,74,33,133,61,73,61,110,33,133,60,112,33,133,77,67,154
1415           .ASCII/                                WELCOME!/<15><12><15><12>
1416           .ASCII/You are on board a lunar entry module (LEM), racing toward/<15><12>
1417           .ASCII/the surface of the moon.  NASA has chosen to control the LEM/<15><12>
1418           .ASCII/with an inferior brand of minicomputer, which has now failed./<15><12>
1419           .ASCII/You are therefore charged with the task of landing your craft/<15><12>
1420           .ASCII/manually.  You have the following controls:/<15><12><15><12>
1421           .ASCII/UP ARROW    - increases the thrust output of your rocket/<15><12>
1422           .ASCII/DOWN ARROW - decreases the thrust output of your rocket./<15><12>
1423           .ASCII/LEFT ARROW - rotates the direction of rocket firing counterclockwise/<15><12>
1424           .ASCII/RIGHT ARROW- rotates the direction of rocket firing clockwise/<15><12>
1425           .ASCII/1 - 9       - sets the delay for display of vital stats (try 6 if remote)/<15><12>
1426           .ASCII/SPACE       - starts a new game (only after old game finishes/<15><12>
1427           .ASCII/CONTROL-C   - exits the program, returns to monitor/<15><12><15><12>
1428           .ASCII/You're on your own...  GOOD LUCK!/<15><12><15><12>
1429           .ASCII/Press SPACE to begin./<15><12><0>
1430
1431
1432  VT52:    .BYTE 33,133,77,62,154,0
```

DR0:[20,1]LANDER.MAC;24

```
1433
1434            .END START
1435
```