AREA: Games/Physics   NUMBER: NAME: LUNAR2
SOURCE: Digital Equipment Corp.   LANGUAGE: BASIC
                                                (EduSystem 10 only)

DESCRIPTION: This program is a compressed version of the lunar module
landing program originally written in 8K FOCAL. The program is also known
as LUNAR, ROCKES, and ROCKET.

The program represents an exact simulation of an Apollo lunar landing
module during the final descent. This portion of the descent would
normally be controlled by the on-board computer backed up by a computer
located on Earth. However, to exercise your knowledge of physics (and
make an interesting game), both computers simultaneously have had a
malfunction; therefore, you are on your own to safely land the spacecraft.

To make a soft landing, you may reset the burn rate of the retro rockets
every ten seconds. You have a choice of not firing at all (burn rate=0)
or firing at a rate between 8 and 200 lbs. per second. You have 16500
lbs. of fuel. If the rockets were not fired, your estimated free fall
impact time is 120 seconds. The capsule weight is 33,000 pounds.

USAGE: This program runs on EduSystem 10 (4K) BASIC only. Retain only
the SQR and RND functions (Option F). Type SCR to get rid of any exist-
ing programs and load LUNAR2. Type RUN to commence landing procedure.
When a "?" is typed under burn rate, enter your burn rate and hit the
return key. Remember, the only acceptable burn rates are 0 or any
number between 8 and 200.

After you're down and the computer has typed "READY", if you wish to try
it again, simply type RUN. Good luck!

```
LIST

13 PRINT "SEC","MI + FT","MPH","LB FUEL","BURN RATE"\PRINT
15 A=120\V=1\M=33000\N=16500\G=1.000000E-03\Z=1.8
21 PRINT L,INT(A);INT(5280*(A-INT(A))),3600*V,M-N,\INPUT K\T=10\PRINT
31 IF M-N<.001 THEN 41\IF T<.001 THEN 21\S=T\IF M<N+S*K THEN S=(M-N)/K
35 GOSUB 91 \IF I<=0 THEN 71 \IF V<=0 THEN 38 \IF J<0 THEN 81
38 GOSUB 61 \GO TO 31
41 PRINT "FUEL OUT AT";L;"SEC"\S=(-V+SQR(V*V+2*A*G))/G\V=V+G*S\L=L+S
51 W=3600*V\PRINT "ON MOON AT";L;"SEC - IMPACT VELOCITY";W;"MPH"
53 IF W>10 THEN 56 \PRINT "GOOD LANDING"\STOP
56 IF W>60 THEN 58 \PRINT "BAD JOLT"\STOP
58 PRINT "NO SURVIVORS-BLASTED NEW LUNAR CRATER"W*.2777;"FT DEEP"\STOP
61 L=L+S\T=T-S\M=M-S*K\A=I\V=J\RETURN
71 IF S<5.000000E-03 THEN 51 \D=V+SQR(V*V+2*A*(G-Z*K/M))\S=2*A/D
73 GOSUB 91 \GOSUB 61 \GO TO 71
81 W=(1-M*G/(Z*K))/2\S=M*V/(Z*K*(W+SQR(W*W+V/Z)))+.05\GOSUB 91
83 IF I<=0 THEN 71 \GOSUB 61 \IF J>0 THEN 31 \IF V>0 THEN 81 \GO TO 31
91 Q=S*K/M\J=V+G*S+Z*(-Q-Q*Q/2-Q↑3/3-Q↑4/4-Q↑5/5)
94 I=A-G*S*S/2-V*S+Z*S*(Q/2+Q↑2/6+Q↑3/12+Q↑4/20+Q↑5/30)\RETURN
99 END
```

```
RUN
```

SEC	MI +	FT	MPH	LB FUEL	BURN RATE
0	120	0	3600	16500	?0
10	109	5016	3636	16500	?0
20	99	4224	3672	16500	?0
30	89	2904	3708	16500	?0
40	79	1056	3744	16500	?0
50	68	3960	3780	16500	?0
60	58	1056	3816	16500	?200
70	48	564	3446.868	14500	?200
80	39	399	3050.708	12500	?200
90	31	987	2623.654	10500	?0
100	23	4483	2659.654	10500	?200
110	17	501	2196.947	8500	?0
120	10	4975	2232.947	8500	?200
130	5	2268	1728.634	6500	?200
140	1	2028	1175.137	4500	?200

```
ON MOON AT 144.8262 SEC - IMPACT VELOCITY 887.6062 MPH
NO SURVIVORS-BLASTED NEW LUNAR CRATER 246.4883 FT DEEP

READY.
```